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MARKETING ETHICAL IMPLICATION & SOCIAL RESPONSIBILITY

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Abstract

In this study, communication ethics and social responsibility are considered. Besides, it addresses advertising ethics. This is followed by ethical implications of technology. In addition, green marketing ethics and social responsibility are discussed. Moreover, it illustrates green marketing and advertising. Finally, environmental social audit is studied.

Key Words: Communication Ethics, Social Responsibility, Advertising, Green Marketing

Introduction

Communication Ethics and Social Responsibility

Communicators encounter a decision of three functions: to speak, listen, or remain silent. Each function implies an ethical decision. Intention to disclose information, motives, or feelings to others inevitably involves an ethical mind. For example, some messages should not be sent, but like those sharing insider information with friends. To do so support certain people an unfair advantage in the marketplace. Distribute a rumor about an organizational change. Such actions appear to be less objectionable than insider trading. Men inevitably make ethical judgments in selecting the timing, subject, and mode of their communications. The press is able to both stimulate public opinion and mis-educate it. Then, we should see terrorists turned into heroes.

There are ethical considerations whether communicators select to speak, write, remain silent, or listen. Certainly, secrets may have detrimental effects on personal safety and ability to make wise decisions. Gossip and rumors seem to be an inevitable part of life. Managers always treat the information as yet to be confirmed. The information may be inaccurate. There is no mechanism for correcting the inevitable distortion. Rumors that McDonalds added worms to its meat content lowered sales. Communicators should have responsibility to expect at least some of the possible reasonable misinterpretations. The ethical organization ought to have a culture that signals its commitment. Various organizations routinely gather information for which they have little use. Organizations are able to eliminate problems by asking a simple question: is this information actually relevant to the current decision? Organizations may apply the methods used to gather information about competitors. Some companies purchase stolen documents. Organization loses monitoring information. The issues occur when information collected for one purpose is utilized for another purpose. Communicators ought to take care that their remarks are

pertinent to the purpose at hand. All pertinent facts are used to bear on a decision. Fair communication needs to speak correct an inaccuracy and refers to avoid the unjust but also to do the just. Accurate information is able to be useless if communicated in an untimely period. Proper timing permits to build and honor relationships.

Unethical communication distorts or withholds information, as well as misrepresents plans. Ethical communicators should recognize responsibility and power in their communications. Ethical communicators have responsibility for how they say it, what they say, and their selection of where, when, and whom they speak. Ethical communicators should be:

- Send honest messages passed by accurate impressions and avoid manipulation through distortion.

- Handle information accurately and responsibly as well as send messages that are unbiased, accurate, and complete.

- Pay attention to feedback and responses.

Ethical enterprises with honest work environments should communicate their standards to employees and provide training that helps workforce accomplish their stated performance goals.

Advertising Ethics

Advertising tries to convince the audience to do something. Therefore it is not objective. This fact disturbs those who think that advertising ought to be objective neutral, and informative. Besides, the easily make certain claims in an advertising message are perception of matters. Such messages can be implied by the situations pictured in the advertisements. Subtle messages are aimed special groups: such as children and teenagers, with limited experience. Advertising should permit progressive society to see and select among different products. If advertising

product is look as violating ethical standards, customers are able to exert pressure refusing to buy the product. They are able to complain to the company and other regulator bodies. The following are example of advertising ethics:

- Advertising restrains from making misleading, false, or inaccurate claims or statements about his products and services or a competitor.

- Advertising must reveal the fact the neglect would mislead the public.

- Advertising claims are exonerated by evidence in possession of the advertising agency and the advertiser making such claims.

- Advertising of guarantees should be explicit, with sufficient information to evaluate customer of their explicit terms and limitations the advertisement must clearly reveal where the full text of the guarantee is able to examine before buying.

Ethical Implications of Technology

Technology threatens our privacy, free from surveillance, right to be left alone or interference from other organizations or individuals. Manager must be responsible for the security and reliability of company information system. The following ethics are appropriate for access of information and the collection:

- Collect specials information that is needed.

- Allot user identification passwords and levels of access that limit information, a person is able to change and observe.

- "log out" e-mail when leave computers.

- Apply safeguards for the security of information and the importance of confidentiality.

The morality of green marketing is organizations integrated green marketing programs within concepts of social responsibility for the provision of environmental benefits through marketing activities presented as a moral duty for the organization. Nowadays, the environment was not presented in terms of being a social concern a moral of business consumers demand environmental attributes, and protestations of ethically-driven greening. The company can satisfy can its social responsibilities of profit maximization. In fact, environmental issues were either not properly, or not realistically, within the excuse of businesses and of the market, and then, ought to be handled at a governmental level.

Green marketing is essential. Organizations & companies ought to introduce of green marketing programmes to ethical motives of social responsibility. It is understood that environment is low priority for people and most customers shall opt for the cheapest, or what give them the right combination of price and quality, as well as shall not take much notice of environmental criteria. Bureaucratization, organization size and professionalization appeared the need to couch greening in more formal, rather than in emotional, personal and informal terms. Social responsibility is augmenting shown in terms of a brand value rather than as moral principle. Green marketing is recognized as a moral corresponded with a true deep ecology position.

It is communications that are the main subjects of moral meaning. Green communications are the most common problem to which moral considerations of both a negative and a positive nature. Positive moral considerations appear in green communications, perceived importance by special audience. Companies can develop different communication vehicles for different

audiences, permitting for careful monitoring of the moral claims and perspectives. Green communications may be looked as part of the wider process of maintaining legitimacy.

Contrary, negative moral addresses over questionable green claims, many people highlighted the importance of being ethical in this respect, although various organizations appeared to show little real consistency. Ethics of certain claims appeared by stakeholders perceived as the most essential and powerful. The truthfulness of green claims tended to be perceived in terms of legitimacy. It is clear that the enterprise's environmental policy statement is printed on paper that contained an incorrect, printed claim. The green niche strategy is still a viable alternative.

The collaborative greening reaction is an acknowledgement by some companies that the issues of the green marketing backlash are that solitary approaches by each company may have only limited potential to provide an effective strategic route forward. Companies try to joint efforts to adjust these issues by working with suppliers to develop products with more fundamental environmental improvement than those previously supplied. Credible green marketing may move forward companies are willing to be supportive of their suppliers.

Collaboration also with competitors, customers or environmental groups is potentially important means of developing and reaching green marketing resource and competence available. Collaboration with competitors on environmental problems is rather less problematic in the context of the backlash, since green problems become more guarding the corporate reputation than seeking differential marketing advantage.

Green Marketing and Advertising

Environmental marketing begins to set their green marketing strategies in plain view: Nowadays, Coca-Cola begins applying recycled plastic in its 2-liter soda bottles. It must promote

corporate images that reflect environmental awareness and involvement. Nowadays' world faces enormous environ-mental issues and challenges. Natural disasters are one of environmental problem. We ought to further concentrate on the importance of environmental marketing. Customers are now more concerned about environment issues than ever. The majority of Americans regard a number of environmental problems as very serious, such as: industrial air and water pollution, destruction of rain forests and ozone, oil spills, industrial accidents, and hazardous waste.

Public concerns over environmental problems produced a dramatic augment the number of "green" product introductions. It is clear that more marketers are making environmental claims about their products. They realize that environmental responsibility is a potential source of marketing advantage enterprises. Many companies are engaged in environmental activities. In order to survive competitive world environment, producers require to create innovative marketing strategies relevant to the environmental issues. Marketers innovate green marketing or environmental marketing, with minimal detrimental impact on the natural environment, and environmentally safe, improve its quality and reclaim products sensitive to ecological concerns.

Marketers apply green marketing philosophy to their communication tools, and perceive green marketing as an opportunity to accomplish objectives, and have a moral obligation to be more socially responsible. Besides, governmental agency forces companies to become more responsible. Moreover, competitors' environmental active-ties also convince companies to strengthen their environmental marketing activities.

Enterprises applying green marketing must sure that their activities do not mislead customers, industries and do not breach any of the regulations concerning environmental marketing. Then, green marketing claims ought to clearly state environmental benefits. They

should describe environmental characteristics that are beneficial. If consumers are environmentally conscious and want to make choices supporting sustainable development, an enterprise is able to can transform these environmental into business opportunities.

Green customers recognize they live in environmental crisis. Green customers have an image of being active. Customers can switch their brand to one that is greener, and possesses environmental commitment. To guide green messages effectively to the targets: the green customers, green marketers ought to be familiar with and clearly understand the promotional tools they use as a green media. Advertising is a powerful mechanism because it has the ability to handle green customers. Companies are targeting the environmentally conscious customers. This becomes evident of the advertising messages of commercial companies. Green advertising informs their customers about the pro-environmental aspects of their products and services. Green advertising includes the relationship between a product, service and the biophysical environment, promotes a green lifestyle or presents environmental responsibility.

Green advertising is promoting high standards of ethics in advertising. It recognizes social responsibilities toward customers and the community for self-discipline. All advertisements contain environmental claims in all media, or ecological domains related to the production, distribution, packaging, disposal good, services, or consumption, or facilities. Green advertising must be legal, decent, truthful and honest. Green advertising ought to be consistent with environmental regulations and conform to fair competition.

Ecolabeling is a voluntary environ-mental performance certification and labeling practiced around the globe. Various different voluntary environmental performance labels and declarations exist. These labels are not misleading, on environmental aspects of services and products, supporting potential market-driven continuous environmental improvement.

Ecolabeling grows at global level for environmental protection on the part of governments, the public and businesses. Without standards by an independent third party, customers may not sure that each labeled product or service is an environ-mentally preferable alternative. This considers with credibility and impartiality has led to the formation of both public and private organizations providing third-party labeling. Such labeling can be taken the form of ecolabels awarded by ecolabeling program at national or regional level. However, customer may not trust the content of green advertisements.

Environmental Social Audit

Social audit refers to an audit of social costs caused by companies and social benefits generated by them, as well as the impact of a safety and health programme, the impact of an environmental control programme, and social responsibility of business. Social audit refers to an audit of social costs, like pollution, wastage of natural resources and energy, industrial accidents, advertising cost, and rise in standard of living, contribution to governmental revenue and national development, etc.

Social audit is mechanism examining and evaluating activities and responsibility of companies towards society at every level. It is an audit to social performance of company's activities, and social costs, as well as social benefits generated by it. It concerns social quality of life and its impact on society. It finds the best ways for managing their activity and resources in the interest of society. Social examination the following areas: environ-mental quality: air pollution-Land-water-Solid waste, Noise, consumer welfare about illness and health, public order and safety, and socio-marketing products.

Social audit provides information to management and to the outside world about the impact of company on society. Social audit is able to clarity both for the external audiences and

management the nature and the corporate activities that have social significance. Social audit should provide accountability for social consequences of activities. The information in a social audit is able to be used to broaden the basis of regularly management decisions to identify present market, products and appeals to socio-market segments, purchase behavior and motivation, as well as new social requirements and future markets.

One issue of a social audit is to measure the social impact. Company faces with issues of making choice about the areas like pollution control programme, equal opportunity and healthy working conditions for employees are family standard. Social audit measurement is difficult, because basis audit to measure social impact single measure or multiple measure, and measure input or output. In social audit, input is pollution expenditure but output is reduction in pollution, economic health of minority business, etc. It is difficult to compare the social performance of different companies. It is difficult to evaluate the effectiveness, of social performance because there are no absolute standards. In Western Europe, in France, and West Germany law requires corporations to report certain kind of social information.

Summary

Because of technical and financial constraints, small and medium enterprises create substantial environmental issues. Pollution prevention by minimization waste in process of production may be able to reduce environmental costs, and ameliorate environmental performance. Environmental awareness promotion and incentives to support them to use cleaner production technologies are important tasks. The critical strategies of environment management are prevention, enforcement and controlling as well as supporting minimization and recycling, and promotion of using clean technology. Environmental audit is important to accomplish cleaner production in manufacturing. Financial incentives encourage research and development

on environmental technology is essential. Environmental management must be the responsible of

top management level for any program to be successful. The world is going to suffer from

environmental issues, if we continue to ignore them. Customers should support green

movements. The academic world ought to concentrate more on what determines the most

effective green advertisings. Green marketers must be honest in presenting policies and

programs. Social indicator measure is to access aspects of quality of life in a given society or

region over a period of time and some goal of general interest to a community or society has

been accomplished, that are difficult to measure.

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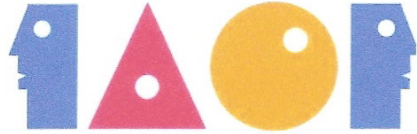
CURRENT RESEARCH PARADIGMS IN EXPATRIATE(S) RESEARCH: A BIBLIOMETRIC APPROACH

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Abstract

The purpose of this study is to map the research paradigms of expatriate research in this century. In this study, bibliometrics and social network analysis techniques are used to investigate the intellectual pillars of the expatriate literature. By analyzing 20,670 citations of 460 articles published in SSCI journals in the expatriate field between 2000 and 2008, this study maps the knowledge network of expatriate studies. The results of this study suggest that contemporary expatriate research is organized along different concentration of interests: expatriate adjustment, global leadership, and repatriation adjustment. The results help profile the knowledge network production in expatriates and provide important insights on the change of research paradigm of current expatriate studies.

Keywords: Expatriate(s), Research Paradigm, Bibliometrics, Social Network Analysis

Introduction

The last decade has seen growing importance placed on research in expatriates and the scholars have produced a great deal of papers in this field. While research findings in expatriates can be disseminated to scholars and managers in the form of journal articles, books, and other documents, scholars are easily confused with the subjects and their contributions to the development of expatriates when faced with abundant publications. Many studies have been made to explore these issues, yet all the issues are usually discussed solely based on the subjective assessment of different experts, which often leads to many controversies in the expatriate area.

To overcome this phenomenon, this study uses the bibliometrics and social network analysis to gain an overview of expatriate research and its evolution from the year 2000 to 2008. Using citation analysis, the interlinked invisible nodes are discovered from which the most influential publications and scholars in the expatriate field are then identified. Furthermore, co-citation analysis is conducted to effectively utilize social network analysis, thereby mapping the intellectual structure of expatriate studies and exploring the invisible knowledge nodes that have contributed the most to the studies of expatriates and their possible evolution patterns.

The paper is divided into four main sections. The first is a review of literature; the second contains a description of the methodology employed; the third presents and discusses the results of the empirical study; and the fourth section presents a summary and discussion of this investigation, indicates its limitations, and comments on future researches.

Review of Literature

The term "bibliometrics" refers to the mathematical and statistical analysis of patterns that appear in the publication and the use of documents (Diodato, 1994). Citation analysis is based on

the premise that authors cite papers they consider to be important to the development of their research. As a result, heavily cited articles are likely to have exerted a great influence on the subject than those frequently cited (Culnan, 1986; Sharplin & Mabry, 1985). Similarly, co-citation analysis of documents records the number of papers that have cited any particular pair of documents and it is interpreted as a measure for similarity of content of the two documents. The approach is instrumental in identifying groupings of authors, topics, or methods and can help us understand the way in which these clusters interrelate (Pilkington & Liston-Heyes, 1999). More specifically, co-citation studies compile co-citation counts in matrix form and statistically scale them to capture a snapshot at a distinct point in time of what is actually a changing and evolving structure of knowledge (Small, 1993).

Several studies have used the bibliometric techniques to study other areas of management research. For example, Ponzi (2002) explored the intellectual structure and interdisciplinary breadth of Knowledge Management in its early stage of development, using principle component analysis on an author co-citation frequency matrix; Etemad (2004) identified the most influential authors and studies in electronic commerce field by using citation analysis; Ramos-Rodriguez and Ruiz-Navarro (2004) examined the intellectual structure change of Strategic Management Research by conducting a bibliometric study of the Strategic Management Journal; Acedo and Casillas (2005) explored the research paradigms of International Management research by applying factorial analysis techniques in an author co-citation study. Recently, Pilkington and Teichert (2006) used bibliometric techniques to investigate the intellectual pillars of the Management of Technology literature and explore whether these are distinct from those commonly associated with its rival fields.

To the best of our knowledge, no such study has handled the field of expatriates; therefore this study aims to fill a gap in expatriate literature by applying bibliometric techniques to a representative collection of research articles relating to this disciplinary area.

Methodology

Based on the objective of this study, the authors explored the intellectual structure of expatriates between 2000 and 2008. This study chose this time period because the expatriate studies of this century represent the most important and the most updated research in expatriates. Citation and co-citation analysis are the main methods for this study. With citation and co-citation analysis, this research assumed three stages, each of which required different approaches to examine the knowledge network and the evolution of the expatriate studies.

First, the databases were selected from a large pool of expatriate publications. Data collection and analysis techniques were designed to collect the desired information about the topics, authors, and journal titles on expatriate research. Social Science Citation Index (SSCI) was chosen to be this study's database source. The SSCI is a widely used database and included citations published in about 2000 journals. Among these journals are the most comprehensive and widely accepted expatriate publications. Unlike other prior studies in the management field, data used in this study were not drawn from journals chosen by the peer researchers (Holsapple et al., 1993; Walstrom & Leonard, 2000; Ma, Lee, & Yu, 2008). Instead, the entire databases of SSCI from 2000 to 2008 served as the universe for conducting the analysis. In order to choose sample articles, this study uses "key words" method to search for matching article titles in SSCI. Using "expatriates", "international managers", "international assignments", "international leaders", "international careers", "global managers", "global assignments", "global leaders", and "global careers" as key words (Lee, McLee, & Wang, 2008) , we received 406 journal articles

which cited 20,670 other publications as references. The cited publications in these papers include both published books and journal articles.

In the second stage, citation analysis was performed on the 20670 cited references using the *Excel* package. After a series of operations, key nodes in the knowledge network in expatriate studies were identified and the structures developed. In the final stage, co-citation analysis is conducted to utilize the social network analysis and factor analysis which map the research paradigms of expatriate studies and explore the knowledge nodes that have contributed the most to the field and their possible evolutions.

Results

Citation Analysis

Preliminary analyses of the referenced citations produced interesting background statistics. The frequency of journal citations is listed in Table 1. International business management and human resource management specific journals featured prominently alongside the expatriate specific journals. A cluster of psychology focused title is also evident, while strategy management received fewer citations.

Among all the cited documents, the most cited expatriate document between 2000 and 2008 was Black's paper (1991) *Toward a Comprehensive Model of International Adjustment: An Integration of Multiple Theoretical Perspectives*, followed by Black's paper (1988) *Work Role Transitions: A study of American Expatriate Managers in Japan*, and another Black's paper (1990) *Cross-Cultural Training Effectiveness: A Review and a Theoretical Framework for Future-Research* (see Table 2). Table 2 represents research focuses of the main author in a field and they indicate the popularity of certain expatriate topics. On examining this list, the readers could notice the high number of citations of what can be termed the field-defining titles, which

Table 1
The Most Frequently Cited Journals

Journals	Number of Citations
International Journal of Human Resource Management	977
Journal of International Business Studies	852
Academy of Management Review	478
Human Resource Management	475
Journal of Applied Psychology	419
Academy of Management Journal	385
Journal of World Business	383
International Journal of Intercultural Relations	348
Personnel Psychology	251
Journal of Management	229
Management International Review	205
Strategic Management Journal	197
Journal of Organizational Behavior	173
Columbia Journal of World Business	159
Human Relations	158
International Studies of Management	133
Human Resource Planning	124
Psychological Bulletin	114
Administrative Science Quarterly	106
Expatriate Management	101
Journal of Personality and Social Psychology	101

lay the ground work for the understanding of expatiates as a distinct field. It is worth noting that

Black was the most important and influent author in the expatriate studies.

Co-citation Analysis

In this stage, data mapping was conducted and a research paradigm of the expatriate studies

was revealed by using co-citation analysis. Co-citations were tabulated for each of the 406

source documents using the *Excel* package. Many articles have very few co-citations counts

and were either unlikely to have had a significant impact on the development of the field and/or

were too recent to have had time to impact on the literature. To facilitate the flow of our analyses

and improve the probability of its success, the authors made sure that all articles in the final set

had at least twenty two citations. Based on the total number of citations received in the selected

Table 2

Highly Cited Documents (Frequency ≧ 22): 2000-2008

ID#	Full Citation Index For Documents	Frequency
1	BLACK JS, 1991, ACAD MANAGE REV, V16, P291	81
2	BLACK JS, 1988, J INT BUS STUD, V19, P277	56
3	BLACK JS, 1990, ACAD MANAGE REV, V15, P113	55
4	BLACK JS, 1989, J MANAGE, V15, P529	50
5	BLACK JS, 1991, HUM RELAT, V44, P497	48
6	TUNG R, 1981, COLUMBIA J WORLD BUS, V16, P68	47
7	TUNG RL, 1982, CALIFORNIA MANAGEMEN, V25, P57	47
8	SHAFFER MA, 1999, J INT BUS STUD, V30, P557	46
9	BLACK JS, 1999, GLOBALIZING PEOPLE I	44
10	HOFSTEDE G, 1980, CULTURES CONSEQUENCE	44
11	TUNG RL, 1998, J WORLD BUS, V33, P125	44
12	CALIGIURI PM, 2000, MANAGE INT REV, V40, P61	42
13	FELDMAN DC, 1992, J INT BUS STUD, V23, P271	42
14	MENDENHALL M, 1985, ACAD MANAGE REV, V10, P39	40
15	CHURCH AT, 1982, PSYCHOL BULL, V91, P540	39
16	EDSTROM A, 1977, ADM SCI Q, V22, P248	39
17	CALIGIURI PM, 1998, J APPL PSYCHOL, V83, P598	37
18	BLACK JS, 1991, J INT BUS STUD, V22, P461	35
19	BLACK JS, 1991, J INT BUS STUD, V22, P225	33
20	PARKER B, 1993, INT J INTERCULT REL, V17, P355	33
21	HARZING A, 1995, INT J HUM RESOUR MAN, V6, P457	32
22	ARTHUR W, 1995, PERS PSYCHOL, V48, P99	31
23	CALIGIURI PM, 2000, PERS PSYCHOL, V53, P67	31
24	GREGERSEN HB, 1990, GROUP ORGAN STUD, V15, P461	31
25	GUZZO RA, 1994, J APPL PSYCHOL, V79, P617	31
26	BIRDSEYE MG, 1995, J INT BUS STUD, V26, P787	30
27	BLACK JS, 1991, J INT BUS STUD, V22, P671	29
28	OBERG K, 1960, PRACTICAL ANTHR, V7, P177	28
29	SHAFFER MA, 1998, PERS PSYCHOL, V51, P87	28
30	TORBIORN I, 1982, LIVING ABROAD PERSON	28
31	CALIGIURI PM, 1999, INT J HUM RESOUR MAN, V10, P163	27
32	KOBRIN SJ, 1988, HUMAN RESOURCE MANAG, V27, P63	27
33	KRAIMER ML, 2001, PERS PSYCHOL, V54, P71	27
34	SEARLE W, 1990, INT J INTERCULT REL, V14, P449	27
35	BLACK JS, 1992, GLOBAL ASSIGNMENTS S	26
36	FORSTER N, 1997, INT J HUM RESOUR MAN, V8, P414	26
37	TUNG RL, 1987, ACADEMY MANAGEMENT E, V1, P117	26
38	BLACK JS, 1990, MANAGE INT REV, V30, P119	25
39	BREWSTER C, 1997, HUMAN RESOURCE MANAG, V7, P32	24
40	DOWLING PJ, 1999, INT HUMAN RESOURCE M	24
41	FELDMAN DC, 1993, J INT BUS STUD, V24, P507	24
42	HARVEY MG, 1989, J INT BUS STUD, V20, P131	24
43	NAUMANN E, 1993, GROUP ORGAN MANAGE, V18, P153	24
44	ADLER NJ, 1992, ACADEMY MANAGEMENT E, V6, P52	23
45	BLACK JS, 1999, HARVARD BUS REV, V77, P52	23
46	STAHL GK, 2002, J WORLD BUS, V37, P216	23
47	BLACK JS, 1992, J INT BUS STUD, V23, P737	22
48	CALIGIURI PM, 1999, INT J HUM RESOUR MAN, V10, P763	22
49	GREGERSEN HB, 1998, SLOAN MANAGE REV, V40, P21	22
50	STROH LK, 1995, INT J HUM RESOUR MAN, V6, P443	22

documents, the top 50 articles were identified, and a co-citation matrix (50 X 50) was

constructed before a pictorial map was developed to describe the correlations among different

articles. The procedures employed in this study follow the recommendation by White and

Griffith (1981).

Social network analysis tools can be used to graph the relations in the co-citation matrix and

identify the strongest links and the core areas of interest in expatriates (Pilkington & Teichert,

2006). Figure 1 shows the core of the co-citation in this study. Sample articles with links of

greater than or equal to ten co-citations are shown in this network. This was produced using

UCINET software (Borgatti, Everett, & Freeman, 2002) and displayed graphically the core areas

of interest. The different shapes of the nodes result from performing a faction study of these

articles. This method seeks to group elements in a network based on the sharing of common links

to each other. These factions can be interpreted as concentrating on the interaction between

expatriate adjustment, global leadership, and repatriation adjustment.

Whilst the diagram in Figure 1 is very informative and provides a clear picture, its focus is

only on the very core area and based on a limited amount of the data available. By taking the co-

citation matrix and grouping the articles using factor analysis according to the correlation

between entries, this method determines which articles are grouped together and therefore share

a common element. The closeness of article points on such maps is algorithmically related to

their similarity as perceived by citers. We use r-Pearson as a measure of similarity between

article pairs, because it registers the likeness in shape of their co-citation count profiles over all

other articles in the set (White & McCain, 1998).
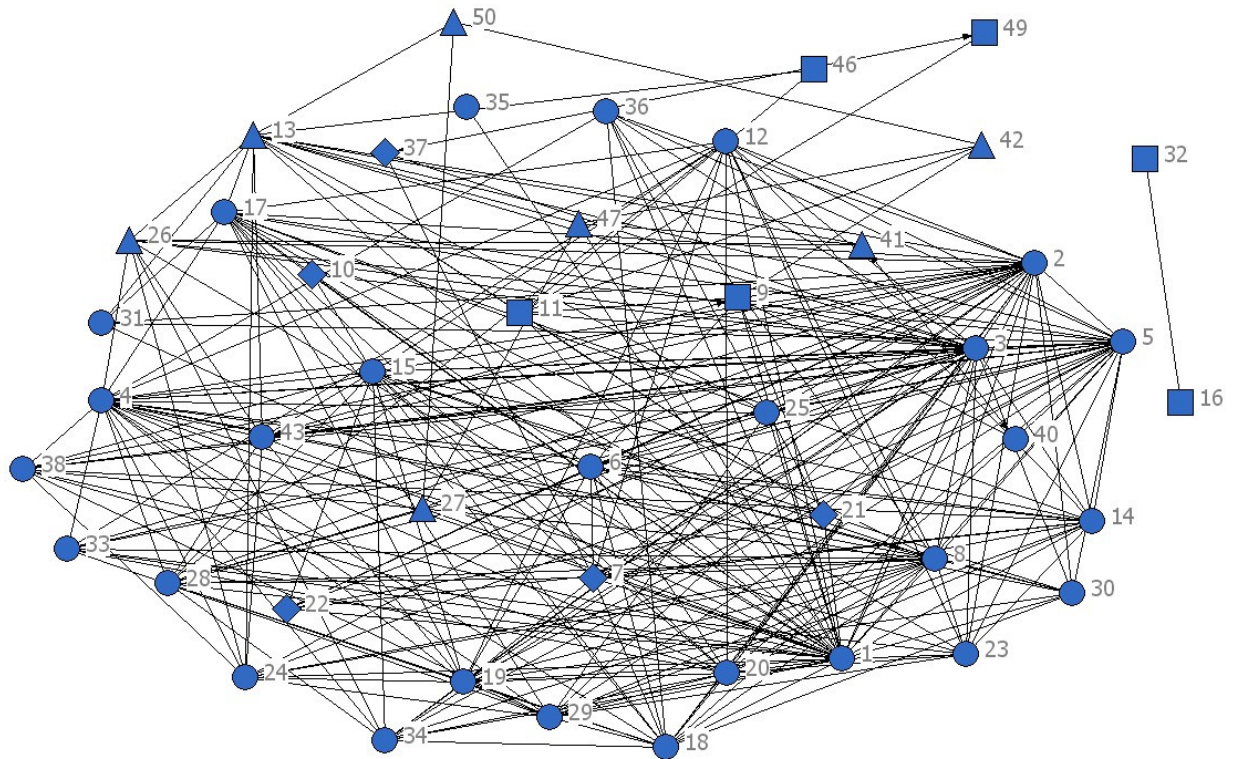
Figure 1
Core Articles Co-citation Network Map: 2000-2008

The co-citation correlation matrix was factor analyzed using varimax rotation, a commonly used procedure, which attempts to fit (or load) the maximum number of articles on the minimum number of factors. The diagonals were considered as missing data and apply the criterion of omitting the two cases (*pairwise delete*) (McCain, 1990).

Three factors were extracted from the data and together they explain over 70.9% of the variance in the correlation matrix. Table 3 lists the three most important factors along with the articles that had a factor loading of at least 0.4. As is usual in this type of analysis, articles with less than a 0.4 loading were dropped from the final results (White & Griffith, 1981, Ma, Lee, & Yu, 2008). We tentatively assigned names to the factors on the basis of our own interpretation of

the articles with high associated loadings. Implicitly, our interpretation of results of the analysis is that the expatriate field is composed of at least three different sub-fields: expatriate adjustment, global leadership, and repatriation adjustment. We made no attempts to interpret the remaining factors on account of their relative small eigenvalues (<6.8%). They have similarly been excluded from Table 3.

Figure 1 and Table 3 clearly indicated that the most influential articles in expatriate studies between 2000 and 2008 clustered together, with the main research focusing on the expatriate adjustment. Black, Mendenhall, and Oddou (1991) argued that the degree of cross-cultural adjustment should be treated as a multidimensional concept, rather than a unitary phenomenon as was the previous dominating view. In their proposed model for international adjustment, Black et al., (1991) made a distinction between three dimensions of in-country adjustment: (1) adjustment to work; (2) adjustment to interacting with host nationals; and (3) adjustment to the general non-work environment. This theoretical framework of international adjustment covers sociocultural aspects of adjustment and has been supported by a series of empirical studies of US expatriates and their spouses (Black & Gregersen, 1991; Black & Stephens, 1989).

Accordingly, interaction adjustment and general adjustment can be categorized as belonging to the non-work life domain for expatriates, while work adjustment obviously is situated in the expatriate work domain. In addition, researchers in this sub-field have pointed out that some expatriates may experience psychological withdrawal (Black & Gregersen, 1991; Shaffer & Harrison, 1998; Tung, 1981), which may be even more costly to the organization than physical withdrawal (Harzing, 1995).

Based on Figure 1 and Table 3, the global leadership subfield is represented by articles in the second group. Organizations recognize the importance of cross-cultural leadership

Table 3
Expatriate Studies Topic Clusters: 2000-2008

Expatriate adjustment	Black (1991) *AMR*, Black (1988), Black (1990) *AMR*, Black (1989), Black (1991) *HR*, Tung (1981), Shaffer (1999), Caligiuri (2000) *MIR*, Mendenhall (1985), Church (1982), Caligiuri (1998), Black (1991) *JIBS*, Parker (1993), Caligiuri (2000) *PP*, Gregersen (1990), Guzzo (1994), Oberg (1960), Shaffer (1998), Torbiorn (1982), Caligiuri (1999), Kraimer (2001), Searle (1990), Black (1992) *GAS*, Forster (1997), Black (1990) *MIR*, Dowling (1999), Naumann (1993),
Global leadership	Black (1999), Tung (1998), Edstrom (1977), Kobrin (1998), Brewster (1997), Adler (1992), Stahl (2002), Gregersen (1998),
Repatriation adjustment	Feldman (1992), Birdseye (1995), Black (1991) *JIBS*, Feldman (1993), Harvey (1989), Black (1992) *JIBS*, Stroh (1995)

development experiences and increasingly use them to prepare individual for the challenges and opportunities associated with global leadership activities. Some studies have demonstrated that there has been a positive trajectory of growth with respect to the number of organizations offering cross-cultural leadership development experiences (e.g., Gregersen, Morrison, & Black, 1998; Stroh & Caligiuri, 1998).

For instance, Adler and Bartholomew (1992) surveyed organizations headquartered in the United States and Canada and found that most organizations had taken a global approach to overall business strategy, financial systems, production operations, and marketing but lacked globally component managers. When high potential managers are sent on global assignments, they are forced to immerse themselves in a variety of novel and cross-culturally challenging business situations (Tung, 1998).

The subfield of repatriation adjustment is represented by articles in the third group. In this line of research, repatriation associated with long-term assignment undertaking has been a well-documented topic within the expatriate literature (e. g. Black, Gregersen, & Mendenhall, 1992; Feldman & Tompson, 1993; Stroh, 1995). Much attention has focused on repatriation and work

adjustment consequential to changing jobs, countries and cultures, and the subsequent need to then readjust back into the home organization upon return (Black, 1988).

A significant issue surrounding this is the development of repatriation expectations and concerns about post-assignment jobs and future work. Many of these constitute organizational norms because they are ostensibly set by the experiences of other returning expatriates. Notably they have included taken-for-granted career-based expatriations of promotion and high-level job opportunities (Black et al., 1992; Stroh, 1995) as well as less desirable expatriations such as the "out of sight out of mind" syndrome associated with having been forgotten by home-based employers and the ad hoc creation of interim jobs in lieu of available or suitable positions.

Conclusion

Using co-citation analysis and social network analysis to analyze the citation data published in SSCI database between 2000 and 2008, this study investigates expatriate research and describes the research paradigms in expatriate area. The results of this study suggest that contemporary expatriate research is organized along different concentration of interests: expatriate adjustment, global leadership, and repatriation adjustment.

Examining the Table 2, the readers could notice the high number of citations of what can be termed field-defining titles, which lay the ground work for the understanding of expatriates as a distinct field. This list can be a quick reference for new researchers to become familiar with the expatriate field of study. This study proposes a comprehensive methodology of identifying the research paradigms of expatriate research. The methodology that this study proposed can be used to investigate the literature of one academic discipline.

The contribution of this paper is to provide a valuable research direction in the expatriate area and propose an objective and systematic mean of determining the relative importance of

different knowledge nodes in the development of the expatriate field. The results of this study complement and improve the findings of other studies that have approached the subject from the qualitative perspective.

Even though this body of research has the undeniable merit of offering valuable insights into the intellectual structure of expatriate studies, it has some limitations. First, our search criteria may be incomplete, and many valuable papers may not have been included. Second, the sample articles were selected from 2000 to 2008, which might affect the generalization of this study. Future study is encouraged to combine the method of citation analysis with content analysis. With a methodology combining both citation analysis and content analysis, the future study will present the more comprehensive research evolution in the expatriate field.

Acknowledgement

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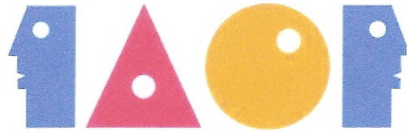
THE INFLUENCE OF CUSTOMER RELATIONSHIP MANAGEMENT PROCESS ON MANAGEMENT PERFORMANCE

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Abstract

Under the competitive environment, customer relationship becomes an important issue for decision makers to enhance the competition advantages. However, there are few literature discussed about the performance of the processes of customer relationship management (CRM), and the practitioners cannot understand how to evaluate the performance of CRM process. In this study, questionnaires are sent to the CEOs of the top 1000 enterprises in Taiwan and multi-regression analysis was used to evaluate the performance of CRM process, and many conclusions are obtained that can assist the decision makers of the related industries in decision making with regarding to the strategies development to deal with the competitive environment during the global financial crisis.

Keywords: Customer Relationship Management, Knowledge Management, Information
          Technology, Customer Orientation

Introduction

Under the competitive environment, customer relationship becomes an important issue for a decision maker to enhance the competition advantages. However, it is difficult to maintain and obtain a reliable customer loyalty under the competitive marketing environment. Consequently, to maintain a high level of customer loyalty, decision makers should pay more efforts in maintaining well customer relationship, and it is the major purpose of the customer management. In addition, apart from the well established customer relationship, decision makers should also perform knowledge management (KM) in their organizations. Through the records, classifications, storages, extensions and renews of knowledge assets, an enterprise can capture the superior competition. Moreover, knowledge is viewed as one of the important and high valued organization assets for an enterprise. In addition, the information technology is one of the most important tools to implement and enhance the customer relationship. Karakostas et al. (2005) stated that the major cause of inefficient customer relationship management (CRM) is the lack of the customer oriented development. Therefore, this study aims to investigate the influence of customer relationship management process on customer relationship management performance.

Literature Review

Dickie (2000) stated that there are 30.7% organizations enhancing the performance of sale and service through the implementation of the CRM. However, on the other hand, Giga (2001) argued that there are 70% enterprises that have not significant effect when they perform the CRM. Wang et al. (2004) investigated the performance of the CRM through two frameworks, tangible and intangible performance. The tangible performance is measured through the customer behaviors, since the basic objective of CRM is to ensure a stable profit and to enlarge

the equity value (Bolton et al., 2002; Grant and Schlesinger, 1995). The intangible performance is to evaluate the quality of relationship between the enterprise and its customers, and is further separated into customer loyalty and customer satisfaction. Zack (1999) concluded that the knowledge treatment process (KTP) includes four factors, namely attaining, improvement, storage and index, and presentation. Alavi (2001) classified the KTP as knowledge creation, knowledge storage, knowledge transformation and knowledge application.

Kim et al. (2003) argued that the success of the CRM depends on the well implementation of information technology (IT). The IT and the appropriate employees' behaviors can enhance the well interaction to customers. In addition, CRM can increase the usage of data base, data mining and data interaction, and establish and extend the knowledge base to accelerate the understanding of an enterprise for the customers (Bose, 2000). Consequently, IT is an important factor for CRM implementation to extract the customer knowledge (Crosby and Johnson, 2000).

Saxe and Weitz（1982）stated that the customer orientation is to implement marketing at the sales point and to assist the decision maker to make an appropriate purchasing decision. Consequently, the customer orientation is based on the customer profit and to capture a long term income for an enterprise (Robit et al., 1993). Therefore, the major objective of an enterprise is to attract its customers, and thus to satisfy the demands of them in the long term through the efforts of their employees.

Hypotheses

The CRM process is to explore the relationship between the enterprise and customers. The tangible performance of CRM is to increase the enterprise profit through enhancing the

customer purchase behaviors in the future. Consequently, the first hypothesis in this study is

presented as H_{10}.

H_{10}: There is a significant effect of CRM process to the management performance.
H_{1a}: The obtaining, maintaining and extension of CRM has a significant effect to the tangible management performance.

Because various steps of CRM process can render different degree of customer loyalty, and

thus the customer loyalty will be enhanced by focus on the CRM. Based on this argument,

another hypothesis is proposed and stated as H_{1b}.

H_{1b}: The obtaining, maintaining and extension of CRM has a significant effect to the intangible management performance.

Croteau and Li (2003) stated that the selection, storage and spread process of KM can

significantly influence the implementation performance. In addition, other scholars argued that

an enterprise should develop the capability of knowledge storage in order for it to establish the

profitable customer files (Crosby and Johnson, 2000; Stefanou and Sarmaniotis, 2003).

Therefore, based on this argument, there is a positive relation between the CRM process and

activities, and thus it can increase the profit of an enterprise (Zablah et al., 2004). Gibbert (2002)

pointed out that a successful application of KM can enhance the CRM process, and thus to

increase the customer value.

As mentioned-above, this study proposes the second hypothesis.

H_{2a}: The KM process has a significant effect to the acquirement, maintenance and extension of CRM in tangible management performance.

H_{2b}: The KM process has a significant effect to the acquirement, maintenance and extension of CRM in intangible management performance.

The CRM technology is a useful tool to assist an enterprise in enhancing the customer

relationship and in capturing the competitive advantages (Bharadwaj et al., 1993). The IT plays

an important role to record the CRM activities, and thus improves the management performance

of an enterprise. Davenport and Short (1990) stated that IT can smooth the operating process of

an organization and improve its performance. Therefore, we present the third hypothesis as

follow:

H_3: The CRM technology has a positive relationship to the acquirement, maintenance and
extension of CRM in management performance.

Williams and Attaway (1996) pointed out that the customer oriented behaviors can maintain

a well relationship between the salesman and the customer. Yilmaz et al. (2005) argued that the

higher the customer oriented behavior, the larger the positive financial performance is. In

addition, the purpose of sales with high customer oriented behaviors is to increase the long term

satisfaction and to create the customer loyalty. Consequently, the fourth hypothesis is obtained

H_4: The customer oriented behavior has a positive relationship to the acquirement,
maintenance and extension of CRM in management performance.

Methodology

The Framework

This study explores the influence of CRM process on CRM performance moderated by

KM, CRM technology, and customer orientation. The proposed framework is presented as

Figure 1.

The Subjects

There are 1000 questionnaires were mailed to the top scale enterprises in Taiwan, and

198 effective questionnaires were obtained. The investigative frames included (1) CRM process,

(2) KM process, (3) CRM performance, (4) CRM IT, and (5) Customer oriented culture. For

measuring the CRM process, this study uses three sub-frameworks, CRM acquirement, CRM maintenance and CRM extension as the independent variables. The moderated variables including KM process, CRM IT and customer oriented culture, and the dependent variable is the CRM performance divided into tangible and intangible performance.
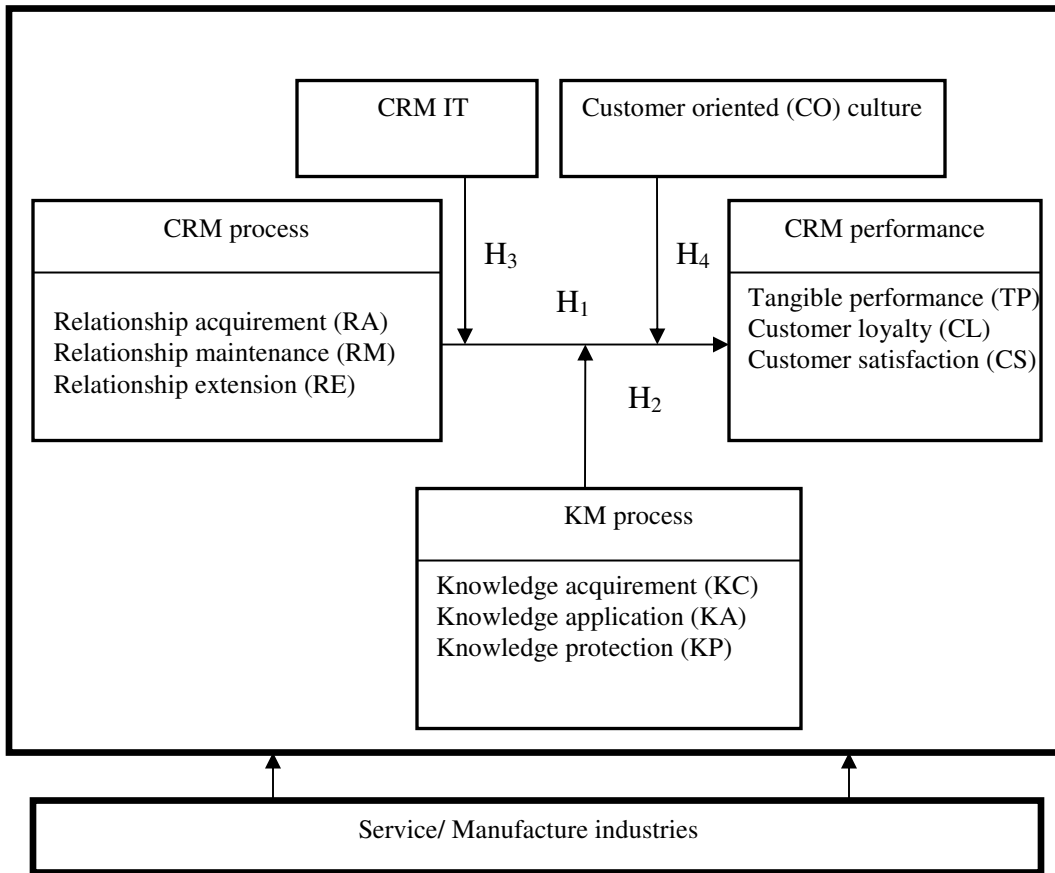
Figure 1 Study Framework

Data Analysis

In this study, we implement the factor analysis to classify the questionnaires. For the factor selection, the criteria are that the eigenvalue should greater than 1 and the factor loading needs greater than 0.5 for each factor. The results indicated that the CRM performance

concluded three factors: tangible performance, customer loyalty and customer satisfaction, and the KM capability has four factors: KM acquirement, KM transformation, KM application and KM protection. Whiles, the CRM IT only contained one factor, as well as the customer oriented culture. The Cronbach's α of each framework is greater than 0.7, meaning that the frameworks are all achieved at a high level of the reliability. In addition, the construct validities of most concluded factors were greater than 0.5, meaning that the overall construct validities were acceptable.

Regression Analysis

This study aims to explore the influence of CRM process on CRM performance, and the cross effect of KM, CRM technology, and customer orientation. Through the regression analysis, the results are presented in Table 1.

As can be seen in Table 1, the acquirement of customer relationship to the tangible performance, customer loyalty, and customer satisfaction attains a positive effect of the management capability in CRM process. Consequently, when an enterprise performs the CRM process, it will produce a positive effect for the tangible performance, customer loyalty, and customer satisfaction. In other words, when an enterprise and its customers maintain steady relationships, it will deeply enhance the customer purchasing behavior and the customer loyalty. Moreover, the CRM extension to the tangible performance, customer loyalty, and customer satisfaction also attains a positive effect of the management capability in CRM process, meaning that when an enterprise strives to extend the customer relationship, it will produce a positive effect for the tangible performance, customer loyalty, and customer satisfaction.

Table 1 The Analysis Of CRM Process To CRM Performance

	Tangible performance				Intangible performance							
					Customer loyalty				Customer satisfaction			
	β	t	p	IF		t	p	IF		t	p	IF
CRM acquirement	0.147	2.101	0.037*	1.408	0.377	5.482	0.000**	1.408	0.312	4.636	0.000**	1.408
CRM maintenance	0.228	3.206	0.002**	1.462	0.131	1.868	0.063+	1.462	0.202	2.946	0.004**	1.462
CRM extension	0.320	4.391	0.000**	1.526	0.208	2.905	0.004**	1.526	0.242	3.453	0.001**	1.526
R² Adjust	0.316				0.340				0.367			
D-W	1.703				1.933				1.804			
F(p)	31.352(0.000**)				34.831(0.000**)				39.045(0.000**)			

**P≪0.01, *P≪0.05, +P≪0.1

Cross Analysis

This study further investigates the cross effects of factors using regression analysis, and the results are presented in Table 2. As can be seen in Table 2, the acquirement of customer relationship and the customer loyalty of CRM performance show a significant effect, however it does not have a significant impact on both tangible performance and customer satisfaction. The major reason is that the first image of a customer to an enterprise usually influences their purchase behaviors, as well as the customer loyalty. In addition, if the decision maker can improve the customer relationship, then the customer loyalty can be increased, as well as increasing the customer satisfaction.

Based on the cross effect analysis, the results indicate that the customer relationship acquirement, KM, CRM IT, and customer oriented culture has significant impaction to the customer loyalty and satisfaction. Based on this finding, we conclude that through the KM, CRM IT, and customer oriented culture, the customer relationship can be enhanced, and thus to increase the customer loyalty and satisfaction. In addition, the customer relationship maintenance and the customer relationship extension to KM, CRM IT, and customer oriented culture can

significantly influence the tangible CRM performance and customer satisfaction. Therefore,

based on the appropriate management behavior, a significant tangible performance can be

produced.

Table 2. The Analysis Of The Cross Effect Among Factors

	Tangible performance			Intangible performance					
				Customer loyalty			Customer loyalty		
Main effect	β	p	VIF	β	p	VIF	β	p	VIF
CRM acquirement	-0.012	0.873	1.832	0.191	0.010*	1.832	0.090	0.192	10832
CRM maintenance	0.099	0.179	1.718	-0.008	0.909	1.718	0.043	0.522	1.718
CRM extension	0.187	0.013*	1.764	0.063	0.385	1.764	0.070	0.301	1.764
Knowledge management	0.155	0.078+	2.435	0.165	0.053+	2.435	0.139	0.082*	2.435
CRM technique	0.092	0.264	2.174	0.160	0.046*	2.174	0.224	0.003**	2.174
Customer orientation	0.270	0.000**	1.728	0.253	0.000**	1.728	0.323	0.000**	1.728
Cross effect									
KM *CRM acquirement	0.058	0.561	2.874	0.381	0.000**	2.874	0.285	0.003**	2.874
KM *CRM maintenance	0.227	0.035*	3.350	0.082	0.431	3.350	0.175	0.088+	3.350
KM *CRM extension	0.330	0.002**	3.283	0.187	0.072+	3.283	0.227	0.025*	3.283
CRM IT *CRM acquirement	0.004	0.977	4.359	0.377	0.002**	4.359	0.223	0.054+	4.359
CRM IT *CRM maintenance	0.189	0.203	6.085	0.066	0.643	6.085	0.202	0.138	6.085
CRM IT *CRM extension	0.374	0.008**	5.432	0.183	0.174	5.432	0.248	0.054+	5.432
Customer orientation * CRM acquirement	0.077	0.440	3.029	0.443	0.000**	3.029	0.308	0.001**	3.029
Customer orientation * CRM maintenance	0.233	0.034*	3.632	0.058	0.586	3.632	0.197	0.055+	3.632
Customer orientation * CRM extension	0.330	0.003**	3.579	0.158	0.139	3.579	0.211	0.039*	3.579
Adjust R^2		0.384			0.415			0.474	

**P<0.01, *P<0.05, +P<0.1

Conclusion

Under the competitive environment, customer relationship becomes an important issue for

decision makers to enhance the competition advantages. Since the market competition is fierce in

recent years, to keep the competitive advantages, an enterprise should focus on the customer

behaviors. Consequently, CRM becomes a very important issue for the decision maker. In

addition, some scholars point out that CRM technology and customer orientation are very

important for strategies development. To this end, many conclusions are obtained that can assist

the managers in decision making with regarding to the strategies development during the global

financial crisis.

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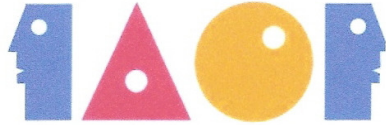
OPTIMIZING TIME SERIES RELATED FACTORS FOR THE FORECASTING MODEL VIA THE TAGUCHI METHOD

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Abstract

In this study, a forecasting approach with multiple controllable factors (data period, horizon length, and the number of observations required), calibrated using the Taguchi method, is proposed. Using an $L_9(3^4)$ orthogonal array, we construct the experimental design for calibrating the parameter levels of a forecasting model, so that fewer experiments are required but more information is obtained. After the orthogonal design and analysis of variance (ANOVA) is implemented, the Taguchi method is used to rank and screen selected factors by examining the main and interaction effects among these factors, while taking into account the cost of the experiments. The computational results show that the proposed approach performs effectively.

Keywords: Forecast, Taguchi Method, Experimental Design.

Introduction

Choosing a forecasting model and suitable levels of each factor is difficult, even for an experienced decision-maker. Trial-and-error is the most commonly used method for determining an effective combination of influential factors and treatments for experiments. Decision-makers require a systematic, less complex approach to determining the levels of the characteristics concerned. This systematic analysis can also clearly reveal the factors which need not be controlled which is essential to a decision-maker attempting to satisfy experimental cost constraints.

In this study we use Taguchi's work to provide a framework for considering interaction effects and for systematically selecting and screening these selected factors. In this approach, we choose the following quantitative forecasting characteristics: data period, horizon length, and the number of observations required for forecasting influences. The Taguchi method is then employed to rank and screen these selected factors by analyzing the main and interaction effects among them. We anticipated that the optimal combination of controllable factors and appropriate settings of each would yield a superior forecasting result. The objectives of the present study can be summarized as follows:

1. To investigate the influence of the main effects and interactions of the specified time series related to controllable factors in the forecast.

2. To investigate the optimal combination of controllable factors and their levels by using orthogonal arrays.

3. To specify an appropriate data period, horizon length, and number of observations required to establish the data collection method, and then to determine the construction of a highly efficient forecasting model.

Literature Review

In many cases, a small improvement in forecasting accuracy can provide considerable savings [5]. Researchers have traditionally used the Autoregressive Integrated Moving Average (ARIMA) model for forecasting, although other models are available. For example, Parzen [6] provided a method for selecting between higher and lower order ARIMA models using the nature of each time series. Carbone [1] and Makridakis *et al.* [5] extended Parzen's scheme by computing two models for each time series, the former aiming at the short term and the latter at the long term.

Because the characteristics may interact with each other when robustness is required, considering more than one forecasting characteristic simultaneously is difficult. Moreover, the effect of interaction may make it difficult to determine the optimum robust settings of factors for all forecasting characteristics [2]. It is of great importance, therefore, to derive a new method for ranking and screening forecasting factors, and to further investigate their interaction effects.

The Taguchi method has been very effective for designing a systematic method of investigating interaction effects [9]. Taguchi method has become a popular for analyzing the interaction effect in order to rank and screen factors. It is also a pertinent approach for solving problems with continuous, discrete, and qualitative design variables [3, 4].

Optimizing Time Series Related Factors Using the Taguchi Method

The Taguchi experimental design method is used here to select, rank, and explore the main and interaction effects. We first determine the quantitative factors and their levels. The orthogonal array is then used to decide the treatment combinations. Subsequently, we rank and screen these factors by analyzing the response table of the experiment. Finally, the decision-maker can determine what works and what does not, while considering the cost of the

experimental design. Therefore, the decision-maker can collect data more efficiently and achieve better business forecasting.

The results of the experiments are analyzed by ANOM to establish the optimum condition. The factors are used to specify the optimum conditions of a process. Meanwhile, the main effects and ANOVA reveal the importance of factors using a pair-wised comparison. ANOVA is routinely used to provide a measure of confidence. The technique does not directly analyze the data, but rather determines the variance of the data. Confidence is measured from the variance. Consequently, the relative percent contributions of factors could be determined by comparing their variance. The process of ranking and screening uses the sum of squares for these factors, which are calculated using a formula (for details of the calculation process, please see Pages 50-56, Roy, 1990). The levels of each factor that might produce the best results are extracted. The ranked and screened factors of the forecasting approach are then obtained by analyzing the main effect and the response table, and the incumbent optimal factors' levels are determined. In the next section, we choose the significant forecasting model, ARIMA, to serve as a demonstration example.

An Illustrated Example

In this section, an example from the Taiwan Power Company (R.O.C.) is used to illustrate the proposed method. These suitable data date from January, 1989 to December, 2001, for a total of 156 intervals (in months).

Determining Needed Factors and Levels

To choose the time intervals needed for the data period, horizon length, and the number of observations required, we adopt the Makridakis et al. model [5]. Firstly, the levels of the data period are set as {1, 3, 6}. The horizon length level is then set as {12, 24, 36}. Finally, the

number of observations required is set as {72, 96, 120}. These optimized levels using the proposed approach are summarized in Table 2.

Constructing the Orthogonal Design and Implementing An Experiment

In this study, this array is designated by the symbol $L_9(3^4)$. To compute the average performance of factor A at level 1, i.e., for A_1, we look in column A and find that level 1 occurs in experiment numbers 1, 2, 3 (Table 1). The average effect of A_1, is calculated by adding the results, Y, of these three experiments as follows:

$\overline{A_1} = (Y_1 + Y_2 + Y_3)/3 = (3.5888 + 3.2113 + 5.2362)/3 = 4.0121$. The average effects of other factors are computed in a similar manner, as shown in Table 3. %MAE is used as the performance index.

Table 1 $L_9(3^4)$ Orthogonal Array For Forecasting.

L_9	A	B	AB	C	Results
Experiment/Column	1	2	3	4	Y (%MAE)
1	1	1	1	1	3.5888
2	1	2	2	2	3.2113
3	1	3	3	3	5.2362
4	2	1	2	3	2.5172
5	2	2	3	1	2.1724
6	2	3	1	2	4.1512
7	3	1	3	2	4.2239
8	3	2	1	3	3.4974
9	3	3	2	1	5.0672

A: Data period, B: Horizon length, C: Number of observations required

Table 2 Factor Levels For Forecasting.

Name of parameter	Levels (month)
Data period	1, **3**, 6
Horizon length	12, **24**, 36
Number of observations required	**72**, 96, 120

Table 3 Analysis Of The Time Series Related Factors Experiment (Main Effect).

Factor/Level	Level 1	Level 2	Level 3	Difference
Data period (A)	4.0121	2.9469	4.2628	1.3159
Horizon Length (B)	3.4433	2.9604	4.8182	1.3749
Interaction (AB)	3.7458	3.5986	3.8775	0.2789
Number of Observations Required (C)	3.6095	3.8621	3.7503	0.1119

Ranking and Screening The Selected Factors

ANOVA establishes the relative significance of individual factors and the interaction effects. The results of the analysis are shown in Tables 4 and 5. The quantities and their interrelationships are defined using the following notations:

Table 4 Analysis of The Time Series Related Factors Experiment (ANOVA).

Column	Factors	f	S	V	P (%)
1	Factor A	2	2.9280	1.4640	33.59
2	Factor B	2	5.5751	2.7876	63.96
3	Interaction A×B	2	0.1168	0.0584	1.34
4	Factor C	2	0.0961	0.0481	1.11
All other/error					
Total		8	8.7172		100.00

One can chart the contributions of factors A (33.59%), B (63.96%), interaction A×B (1.34%), and factor C (1.11%) in the right-hand column of Table 4. The "difference" column (Table 3) reveals the maximum difference among the response results of each factor's level set by the ANOM. In the right-hand column of Table 4, three factors are ranked in the order of B (percent contribution, 63.96%; difference, 1.3749) -- A (percent contribution, 33.59%; difference, 1.3159)

-- C (percent contribution, 1.11%; difference, 0.1119). Following the above analysis, one assumes that factors A and B are stronger than interaction A×B and factor C, regarding the overall performance of these forecasting factors. The interaction A×B and factor C can be pooled in the selection of levels for optimal conditions.

Table 5 Analysis Of The Time Series Related Factors Experiment (Pooled ANOVA).

Column	Factors	f	S	V	F	P (%)
1	Factor A	2	2.9280	1.4640	27.5188	32.37
2	Factor B	2	5.5751	2.7876	52.3985	62.73
3	Interaction A×B	(2)	(0.1168)	Pooled		
4	Factor C	(2)	(0.0961)	Pooled		
All other/error			0.2129	0.0532		4.90
Total		8	8.7172			100.00

f = Degrees of freedom
S = Sum of squares
V = Mean squares (variance)
F = Variance ratio
P = Percent contribution

Pooling Factors

By analyzing the main effect, we can see that factor B (the horizon length) and factor A (the data period) have a larger effect than factor C (the number of observations required) does. Note that in the ANOVA table (Table 4), the effects of factor C and interactions A×B are insignificant, totaling slightly more than 2%, These factors are pooled to obtain a new table of ANOVA, shown as Table 5. As to factors A and B, in an F test, the F values are: $F_{V_1=2, V_2=4} = 6.9443$ at 95% confidence levels ($F_{0.05}$ (f$_1$, f2)). Since $F_A = 27.5188$ and $F_B = 52.3985$ (Table 5) are greater than $F_{V_1=2, V_2=4} = 6.9443$, factors A and B significantly affect this forecasting model and they will not be pooled.

If the decision-maker decides not to pool factor C, we will optimize the factors' levels and construct a forecasting model. Then we can carry out the complete analysis using ANOM. From Table 3, we choose the level with the smallest mean average response for each factor using repetitive runs. Consequently, we can obtain the optimal level for factor A as level 2 (*%MAE* =2.9469). In addition, level 2 (*%MAE* = 2.9604) for factor B, along with level 1 (*%MAE* =3.6095) for factor C, should be chosen. *%MAE* is 2.1724 if the optimal level for each factor is used.

When comparing results between factors with optimal levels (*%MAE* is 2.1724), and factors with non-optimal levels (*%MAE* is 3.7406), we find a 42% improvement in this specific example.

Validating the Experiment

Figure 1 shows a comparison of forecasting performance when optimized using ARIMA with different numbers of calibrated factors. The first histogram (*%MAE* =3.7406) in the figure indicates the non-calibrated performance, while the second histogram (*%MAE* =2.7124) represents the performance with all three controllable factors calibrated. The third histogram (*%MAE* =2.7334) denotes the performance where factors A and B (factor C is pooled) are calibrated.

Conclusion

As demonstrated in the above analysis, the proposed method considers both main factors and their interactions, simultaneously. Moreover, this method evaluates the forecasting task more economically. We can rank and screen controllable factors by using the Taguchi method. Since it is difficult to determine a forecasting model to suit every application and each application has its

own inherent characteristics, the proposed approach offers a robust design for a forecasting model with regard to data collection.

Figure 1 A Comparison of Forecasting Performance using Different Numbers of Controllable Factors.
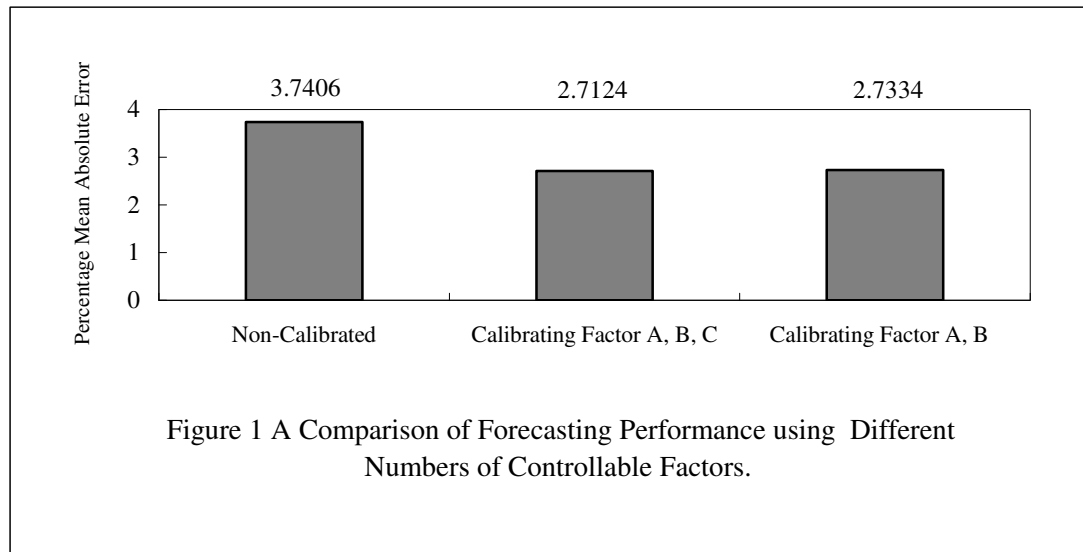
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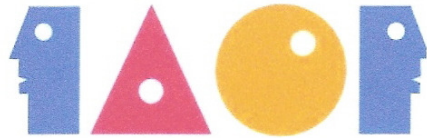
SUBSTITUTIVE RELATION OF EQUIVALENT EFFICIENCY IN DATA ENVELOPMENT ANALYSIS

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Abstract

This paper discussed the circumstances that do not affect the efficiency value of each Decision Making Unit (DMU), and the relation between "evaluating efficiency space" under equivalent Data Envelopment Analysis (DEA). If the changing relation of "evaluating efficiency space" can be controlled, then the changing quantity of each input and output can be controlled. This paper used a substitutive function to identify the substituting relations between inputs or outputs of each DMU. Therefore, by considering the whole market economically, a "lower cost" item can be substituted for a "higher cost" item. To describe this strict deduction, this paper developed 3 theorems, 4 corollaries, and 4 definitions. A few examples were utilized to demonstrate concept practicability.

Keyword: Data Envelopment Analysis, Equivalent Efficiency, Substitutive Relation

Introduction

From variables for known data in Data Envelopment Analysis (DEA), including m inputs and s outputs, the efficiency value of each Decision Making Unit (DMU) can be determined. However, the relations between these variables do not always remain the same. For instance, when evaluating a hospital's performance, under a situation of unchanged cost maintain at the lowest operational costs, if the hospital "hires one more doctor," then it should also "fire k nurses"; this is the essence of "substitution."

Mette et al. (2006) divided trade-off analysis into marginal and non-marginal rates of substitution. Banker and Maindiratta (1986), Bessent et al. (1988), Charnes et al. (1996), Olesen and Petersen (1996), Rosen et al. (1998), and Podinovski (2004, 2005, 2007) are marginal rates of substitution. Cooper et al. (2000) and Mette et al. (2006) are non-marginal rates of substitution. The drawback of marginal rates of substitution is that the substituting is effectual under extremely small substituting quantity. Analyzing the impacts of very small changes are not appropriate for numerous situations, in which the consequences of substantial changes to variables are of interest to, say, managers.

To deal with the substitutive phenomenon between variables, Podinovski (2004, 2005, 2007) proposed the concepts of production trade-off and weight restrictions, and assumed that such trade-offs exist naturally in almost any real production technology. The primary advantage of these two concepts is that Podinovski combined production trade-off and weight restrictions. However, the deduction of the mathematical formula emphasized in literature did not consider the macroeconomic beneficial results and their practicability.

The efficiency value of each DMU is evaluated on the basis of values of all inputs and outputs. At this moment, this paper is interested in determining the size of substitution, the kind

of change to the structural relations between inputs or outputs, and what would maintain the original evaluated efficient value.

This work defines this relation of evaluating efficiency as "the substituting relation of equivalent efficiency." Restated, what can be known about the fluctuation between inputs or outputs of the "evaluating efficiency space" under not changing the efficient value in each DMU?

The remainder of this paper is organized as follows. Section 2 introduces the concept of and explains substitutive relation theory. Section 3 presents a numerical example demonstrating the utility of substitutive relation theory. Section 4 presents conclusions.

Substitutive Relation Theory

When considering a substitution between variables, some increase and others decrease. If three or more variables are considered simultaneously for substitution, they will create an extremely large interference or create a contradicting phenomenon. Therefore, this paper only emphasizes the substitution relation between any two inputs or two outputs. This paper describes the concept of substitutive relation theory as follows.

Assume that two substitution variables are x_i and x_j; x_j represents independent variable, x_i represents dependent variable, and the regression model is

$$x_i = a + bx_j \quad \ldots\ldots\ldots(1).$$

Using Eq. (1), the following theorem is obtained.

Theorem 1

Under the situation of unchanged expected influence of each variable for its DMU, when x_j is increased by one unit, x_i should be increased by -b units.

Proof:

Equation (1) can be expanded to $2x_i = x_i + a + bx_j$. Assume that the influence of each unit x_i is q. If x_j increases by one unit under the situation of keeping influence unchanged, and assume that x_i should increase by d units, and expected value represents influence, then

$$E(2x_i) = E(x_i + d + a + b(x_j + 1))$$
$$2q = E(x_i) + d + [a + bE(x_j)] + b$$

i.e. $2q = q + d + q + b$, we proof $d = -b$. #

The corollary below can be obtained easily.

Corollary 1

Under the situation of unchanged expected influence of each variable for its DMU, when x_j increases by k units, then x_i should increase by -kb units.

For convenience, Eq. (1) is used to determine the relation between x_i and x_j . Assume that P_{ij} represents the obtained substitutive alternative when x_j increases by one unit, and the substitution relation correlates with x_i .

Definition 1

If variable x_j increases one unit, then variable x_i increases -b units in Eq. (1). The substitutive alternative for variables x_i and x_j is represented as $P_{ij} = (-b, 1)$.

By Definition 1, the operational rules of "substitutive alternative" P_{ij} are defined as Definition 2.

Definition 2

Assume that (-b, 1) and (-d, 1) are any two substitutive alternatives, k is any real number, and the operational rules of the substitutive alternative are defined as follow.

(1) For any substitutive alternative $(a,\ b) = (a/b,\ 1),\ b \neq 0$

(2) If $x_i = a + bx_j$, then $\alpha(-b,\ 1) = (-\alpha b, \alpha)$ represents the cases in which variable x_j is

increased by α units, variables x_i will be increased by -αb units.

Definition 3

   To define the combining operation among substitutive alternatives, ⊕ :

If $P_{kj} = (-b_1,\ 1)$ and $P_{ji} = (-b_2,\ 1)$ are any two substitutive alternatives, then the combination ⊕

of two substitutive alternatives will be defined as follows:

$P_{kj} \oplus P_{ji} = (-b_1, 1) \oplus (-b_2, 1) = (-b_1 b_2, 1) = P_{ki}$.

To describe the flawlessness of Definition 3,

let $(-b_1,\ 1)$, $(-b_2,\ 1)$ and $(-b_3,\ 1)$ be any three substitutive alternatives.

(1) Identity element

   If $(-b_1,\ 1) \oplus (-1,\ 1) = (-b_1,\ 1)$ and

      $(-1,\ 1) \oplus (-b_1,\ 1) = (-b_1,\ 1)$

         then (-1, 1) is the identity element of operation ⊕.

(2) Inverse element

   If $(-b_1,\ 1) \oplus (-1/b_1,\ 1) = (-1,\ 1)$, then

      $(-b_1,\ 1)$ and $(-1/b_1,\ 1)$ are the inverse element of operation ⊕ for each another.

(3) Commutativity

   $(-b_1, 1) \oplus (-b_2, 1) = (-b_1 b_2, 1) = (-b_2, 1) \oplus (-b_1, 1)$

(4) Associativity

   $[(-b_1, 1) \oplus (-b_2, 1)] \oplus (-b_3, 1) = (-b_1 b_2, 1) \oplus (-b_3, 1) = (-b_1 b_2 b_3, 1)$
   $= (-b_1, 1) \oplus (-b_2 b_3, 1) = (-b_1, 1) \oplus [(-b_2, 1) \oplus (-b_3, 1)]$

(5) Closure

Set $S = \{(-b, 1)/b \in R, \ b \neq 0\}$;

If $(-b_1, 1)$ and $(-b_2, 1)$ are any two substitutive alternatives in set S,

then $(-b_1, 1) \oplus (-b_2, 1) = (-b_1 b_2, 1) \in S$.

Theorem 2

If the substitutive alternatives are $P_{c1} = (-b_{c1}, 1)$ and $P_{f1} = (-b_{f1}, 1)$, then

$P_{cf} = (-b_{c1}/b_{f1}, 1)$.

Proof:

Let (1) $P_{f1} = (-b_{f1}, 1)$, i.e., $x_f = a_{f1} + b_{f1} x_1$ then $x_1 = -a_{f1}/b_{f1} + (1/b_{f1}) x_f$.

Thus, $P_{1f} = (-1/b_{f1}, 1)$

$\quad$ (2) $P_{c1} = (-b_{c1}, 1)$, i.e., $x_c = a_{c1} + b_{c1} x_1$

By Definition 3,

$$
\begin{aligned}
P_{cf} &= P_{c1} \oplus P_{1f} \\
&= (-b_{c1}, 1) \oplus (-1/b_{f1}, 1) \\
&= (-b_{c1}/b_{f1}, 1)
\end{aligned}
$$

The theorem is proved. #

Theorem 3

If P_{ij} and P_{ik} are two substitutive alternatives, then $\alpha_j P_{ij} + \alpha_k P_{ik}$ is also a substitutive

alternative, where α_j and α_k are any real numbers.

Proof:

Assume that $x_i = a_{ij} + b_{ij} x_j$, $x_i = a_{ik} + b_{ik} x_k$ and $x_j = a_{jk} + b_{jk} x_k$ are regression models, if the

relation between x_k and x_j is substituted into the regression model of x_i and x_k, then

$$x_i = a_{ik} + b_{ik}x_k = a_{ik} + \left(b_{ik}/b_{jk}\right)\left(x_j - a_{jk}\right)$$
$$= \left(a_{ik} - b_{ik}a_{jk}/b_{jk}\right) + \left(b_{ik}/b_{jk}\right)x_j$$

Thus,

$$\alpha_j P_{ij} + \alpha_k P_{ik} = \alpha_j(-b_{ij},\ 1) + \alpha_k(-b_{ik}/b_{jk},\ 1)$$
$$= \left(-(\alpha_j b_{ij} + \alpha_k b_{ik}/b_{jk}),\ \alpha_j + \alpha_k\right)$$
$$= (\alpha_j + \alpha_k)\left(-\frac{\alpha_j b_{ij} + \alpha_k b_{ik}/b_{jk}}{\alpha_j + \alpha_k},\ 1\right)$$

From the deduction of Theorem 1, if x_j is increased by one unit, then x_i should be

increased by -b units; if x_j is increased by $\alpha_j + \alpha_k$ units, then x_i should be increased

by $-\left(\alpha_j b_{ij} + \alpha_k b_{ik}/b_{jk}\right)$. Based on this deduction, this work can prove that $\alpha_j P_{ij} + \alpha_k P_{ik}$ is also a

substitutive alternative. #

By Theorem 2, the relation can be extended as follows.

If each substitutive alternative uses the 1st variable as a benchmark, i.e., in m input

variables, consider only $P_{21}, P_{31}, \cdots, P_{m1}$, then the substitutive alternative between the other

variables, say, P_{cf}, can also be inferred from P_{c1} and P_{f1}.

Corollary 2

Assume that x_c and x_f are any two variables of input variables or any two variables of

output variables, then P_{cf} can be inferred from P_{c1}.

Proof:

Assume that the relation of P_{c1} is $x_c = a_{c1} + b_{c1}x_1$,

the relation of P_{f1} is $x_f = a_{f1} + b_{f1}x_1$,

then the relation between variables x_c and x_f is

$$\begin{aligned}
x_c &= a_{cf} + b_{cf}\, x_f \\
&= a_{cf} + b_{cf} \left(a_{f1} + b_{f1} x_1 \right) \\
&= a_{cf} + b_{cf}\, a_{f1} + b_{cf}\, b_{f1} x_1 \\
&= \left(b_{cf} b_{f1} / b_{c1} \right)\left(\left(a_{cf} + b_{cf}\, a_{f1} \right) b_{c1} / b_{cf} b_{f1} + b_{c1} x_1 \right)
\end{aligned}$$

Therefore,

$$\begin{aligned}
P_{cf} &= \left(b_{cf} b_{f1} / b_{c1} \right)\left(- b_{c1},\ 1 \right) \\
&= \left(b_{cf} b_{f1} / b_{c1} \right) P_{c1}
\end{aligned}$$

The proof is done. #

Definition 4

Using input variables $x_1, x_2, x_3, \cdots, x_m$, the simple regression models for

variable x_1 are $x_2 = a_{21} + b_{21} x_1,\ \cdots,$ and $x_m = a_{m1} + b_{m1} x_1$; (m-1) substitutive alternatives,

$P_{21}, \cdots, P_{m1}$ can be obtained. Similarly, there are (s-1) substitutive alternatives for output variables.

These substitutive alternatives are called basic substitutive alternatives.

Corollary 3

Any substitutive alternatives between variables can be represented by basic substitutive

alternatives.

Proof:

Assuming (r, t) is any substitutive alternative for variables x_i and x_j.

Let $(r,t) = \alpha_2 (b_2,1) + \alpha_3 (b_3,1) + \cdots + \alpha_m (b_m,1)$, m $\geq$ 3,

where $(b_i, 1)$, $i = 2, \cdots, m$, are basic substitutive alternatives, α_i, $i = 2, \cdots, m$ are the weights of

the basic substitutive alternatives.

To solve the following equations:

$$\begin{cases} r = \alpha_2 a_2 + \alpha_3 a_3 + \cdots + \alpha_m a_m \\ t = \alpha_2 + \alpha_3 + \cdots + \alpha_m \end{cases} \quad \cdots\cdots\cdots\cdots (2)$$

(a) When $m \geq 4$, there are (m-1) variables in Eq. (2), namely, $m-1 \geq 3$, then there are infinite

solutions for Eq. (2). However, let m-3 weights of α_i, $i = 2, \cdots, m$ be 0, thus, there is one set of

feasible solutions. If an objective function is added, then an extreme value is obtained.

(b) When m=3, this inference must be tenable. #

The following example is a description of solving weights (α_i).

Example 1:

Assume that $x_2 = 5 + 2x_1$;

$$x_3 = 3 - 4x_1;$$

$$x_4 = 18 + 20x_1, \text{ then there must be}$$

$$x_3 = 13 - 2x_2.$$

If the optimal solution for the objective function is that x_2 should be increased by one

unit, x_3 should be decreased by two units; then from the substitutive alternatives of x_2, x_3, x_4

and x_1, { $P_{21} = (-2, 1)$, $P_{31} = (4, 1)$, $P_{41} = (-20, 1)$ }, assuming that the weight of three alternatives are

α_2, α_3 and α_4,

Let

$$P_{32} = (2, 1)$$
$$= \alpha_2(-2, 1) + \alpha_3(4, 1) + \alpha_4(-20, 1)$$

Then solve the following equations

$$\begin{cases} -2\alpha_2 + 4\alpha_3 - 20\alpha_4 = 2 \\ \alpha_2 + \alpha_3 + \alpha_4 = 1 \end{cases}$$

If $\alpha_4 = 0$, then the solutions for α_2 and α_3 are

$\alpha_2 = 0.3333, \alpha_3 = 0.6667$.

Corollary 4

Assume that two input variables (or two output variables), x_i and x_j, exist and their relation

is $x_i = a_{ij} + b_{ij} x_j$, then the substitutive alternative is $P_{ij} = (-b_{ij}b_{j1}, \ 1)$, where b_{j1} is the coefficient of

the substitutive alternative $P_{j1} = (-b_{j1}, \ 1)$.

Proof:

Assume that $x_i = a_{ij} + b_{ij} x_j$ and $x_j = a_{j1} + b_{j1} x_1$ are known;

therefore,

$$x_i = a_{ij} + b_{ij}(a_{j1} + b_{j1} x_1)$$
$$= a_{ij} + b_{ij} a_{j1} + b_{ij} b_{j1} x_1$$

Thus, $P_{ij} = (-b_{ij}b_{j1}, \ 1)$. #

Numeric Illustration

This section uses a numerical example to describe the substitution process among input

variables or output variables in the scenario in which the efficient value of each DMU dose not

change.

This example has three input variables, three output variables, and 13 DMUs. Table 1

shows the content of the original inputs and outputs of each DMU, and the efficient value of each

DMU solved by the input-oriented CCR model.

Based on the original data (Table 1), input variable X_1 is an independent variable that

individually obtains the regression model of the other input variables; output variable Y_1 is an

independent variable that individually acquires the regression model of the other output

variables. The regression models are as follows:

$$\begin{cases} x_2 = 17.766332 + 0.3241206x_1 \\ x_3 = 23.652261 + 0.2371859x_1 \\ y_2 = 15.412536 + 0.409621y_1 \\ y_3 = 8.7827988 + 1.1588921y_1 \end{cases}$$

Hence, the basic substitutive alternatives of x_1 to x_2 and x_3

are $P_{21} = (-0.3241206, \ 1)$ and $P_{31} = (-0.2371859, \ 1)$; the basic substitutive alternatives of y_1

to y_2 and y_3 are $Q_{21} = (-0.409621, \ 1)$ and $Q_{31} = (-1.1588921, \ 1)$.

This section separately discusses three situations using the basic substitutive alternatives.

(1)   Consider only the substitution of two input variables (x_2, x_1). (2) Consider only the

substitution of two output variables (y_2, y_1). (3) Consider the substitution of two input variables

(x_2, x_1) and two output variables (y_2, y_1) simultaneously. Table 2 presents the efficiency values

of original and after substituting.

The substituted and original efficient values are not different. The few parts of efficiency

value that are slightly different likely resulted from a calculation error by the computer.

Conclusion

Considering the whole market economically, "low cost item" can be substituted for "high

cost item". When adopting DEA to evaluate efficiency, if the change relation between the

"evaluating efficiency spaces" can be controlled, then the change quantity of each input and

output item can be controlled. This research utilized the "substitutive function" to identify the

substitutive relation between inputs or outputs for each DMU.

After deducing the theories and demonstrating the numeric example, this paper demonstrated that substitution between inputs or outputs does not change the efficient value of each DMU. That is, the substitution between inputs or outputs can be performed under a situation of equivalent efficiency for improved economic behavior.

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Table 1: The Input, Output Variables and the Efficient Values of Each DMU

DMU	Input variables			Output variables			Efficient value
	X_1	X_2	X_3	Y_1	Y_2	Y_3	θ
1	20	22	30	6	24	21	1
2	10	18	28	4	10	12	0.8168
3	15	23	29	5	20	16	0.8718
4	17	20	22	7	16	19	1
5	21	26	31	3	15	10	0.5643
6	14	24	26	6	19	17	0.9418
7	11	22	25	5	22	14	1
8	19	20	27	8	18	18	1
9	16	25	25	7	20	14	1
10	20	28	30	9	17	19	0.9067
11	13	25	30	10	22	20	1
12	18	22	25	8	18	17	0.9777
13	19	25	30	9	15	18	0.9

Table 2: Comparison of the Efficient Values Of Original And After Substitution

DMU	original	substitute x_1 for x_2	substitute y_1 for y_2	substitute x_1 for x_2 and y_1 for y_2
	Score	Score	Score	Score
1	1	1	1	1
2	0.8168317	0.812997	0.8168317	0.812997
3	0.871773	0.871877	0.8704624	0.8705551
4	1	1	1	1
5	0.5642955	0.5636038	0.5590672	0.558393
6	0.941846	0.9420734	0.9414284	0.9416443
7	1	1	1	1
8	1	1	1	1
9	1	1	1	1
10	0.9066667	0.9066667	0.9102041	0.9102041
11	1	1	1	1
12	0.9777391	0.9777391	0.9828571	0.9828571
13	0.9	0.9	0.9090909	0.9090909
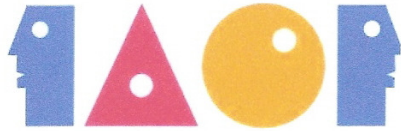
FACTORS INFLUENCING FIRMS' READINESS TOWARDS INNOVATION IN HOUSE BUILDING INDUSTRY: A MULTI-DIMENSIONAL CONSTRUCT

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Abstract

Evidence worldwide suggests that house building industry, is lagged in terms of innovation compared to other sectors in the economy. Many have argued that this is due to the characteristics of the industry itself which make innovation difficult to evolve. However, with the many challenges faced by the industry, there is a need for the players to innovate in order to survive. This paper aims to identify factors that can influence players or firms in the house building industry towards innovation. Specifically, with the help of readiness towards change theory, this paper seeks to identify factors which influence firms in the house building industry to adopt innovation. Since innovation in the industry can come in many forms, we argue that a multidimensional construct is more suitable than the unidimensional approach. At the end of the paper a framework which identifies possible factors that affected firm's readiness towards innovation are presented.

Keywords: Readiness Towards Innovation, Firm Readiness, Innovation, House Building Industry

Introduction

The need for innovation in the house building industry has been widely acknowledged. Increasing technological capabilities, changing consumer needs, tighter control over environmental regulations and quality standard, rising construction costs and increased competition are the many challenges faced by the industry. One way to cope with these challenges is through innovation (Duncan, 1972). Through innovation, firms gain capability and able adapt to market changes and demands (Kamaruddeen, et al., 2009a). Innovation claimed to be fundamental source of innovation, propels firms to generate new outcomes which is vital for their survival (Salavou, 2004). Nevertheless, to be able to sustain with such challenging environment, it is no longer sufficient if innovation is treated as a onetime event. Rather the firms must continuously be innovative to be able to securely sustained competitive advantage (Cooper, 1998). Pressure towards innovation indicates that firms not only should open to new ideas but also proactively pursue these ideas further. Innovation exhorts firms to improve or change their existing product, process or service continuously, by reducing cost or increase efficiency (Roy, et al. 2004). Inevitably, there will be trade-offs to be managed between keeping down the costs of innovation and delaying or abandoning the proposed innovation. Innovative firms encourage risk taking and boost up the efforts of developing new products, processes or services (Olson, et al., 2005). The embrace towards innovation will definitely help firms to improve their performance (Barlow, 1999).

Despite the agreement with regards to the need for innovation in the industry, evidence suggests that the industry is laggard towards innovation. In order words, the house building industry in countries worldwide is lack behind in adopting innovation. The industry which composes of a large number of small and medium sized firms and a small number of big firms,

still rely on the old ways of building housing which have proven worked to the advantage of the main players; the developers, contractors, subcontractors, suppliers and other dealers. Clark (2001) criticises that these players are too slow to incorporate new ideas which offer better quality housing and other environmental benefits. Among the reasons for this reluctant towards innovation, are the fear of embracing to something new and the negative perceptions with regard to innovation. It is argued that innovation will interrupt the firm structure or work process and turn the clients away (Barthorpe et al., 2000). The temporary nature of housing projects and the involvement of sub-contractors and other external consultants also make innovation efforts challenging in the industry (Asibong & Barlow, 1997). The industry is also criticised for lack of ability to invest in innovation, research and development (Barthorpe et al., 2000). In several developed countries, expenditure on research and development in the house building industry is also minimal. According to Gibb (1999), this is evidence of a lack of interest amongst the main industry players in respect of innovation. Similarly, it is not surprising that there is little academic research interest with regard to innovation in the industry. A few limited studies have mostly focused on barriers and strategies to promote innovation the house building industry. The earlier works of Ball (1999), Barlow (1999) and Gibb (1999) focus on the barriers towards innovation by house builders across the United Kingdom. More recent studies by Barlow and Vernables (2004), Halman et al. (2008) and Yusof et al. (2009) also focus on challenges and strategies to increase innovation in various areas of the house building industry in developed countries. House building industry studies that specifically identify the factors that influence innovation or a firm's propensity to innovation are rare.

This paper aims to fill this gap. With the help of readiness theory, this paper attempts to identify factors that can influence the industry players' readiness to embark into innovation. Many have argued that a revamp of house building industry is long overdue and essential for the prosperity of the industry (News Straits Times, 5th June 2004). Deploying innovations throughout the industry poses challenges because the many parties and stakeholders involved. Therefore there is a need to identify what drives innovation in house building firms. Tushman and Moore (1982) suggested that a firm's response to new ideas and its ability to transform them into viable products is influenced by its firm characteristics. Thus, the adoption of new ideas by a firm is a consequence of strategic initiatives pursued by decision makers in the firm rather than merely a reaction to external innovation. In addition, innovation effort is rarely confined within the boundaries of individual firms (Dogson, 1994). The external environmental factors or the market contexts in which firms operate can encourage (Rothwell, 1994) or constrain (Nicol & Hooper, 1998) a firm's response towards new ideas. Pursuing from these studies, we postulate that the success of innovation will depend on internal and external factors that affect the firms involved. Although there may be firms which have already adopted new products, processes, or services, the factors that can drive these firms towards innovation are not known. It is hoped that at the end of the paper a framework of possible factors that affect innovation can be established for more comprehensive and empirical studies with regard to innovation in the house building industry can be worked upon.

<div align="center">Innovation in the House Building Industry</div>

There seems to be a lack of consensus as to what can be conceptualised as innovation. The confusion arises because of the flaws in the definitions of innovation. In its simplest term innovation can be defined as producing or adopting something new (Gopalakrishnan &

Damanpour, 1997). Egbu and Anumba (2004) identify 5 dimensions; product, process, service, technological and market innovations. Service innovation is either a new or an improved service concept, customer interaction channel or delivery system (Van Ark et al., 2003). Technological innovation includes research or advanced development, breakthrough platform or an improvement to something already existing but with better performance (Shavinina, 2003). Market innovation can be in the form of new or improve method in product design or packaging, product placement or pricing, aimed at addressing customer needs, opening up new markets or newly positioning a product on the market (OECD, 2005). In the context of house building industry, Kamaruddeen et al. (2009b) define innovation as a tendency of a firm to adopt new products, methods, process and organizational system that are new either to firms or the industry. The many forms of innovation exist because housing development is a complex one. It starts with initial development idea and acquiring land and end with completion, occupation, refurbishment or redevelopment. Barlow (1999) suggests that innovation in house building industry can essentially take two forms: product innovations or process innovation. Product innovation is improvement in the product design and the level of service quality. Process innovation is improvement through the way in which the product, in this case, a house, being built. Subscribing to this reason, we argue that the literature which conceptualized innovation as unidimensional construct is insufficient in explaining innovation efforts in the house building industry. Rather, we argue that a multidimensional approach to explain innovation is more appropriate when a firm adopts one innovation, the same innovation also constitutes of other type of innovation. For example the Industrialised Building System (IBS) has resulted in both technology and process types of innovation. The use of IBS technology

means that the parties involved need to alter their building process and modify their project structure.

Yet there are limited studies which examining firm innovativeness from a multi-dimensional perspective. The few extant studies on innovation adoption in the Malaysian house building industry tend to examine innovativeness from a uni-dimensional point of view focusing on one type of innovation. Yusof et al. (2008) for example examine the readiness of housing developers and financial institutions towards a new housing delivery system. The authors suggest that there is a need for measuring innovativeness of housing developers from a multi-dimensional perspective. Elsewhere, Hagedoorn and Cloodt, (2003) have shown the advantage of using multiple indicators in determining firm's innovativeness. Because innovativeness of a firm is a key success factor for overall performance and success (Jansen et al., 2006), multi-dimensional perspective will enable the researcher to identify the innovative firms by examining all aspects of innovativeness such as the propensity to adopt innovative building products, new construction concept and practice, as well as new marketing strategies.

Factors Affecting Innovation

There is also an inadequate specification of factors which influence innovation despite of the many research interest in this particular area. A firm's readiness to adopt new ideas is widely recognised as an important factor in whether that firm will flourish. Few studies, however, have developed a holistic and systematic framework to assess readiness. 'Readiness' can be defined as the ability or capability of a firm to adopt or implement new ideas, processes, or products (Burns and Stalker, 1961). Some authors consider the ability of employees and managers as indicators of firm readiness to adopt or implement innovation. According to Armenakis et al. (1993), the attitude of a firm's employees towards a proposed innovation is an indicator of the firm's

readiness to make that innovation. Holt et al. (2007) note that readiness is usually discussed in the context of managers' efforts to avoid or overcome employees' resistance to innovation. On the other hand, some researchers define readiness not in terms of member resistance but in terms of member motivation to adopt the innovation. From this perspective, 'readiness' is the extent to which individuals are prepared to participate in firm development activities (Huy, 1999). 'Readiness' is reflected in the willingness, motives, and aims of firm members regarding a proposed innovation (Beckhard and Harris, 1987). Readiness can also be defined in terms of the social, technological and systematic ability of a firm to try new things (Beer, 1987). Thus, as rightly conceptualised by Armenakis et al. (1993) and Eby et al. (2000), readiness is the antecedent to behaviours that are associated with adoption or resistance.

Previous studies on readiness have analysed many factors that affect firm readiness towards innovation. Some authors use the Workplace Readiness Model of Muir (1996) to develop a 'change message' that takes internal and external contextual factors into account. Contextual factors that are considered include a firm's operating environment, the nature of interpersonal and social dynamics within the workplace, and the selection and use of innovation agents who are able to communicate the value of an innovation to all levels of the firm (Looi, et al., 2002). Other authors use the Burke-Litwin model. For example, De Pofi (2002) uses the Burke-Litwin model in his study of firm innovation management, which focuses on transformational factors and transactional factors associated with innovation. 'Transformational' factors include environmental forces such as the external environment and firm leadership, mission, and strategy. 'Transactional' factors innovation from day to day and include variables such as reciprocity between people or groups. The Burke-Litwin model considers firm culture, management practices, firm structures and systems, individual needs and values, task

requirements, member skills and abilities, and individual and firm performance (De Pofi, 2002).

A more recent publication by Holt et al. (2007) uses the innovation categories suggested by

Armenakis and Bedian (1999) to examine the content of 32 readiness instruments and uses them

to develop an integrated model of readiness for innovation. Their model suggests that a number

of factors influence readiness to innovation, including innovation-specific content, the process

involved in implementing the innovation, the internal firm context and the characteristics of the

individuals responsible for implementing the innovation (Holt et al., 2007). Drawing from the

aforementioned literature, four categories of factors which influence innovation readiness can be

identified: firm characteristics, resources, market, and external support factors. The following

provides a detail discussion of the factors.

Firm characteristics consist of a variety of firm variables such as firm culture

(Rangarajana, et al., 2004), firm structure (Lim, 2003) and firm size (Garcia-Morales et al,

2007). Firm culture encompasses the firm's shared values, its behaviour patterns and the set of

norms that shape the way the firm carries out its business (Teece, 1996). Specifically it refers to

how individuals perceive their firm and the pattern of beliefs, values and expectations created by

these perceptions (Ivancevich et al., 2005). For instance, a culture that is receptive of risk can

encourage innovation (Ramayah et al., 2005). Likewise, firms with innovative cultures are more

likely to be successful at implementing new practices (Ungan, 2007). 'Firm structure' is the way

in which a firm is structured for the purpose of achieving predetermined outcomes (Borgatti,

1996). A number of structural attributes have been identified as influencing firm decisions

regarding innovation. For instance, Russell (1999) found that an informal, decentralised structure

offers increased autonomy and control to a firm's subordinates, which drives the firm to embark

on new ventures. Similarly, a structure that permits flexibility and speedy decision-making

results in a positive impact on a firm's receptiveness towards new ideas (Covin and Slevin, 1990). Firm size has long been considered as important factor that affect innovation. Garcia-Morales et al (2007) find that since large and small firms have different characteristics, the factors which trigger innovation for these firms are different; in large firms strong structure, investment to R&D, and quality of workers are important to influence firm readiness towards innovation, where as in small firms, the factors are flexibility in structure, specialization and strong ties with clients. Large profit motivated firms have positive relationship with innovations that warrant high technology utilisation but the same does not happen in small firms (Lee & Xia, 2006). Therefore it can be assumed that the higher the firm characteristics readiness, the higher the developers' readiness towards innovation.

'Resources' include assets, capabilities, firm processes, information and knowledge (Barney, 1991). 'Capital resources' include money and land. Financial resources are required for various business activities, including operation, management, and acquisition. Financial resources may come from the proprietor's own cash reserves, bank loans, sale or rental proceeds, stakeholders' shares, or non-liquid assets (Abdul Hamid, 2002). Firms with strong funds and equipments have many advantages and more capable to be innovative (Stock et al., 2002). 'Human capital' refers to the leaders and employees who work in a firm (Somboon, 2006). Many past studies have proven that effective leadership and employee skills are crucial factors in the successful implementation of innovation in a firm. For example, Kearns and Lederer (2004) find that a strong top-level leadership commitment encourages other functional managers to join the process of innovation, thus engaging their knowledge of business processes and leading to the successful adoption of new ideas. On the other hand, individuals responsible for developing and implementing new ideas must possess appropriate knowledge, skills and expertise, either by

formal training or through experiential learning opportunities made available within the firm (Siemieniuch and Sinclair, 2004). Thus, the higher the resource readiness, the higher the developers' readiness towards innovation.

The preceding discussion has focused on the internal aspects of firms. However, external factors which are beyond the control of the firms are also important. For instance, Johnson (2004) finds that the emergence of new technology was a driving factor leading firms to implement quality standards. He also finds that environmental forces such as mandated, involuntary, customer-required quality registration had an impact on firm innovation. An empirical study by Haveman (1992) looks at the impact on firm change of shifts in California's loan industry regulations and found that these modified regulations generally enhanced the financial performance of the firms concerned. We can assume that the higher the external support readiness, the higher the developers' readiness towards innovation.

Market is another factor that can influence innovation. 'Market readiness' refers to the extent to which the customers and other stakeholders of a firm are able to absorb innovation (Slater and Narvere, 1995). Market readiness includes the responsiveness of a firm to market information (Ibid.). A market-responsive firm gathers ideas for improvement and new ideas from the market (Hurley and Hult, 1998). The 'market orientation' of a firm is the extent to which the firm makes meeting the needs of current and future customers a main goal (Day, 1994; Kohli and Jaworski, 1990). Interaction, participation and making contact with customers and stakeholders are vital to facilitate the implementation of new ideas (Imai, et al. 1985). Market knowledge stimulates new ideas and provides an opportunity to act proactively (Slater and Narver, 1995). Therefore, the higher the market readiness, the higher the developers' readiness towards innovation.

Conclusion

The paper adds to the limited knowledge on innovation efforts within the house building industry by focusing on factors impacting firm's readiness towards innovation. Innovation is considered as a vital source for change and within the house building industry, innovation comes in many forms. Thus innovation is considered as a multidimensional construct, which encompasses product, process, service, technological and market innovations. Overall, this paper identifies four major factors that may influence the readiness of firms in house building industry towards innovation. The factors are firm characteristics, resources, external support, and market factors. More work in terms of an empirical study is needed to validate the appropriateness of the proposed matrix. We believe the proposed matrix can be applied in other industry.

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AN INTEGRATED RELATIONSHIP ON BRAND STRATEGY, BRAND EQUITY, CUSTOMER TRUST AND BRAND PERFORMANCE – AN EMPIRICAL INVESTIGATION OF THE HEALTH FOOD INDUSTRY

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Abstract

This research has developed a brand and customer trust relationship and theory frame for the health food market. The data collected from questionnaire investigation method in Taiwan, probing into the brand strategy, brand equity, and customer trust in health food market with LISREL linear structural model via questionnaires. The most significant findings are significant positive correlation between brand strategies, brand equity, customer confidence and brand performance.

Keywords: Brand Strategy, Brand Equity, Customer Trust, Brand Performance.

Introduction

If customers do not have sufficient knowledge of health foods, they will face many problems easily. Therefore, the health food manufacturers must understand how to utilize the brand strategies, having the consumers to recognize their brands, and acquiring the customer trust through the establishment of brand equity, and then responding the fruitful result to the brand performance. According to the research motivations and objectives, the research scope of this study is defined as follows :(1) The health food is being defined as "Foods that can provide special nutrients or particular health care effects, which can satisfy with the requirements of health care or functions". (2) This study aims at the brands of health foods sold in Taiwan area as the primary research object, excluding the foreign brands that are not being sold in Taiwan.

Literature Review

Definition and Purpose of Brand Strategies

Aaker (1996) disclosed that the development of a brand identification, a statement for brand value, and a brand positioning. According to Aaker (1996), the goal of brand strategies was to create a resonance between an enterprise and consumers. Kotler (2000) had classified the brand strategies into five strategies, which comprise the extension of product line, brand extension, multiple brands, new brand, and co-branding etc. Besides, Aaker & Joachimsthaler (2000) revealed that the "Brand Relation Spectrum" was architecture of brand combination for defining the essence of relationship between of the brand role and the brand itself.

This study refers to the brand strategy factors revealed by Aaker & Joachimsthaler (2000), and probes into four strategies related to its brand group, endorsed brand, sub-brand, and "A Branded House", and hereby taking these as the variables of the present study.

Definitions of Brand Equity

In light of the related literatures of prior researches of brand equity, most scholars defined the brand equity as: an additional value that the brand gives it to the product or service, Aaker (1991) proposed that brand equity contains five primary factors in order to create values for the enterprise and consumers. The detailed description is as follows:

1. Brand loyalty: The brand loyalty is the core of brand value, which can maintain original customers and attracting new customer groups, also providing transaction leverage and sometimes responding the threats from its competitors.2. Brand awareness: Latent customers have a capability to recognize or recall certain brand from specific product classification, which can reflect the intensity of customer's feeling on this brand.3. The perceived quality: The customers will have a subjective satisfaction at the comprehensive quality or recognition level against the product or service offering under such brand.4. Brand association: It indicates that in the consumer's memory, for all associate with the brand, if these associations can be assembled all together with some signification, then the impression on this signification would become a brand image. The brand image is a communication result of the brand positioning.5. Other proprietary brand assets: comprises the patent, trademark, relationship between channel operators etc.

Keller (1993) studied the brand equity based on the standpoint of consumers, and proposed that brand equity was derived from the consumers' brand knowledge.

Measurement of Brand Equity

Generally speaking, the brand equity usually can be examined with two aspects, the financial aspect, and the customer foundation aspect. Aaker (1991) revealed two methods for measuring the brand equity through the customer foundation aspect: 1. Price premium approach.

2. Customer preference. The indirect method utilized by Keller (1993) was measuring the brand knowledge, which is utilizing the brand awareness and brand image to evaluate the latent sources of brand equity; however, the direct principle was directly measuring the variation result of brand knowledge that customers directly responded to the promotion activities. Lasser, Mittal & Shpowera (1995) had firstly developed five factors of brand equity according to academic and industrial literatures, which comprised: Product performance, social image, value, level of trust, and brand identification/dependence.

Aaker (1996) reconstructed the measurement method for brand equity by adding the market behaviors to four original factors developed by him comprising: the brand loyalty, brand awareness, brand perception, and brand association. The brand loyalty could be measured through two indices, such as the price premium and satisfaction/loyalty; and the brand awareness could be measured through the brand awareness index; the brand perception could be measured through two indices, such as the perceived quality and leadership position; and the brand association could be measured via the indices of perceived value, brand characteristics, and association of enterprise etc., and finally the market behavior could be measured via indices of market share, price and channel coverage.

This study refers to Aaker's (1996) research, probing into the brand loyalty, brand awareness, perceived quality and brand association within the brand equity, all of them are considered as variables in this study.

Customer Confidence

Doney and Cannon (1997) proposed the trust meaning both transaction parties all believed that the other party who was reliable with a heart of benevolence. And high confidence would enhance the commitments from both transaction parties, facilitating the mutual

correlation, decreasing transaction cost; therefore, the transaction cost theory was becoming an extreme important issue.

Transaction Cost Theory

The concept of transaction cost was disclosed by Coase (1937), who proposed that the market could moderate the transactions via price mechanism, thereat, the transaction not only was subjected to the operation of market mechanism to moderate prices, but also both the prices and transactions, in a transaction procedure, would be affected by the negotiation conditions, and competition status of both parties.

Williamson (1985) had classified the transaction costs into the information search cost, agreement cost, contracting cost, monitoring cost and execution cost.

Definition of Trust

Mayer et al. (1995) defined the trust as, a trustor were willing to accept the vulnerability due to trustee's behaviors, this willing was constructed on a foundation that the trustor allowed the trustee to perform an extreme important action for him and expecting to obtain a positive response from the trustee, despite it might be a problem in monitoring, controlling the trustee' responses.

Doney and Cannon (1997) revealed that the trust was a kind of reliability and benevolence of trustee that could be recognized by us. However, Kristof, Gaby and Dawn (2001) proposed that the trust represented the level of trust on the dependence and honor that the consumers towards the retailers.

Han, Sang-Lin and Sung, Hyung-Suk (2008) found that supplier–buyer transaction performance is influenced by the eight important factors: supplier competence, purchasing value,

customer satisfaction, switching cost, brand trust and loyalty, relationship quality, commitment, and transactional performance.

In light of the preceding literatures, the consumer had defined the "trust" of retailers as, the trustee possessed characteristics, such as reliable, good intention, and capability of fulfilling commitments etc., and in addition, the maintenance of transaction partner's relationship was also rather important. This study proposes that methods, such a locating a trustful transaction object and constructing a long-term transaction relationship, will be able to weaken the other party's opportunism behaviors, improving transactions atmosphere, developing the maintenance of mutual-trust as well as weakening the atmosphere uncertainty and reducing the transaction cost.

Sources and Factors of Trust

Bhattacharya et al. (1998) also emphasized that trust contained several features comprising: (1) From the aspect of scenario feature: trust was inhering in an uncertainty and risky atmosphere; (2) From the aspect of individual recognition: trust reflected a kind of expectable standpoint; (3) From the aspect of influence: trust is important and powerful; (4)

From the aspect of interaction: trust existed in the relationship of mutual dependence. Young-Ybarra & Wiersema (1999) had partitioned trust into three primary characteristics: 1. Dependability: the partner's activities would prior focus on the benefits of allied members; 2. Predictability: the partner's actions is uniform, therefore, it is allowable for each member to predict its partner's activities; 3. Reliability: each partner believed that there were no any opportunism behavior made by any other member. This study refers to the above literatures and probing into the reputation, goodwill, reliability and professional capability within the customer confidence, and hereby adopting all these factors as variables in this study.

Definition of Brand Performance

Duquette and Stowe (1993) suggested that the so-called "performance" meant a kind

of measurement on the level of achievement of organization's goal, which utilized methods

of index and measurement to representing the levels of achievement of missions, targets, and

objectives of related project. In addition to tangible assets belonging to the product itself, the

brand performance also possessed additional intangible assets. Besides, it had a close linkage

with consumers, but having various subjective judgments about measuring indices of

consumers.

Delaney and Huseelid (1996) indicated that while judging whether an enterprise or a

business unit had achieved its goal or not, it needed to add some subjective judgments in order to

evaluate the organization's performance, wherein, all recognized indices would have a high

linkage with those objective indices. However, Kaplan & Norton (1996) emphasized that

ultimate goal for all business operations, investments, improvement activities, would like to

improve the company's finance. Therefore, no matter it was an objective or subjective measuring

performance, the ultimate goal lay in the creation of company's profits, striving for the

sustainable competitive advantages.

Brand Performance Index

Aaker (1991) disclosed the "Brand Equity Ten" from the viewpoints of products and

markets, which had also been classified into five classifications for performing the measurement,

comprising: the brand loyalty, brand awareness, brand perception, brand association and market

behavior. Keller (2003) set forth the "Brand Value Chain", which comprised four stages, such as:

the investment of marketing plans, customers' attitudes, brand performance, shareholder value

etc., and wherein, the brand performance could be measured along with the assistance of six

factors including: the flexibility of prices, price premium, brand extension rate, market share, profit capability and cost structure.

This study refers to the "Brand Value Chain" presented by Keller (2003) adduces, and summarizes preceding research literatures, and picks up the flowing measurement indices for brand performance, comprising: the market share, relative prices, price premium, and flexibility of prices etc. after consideration, and in addition, all will act as variables in the study as well.

Research Methods

Research Framework

The conceptual framework and operational framework is shown in Figure 1.
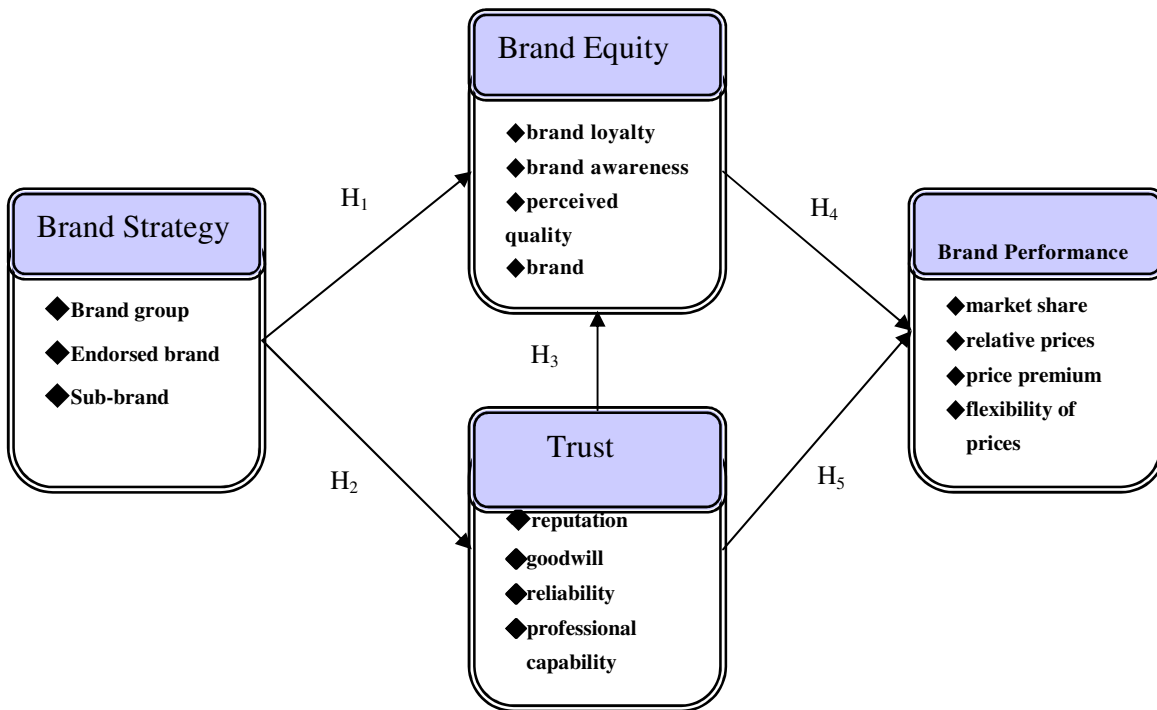
Figure 1 Operational Research Framework

Research Hypotheses

In light of the research problems and conceptual framework, hence, this study develops related research hypotheses. Rao et al. (2004) revealed that the brand and brand equity represents with the relationship between the manufacturer and his consumers, and it also can affect the manufacturer's value. Rust et al. (2004) emphasized the strategies that a company drawing up would affect the brand equity in marketing assets, and would also affect the company's value ultimately. Thus the research hypothesis as follows:

H1: The more successful brand strategies that a company has, the higher brand equity it will be.

Blackett & Board (1997) discovered the cooperation of both parties of co-brand would facilitate the new company being quickly accepted by the original customer groups and hence creating new market thereto. While a brand owner is creating its brand strategies, it should consider the level of consumer confidence in the company. Thus, the research hypothesis as follows:

H2: The more successful brand strategies that a company has, the higher level of customer confidence it will be.

Madhok (1994) pointed out that trust included the structure factors (e.g. trust based on threat, plot) and social factors (e.g. trust based on private relations, identification, mechanism), the former could urge the members to establishing the cooperative relationship, and the later could urge the creation of overall beneficial behaviors. Thus, research hypothesis as follows:

H3: The customers have higher level of trust in the company, the higher brand equity that company will have.

Kim, H.B, & Kim, W. G.（2005）indicated that brand loyalty, perceived quality, and brand image are key components of customer-based brand equity, also found a positive relationship to exist between the components of customer-based brand equity and the firms'

performance in luxury hotels and chain restaurants. Srivastava and Shocker (1991) emphasized that the brand equity included the brand advantage and brand value, wherein, the source of brand advantage mainly resulted from consumers and distributors' cognitive behavior; therefore it could make the said brand possessing the sustainable and diversified advantages. Thus, this study discloses the research hypothesis as follows:

H4: The higher brand equity of the company, the higher brand performance that the company will have.

Singh and Sirddeshmukh (2002) indicated that the transaction related to trust had the following characteristics: the service performance was very difficult to be judged, there was a significant result, and it needs a high participation. In the health food industry, it is difficult in determining the product function and effects, and it needs a high participation etc, therefore, it could assume that "Trust" was playing an important role. In addition, Bloemer and Odekerken-Schroder (2002) revealed that if the consumers had enhanced the level of trust in the supermarkets. Thus, this study discloses the following hypothesis:

H5: The higher level of customer confidence in the company, the higher brand performance will be.

Measurement of Research Variables

The contents of questionnaire have been modified according to related literatures, in order to comply with actual situations. The measurement on each variable will be performed along with 7-point Likert Scale.

Sampling

The present questionnaire contents were modified according to comments provided by industrial experts. The research object aims at the young people aged about 25~26 who had ever bought health foods and residing in Taipei metropolitan area, and moreover, the selected

marketing channels comprising the direct-sales, cosmeceutical store, hospital, clinic or pharmacy store as well as general food store etc.

Anderson & Gerbing (1988) suggested that 100~150 samples would be the minimum size limitation for sample size to satisfy with LISREL maximum likelihood estimation. When the error of sampling data is discrete, the required sample size can be computed by using the formula as follows.

$$n = \frac{Z^2_{\alpha/2} \times p \times q}{e^2}$$

*n: sample numbers, α: obvious level, e: error, p: yield, q: defective rate

This study is preparing to distribute 450 questionnaires, in order to meet the requirement of sample size. This study recovered 423 copies, deleting 36 invalid questionnaires; there were 387 valid questionnaires in total.

Validity and Reliability Analysis

The variables being probed in this study deriving from the theory model revealed by related scholars, as to the questionnaire aspect, it was also being summarized from specialists' opinions, hence, its contents conforms to the requirement of validity.

This study has constructed the validity through the LISREL analysis. The Cronbach's α value of each latent variable used in this study respectively comprises: brand strategies 0.62, brand equity 0.83, competition strategies 0.80, brand performance 0.81; and wherein, the composition reliability (CR) is almost larger than 0.6, The Cronbach's α value is larger than 0.5, which is still acceptable.

Data Analysis and Results

This study adopted SPSS13.0 and AMOS7.0and utilized AMOS7.0 to analyze the goodness of fit for overall model and interpretative capability. In the Pearson correlation, all factors had an obvious positive correlation. This study adopted the indices presented by Hair et al. (1998) to process the evaluation criterion of overall goodness of fit for the model. The assessment results showed that LISREL Model used in this study has a perfect goodness of fit.

Hypothesis Testing of Model

The overall model path of this study is shown in Figure 2.

Study Findings

The relationship between the brand strategies, customer confidence and brand equity. Due to the H1 is being supported, it is found, therefore, the more successful brand strategies that a company has, the higher brand equity recognized by the customers it will be, that is, the brand strategies has a positive effect on the brand equity; according to research H3, it is found, therefore, the customer confidence also presents a positive relationship with the brand equity. So both the brand strategies and customer confidence have an absolute relationship with the brand equity.

The relationship between the brand strategies and customer confidence

Due to the H2 is being supported, it is found, therefore, the brand strategies has a positive effect on the customer confidence, meaning that the more successful brand strategies that a company has, the higher level of customer confidence it will be, therefore, by the time while the company is drawing up the brand strategies, it is extreme important to choose appropriate brand strategies for target market.

Note: ———▶ obvious ┈┈┈┈▶ not obvious
* indicates when t-value is larger than 1.96, p<0.05
** indicates when t-value is larger than 2.58, p<0.01
*** indicates when t-value is larger than 3.29, p<0.001

Figure 2. Overall model's Path Chat

The relationship between the brand equity, customer confidence and brand performance.

Due to the H4 is not being supported, it is found, therefore, although the company has higher brand equity, the company may not always have higher brand performance, that is, the brand equity does not have a positive effect on the brand performance; due to the H5 is being supported, it is found, therefore, the higher level of customer confidence in the company, the higher brand performance will be, that is, the customer confidence has a positive effect on the brand performance.

In light of the preceding results, it can be found that when a customer is choosing the health foods, if the company can effectively maintain its cooperation with customers on mutual-trust and relationship, then it will drive the promotion of overall performance.

Conclusion

Marketing Implications

(1) According to the research results, it is found that the customer confidence has an obvious influence over the brand performance. The establishment of the company's brand strategies shall incorporate how to construct the customer confidence.

(2) The reputation of the brand would be the prior consideration for the customers. The proper operation on the brand strategies can strengthen the customers' trust level to products, and further promoting its brand performance.

(3) It is clear that the related brand supplier shall draw up accurate brand strategies according to its product features and market situation, so that it will be able to possess concrete customer confidence, high brand equity and perfect brand performance.

Research Contributions

This study has established the research framework and hypotheses through the literature review and summarizing the research results with implementation of empirical analyses, thus, this study is able to provide the contributions as follows:

Academic Contributions

1. *Introduce the consideration variable of customer confidence into the studies related to the brand*

In view of the prior brand researches, most of them were focusing on the brand strategies, the brand equity. This study primarily focuses on the brand and incorporating the factors of trust which has an absolute relationship with customers, so as to probe into the brand strategies, brand

equity and customer confidence, and wherein, all of them will be used as a basis for evaluating the customers' brand performance, and hoping that it will be easier for the brand strategies to meet the customers' requirements with the concept of brand measurement, and hence, it will be able to discover the core problem and correcting the company's marketing strategies and service attitude for improving the overall brand performance.

2.   *Apply brand-related theories to the health foods industry*

In the past, most of researches related to the health food industry were focusing on channel-related themes, and this study has established one brand strategy by way of actual observations, theoretically probing into the construction of one research framework related to the relationship between the brand strategies, equity and customer confidence as well as the brand performance, and in addition, setting forth the research hypotheses and empirical analyses, where the whole process can be used as a reference in the future researches.

Practical Contributions

1.   *Dissect the competition markets of health foods*

The health care products are currently popular merchandises, this study utilizes related literatures to constructing the analyses of the customers' brand concepts of health foods, so that it can be used as a model strategy for drawing up the company's related strategies, and meanwhile acting as a reference in the establishment of marketing strategies by the related circles.

2.   *Utilize linear structure model in the empirical researches related to the health food industry*

This study utilizes the linear structure model to look into the influence of brand strategies, equity and customer confidence of health foods upon its brand performance, and furthermore setting forth a relationship model with excellent goodness of fit.

Research Limitations

1. This study is simply focusing on the Taipei City as the sampling target; therefore, it may not understand the variation characteristics of samples obtained in other areas.

2. The current research is focusing on the conscious feeling of consumers, which has not probed into the feeling of other channel members.

3. Use the questionnaires as the basis of performing measurement, along with 7-point Likert Scale, wherein, the interviewee was filling the questionnaire according to its subjective memory, it still has some distortion or deviation.

Future Work and Suggestions

1. Several variables such as the manufacturer's management capacity, the marketing application mechanism etc., all may have more obvious influence on the brand performance, therefore, it can construct a more comprehensive overall model by introducing these variables.

2. Miquel, Caplliure & Aldas-Manzano (2002) assumed that the consumers having higher level of product participation would acquire larger volume of product knowledge, so they can recognize the product's brand, quality difference, therefore, it is able to adjust the relationship between the consumer confidence with purchasing intention. Thus, this study, based on the consumption characteristics of health food industry, suggests the future researches may incorporate the influence variables of product participation level.

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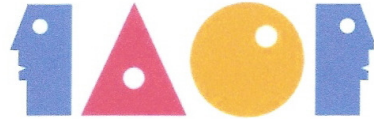
A STUDY OF THE EFFECT OF TV DRAMA ON RELATIONSHIPS AMONG TOURISTS' EXPERIENTIAL MARKETING, EXPERIENTIAL VALUE AND SATISFACTION

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Abstract

This study aims to use TV drama to explore, from the perspective of experiential marketing, whether viewers' experiential value, after watching the TV drama, has increased the level of their satisfaction and the correlation between experiential value and satisfaction, and whether experiential value plays a successful mediating role between experiential marketing and satisfaction.

Using regression analysis, the proposed model was tested on 335 valid respondents. This study invites tourists that have watched "Black and White" and been to various famous gathering spots, tourists' attractions, and transportation hub, etc., in Kaoshong, which were shown in the TV drama, as sampling subjects. Sampling was conducted everyday from August 17, 2009 to September 12, 2009. Among the total of 412 questionnaire surveys issued, after deleting invalid or incomplete ones, there are 335 valid samples remaining, consisting 81.3% of returning rate.

The results indicate that there is a partial positive relationship between tourists' experiential marketing and their satisfaction, a partial positive relationship between tourists' experiential marketing and experiential value, a positive relationship between tourists' experiential value and satisfaction, and a partial mediating effect of tourists' experiential value on the relationship between experiential marketing and satisfaction.

Keywords: Experiential Marketing, Experiential Value, Satisfaction, Destination Marketing, Black and White.

Introduction

For residents in all destinations around the world, they all wish the destinations that they live are recognized as a destination of multi-activities, a renowned tourists' attraction, or a place of excellent living quality, etc. Avrahan (2000) stated that in order to achieve the aforesaid objectives, destinations would apply various marketing techniques to elevate their desired images. The concept of destination marketing is not new. In fact, many literatures on destination marketing all pointed out that destinations, in order to cope with fierce competition, would be motivated to have strategies that implement destination marketing as an important device of destination operation management (Ashworth & Vooged，1990；Kotler et al., 1993). Kotler (2006) extended the marketing concept to governmental public department, elaborating that governments have also started to used marketing concept in promoting policies and that destinations need to use marketing to plan local cultural advantages that distinguishes from others to attract international investors and tourists.

The concept of experiential marketing was first introduced in 1999 by Schmitt, a psychologist, who used five strategic experiential models, consisting of sense, feel, think, act and relate, as strategic basis of marketing. Such concept is similar to consumers' psychological intention valued by many scholars that promote destination marketing. The new marketing concept is eventually used in destination marketing and become the destination's experiential marketing. Under the whole increasingly competitive environment, not only business themselves, but also county and city governments have eventually sensed the important concept of experiential marketing, starting to apply advance destination marketing strategy to present competitive advantage of local governments that differentiate them from others.

After entering the age of experiential economy, regardless of business or county and city governments, their marketing objectives are all in the creation of a valuable experience, or even an irreplaceable experiential value for the consumers. Morrison (1996) pointed out that in tourist service industry the phenomena of emotional attachment to a specific product or brand, the so-called emotional consuming behavior, occur easily. A short service process can induce customers' pleasurable emotional feeling and response, thus affecting future consuming behavior. Therefore, since the year 2000 TV drama series stared by young idols have gained popularity in Taiwan. Many viewers, under the influence of Japanese and Korean drama, visit destinations and sites shown in the drama, showing that the successful marketing of destinations to the entire world via television and media also would activate destination development and tourism opportunities.

In "Black and White", a TV drama series shot in the background of Kaohsiung City, the story line has been presented to allow viewers to know the destination from different dimensions and clearly structure the destinations' brand. In the series many famous gathering points, tourists' attractions and major transportation hub of Kaohsiung Metropolitan are shown to viewers, hoping to achieve successful destination marketing of Kaohsiung City by inducing viewers' inner experiential value and intention to tour the destinations, thus, bringing more destination development, tourism and relative opportunities like business conventions, etc. to the destination. Therefore, the study aims to use "Black and White" as an example to explore, from the perspective of experiential marketing, whether viewers' experiential value, after watching the TV drama, has increased, the level of their satisfaction, the correlation between experiential value and satisfaction, and whether experiential value plays a successful mediating role between experiential marketing and satisfaction. Moreover, the study aims to explore in depth, through

empirical point of view, to construct the relative knowledge of "experiential marketing" on satisfaction.

Based on the aforesaid study motives and problems, the aims of the study are to test the following:

1. Test the relationship between tourists' experiential marketing and their satisfaction.

2. Test the relationship between tourists' experiential marketing and their experiential value.

3. Test the relationship between tourists' experiential value and their satisfaction.

4. Test the mediating effect of tourists' experiential value on experiential marketing and satisfaction.

Literature Review

The study aims to understand the correlation between experiential marketing on experiential value and tourists' satisfaction, including experiential marketing, experiential value and satisfaction, etc.

Experiential Marketing Theory

Schmitt (1999) first defined experiential marketing as "individual customer, after direct observation or participation of event, feels certain stimulus that induces motives and generate identified thoughts or consuming behavior" and proposed that the definition on products by conventional marketing is more constricted. Thus, in addition to include conventional marketing perspective, individual consumer's psychology and social behavior theory as basis are used as basis to be integrated to propose the conceptual structure of experiential marketing. Such structure includes two layers: Strategic Experiential Modules (SEMs) and Experiential Providers (ExPros).

Schmitt (1999) claimed that experiential forms consist of five aspects: sense, feel,

think, act and relate. The five experiential forms can be deemed as one strategic experiential

module. To comply with objective and quest of marketing proposal, every form can be applied

independently or integrated together. Upon creating marketing projects, the seven experiential

providers used in execution is an important strategic executing combination, include

communication, verbal identity and signage, product presence, co-branding, spatial environment,

web site and environment, people.

Experiential Value Theory

Holbrook and Hirschman (1982) pointed out that consumer value is an experience

that does not exist in the products purchased, on chosen brands, nor on the ownership of

products, but in the process of consuming experience. The experiential value of Holbrook (1994)

provides inner and external value to customers and inner value is usually the consuming

experience generated due to personal factor. Holbrook (1999) proposed that consumers value as

interactive, relatively, preferential and experiential value and that all products can be created

value via consuming experience.

Holbrook (1996) stated the structure of experiential value, with addition of environmental

factor and the interaction between environment and individuals; inner/external, active/passive,

and self-guidance/others-guidance. Mathwick et al. (2001) simplified Holbrook's theory and

proposed an experiential value scale (EVS) that classify by inner/external value and

active/passive value into four categories: consumer return on investment (CROI), service

excellence, aesthetics, and playfulness.

Customer Satisfaction Theory

Cardozo (1965) was the first one applying the concept of customer satisfaction to marketing.

Howard & Sheth (1969) proposed that consumer satisfaction is the mental status of customers on

whether their satisfaction is achieved after evaluating examination on their input for the products

purchased and the reward they obtained. Singh (1991) based on service marketing social

psychology and organization theory to define customer satisfaction as a type of multiple

dimensions and is measured on satisfaction degree of all attributes performance of product on

multiple items and measurement of customer satisfaction can vary due to difference in industry

or study objects.

Woodside, Frey, & Daly (1989) illustrated that customer satisfaction is an attitude

after consumption and shows the degree of customers' likes or dislikes after experience. From

the viewpoint of tourism, Bigne et al. (2001) claimed that recreational satisfaction is tourists'

whole evaluation on recreational process.

Hypothesis

Experiential Marketing and Satisfaction

Jarret, Wallace, Jarret, & Keeling (1996) studied the first hospital hotel in England.

After promoting style and comfort of hospital rooms, 99% of customers showed high satisfaction

to the hospital. Kim (2005) studied tourists' recreational experience in leisure farms for the

relationship between satisfaction and revisit intent by sampling 400 tourists in Wei Chuen Pu Sin

Ranch in Taoyang. The result showed that there is a positive relation between recreational

experience and satisfaction. Based on the aforesaid literatures, a good experiential marketing

experience actually can affect customers in generating positive satisfaction. However, the

difference in stimulus, experiential media in experiential marketing can definitely vary tourists'

generated experiential marketing satisfaction and behavior intention. Therefore, the study uses

destination experiential marketing and TV idol drama series as experiential media to explore the

correlation between tourists' experiential marketing and satisfaction, forming Hypothesis 1.

H1: .There is a positive relationship between tourists' experiential marketing and their satisfaction.

Experiential Marketing and Experiential Value

Mathwick et al. (2001) stated that the recognition of experiential value comes from people's direct usage or long distance appraisal on service and products. Prahalad & Ramaswamy (2004) emphasized experiential as a new basis of value and modern market value is created by the mutual interaction of consumers and business. Cheng & Wang (2004) proposed that experiential value is the customers' experiential creation after consumption and pointed out that 711 in Japan and Elite Bookstore in Taiwan put marketing focus on customers' experiential by using living theme to create a valuable experiential that changed customers' feeling toward brand and even their consuming behavior. Wang (2003) studied Starbuck consumers on the relationship among their experiential marketing, experiential value and purchasing intention. The result showed that there is a positive relationship between experiential marketing and experiential value while the mediating variable, experiential value is positively related to purchasing intention. The aforesaid literatures showed that good experiential marketing experience can actually affect customers in generating positive experiential value. Therefore, this study uses destinatio experiential marketing and TV idol drama series as experiential media to explore the correlation between tourists' experiential marketing and experiential value, forming Hypothesis 2.

H2: .There is a positive relationship between tourists' experiential marketing and their experiential value.

Experiential Value and Satisfaction

Woodruff et al. (1993) proposed that customers, in viewing product experiential,

have intertwined value and satisfaction. Satisfaction is a value obtained from a product used

under a specific environment. It is an immediate response and customers would think satisfaction

in different value levels. (such as benefit and purpose level) Thus, the degree of customers'

satisfaction may vary with different value level of products. Petrick et al. (2001) stated that more

business has understood that the importance of analyzing customers' satisfaction. If business

managers can find factors that affect customers' satisfaction toward products or services,

business may change customers' experiential when using products or services and let customers

obtain maximum satisfaction. The aforesaid literatures showed that the creation of a better

experiential value can actually affect customers in generating positive satisfaction. Therefore, the

study aims to explore the correlation between tourists' experiential value and their satisfaction,

and whether experiential value has mediating effect, forming Hypothesis 3 and Hypothesis 4.

H3: There is a positive relationship between tourists' experiential value and their satisfaction

H4: There is a mediating effect of tourists' experiential value on the relationship between experiential marketing and satisfaction.

Research Design and Method

Sampling and Data Collection

The study applied convenient sampling method and invite tourists that have watched

"Black and White" and been to various famous gathering spots, tourists' attractions, and

transportation hub, etc., in Kaoshong, as shown in the TV drama, as sampling subjects. Sampling

was conducted everyday from August 17, 2009 to September 12, 2009. Among the total of 412

questionnaire surveys issued, after deleting invalid or incomplete ones, there are 335 valid

samples, consisting 81.3% of returning rate.

The result of sample shows that in the structure of the sample, male consist of 37.6%, female, 62.4%; mostly under age 20 (46.9%), least above age 51 (1.2%); mostly with educational level of university (college) (74.9%), least with educational level of middle school or less (2.4%); mostly students (66.6%), least with occupation in industries (1.2%); mostly resides in southern Taiwan (63.3%), least in the east part of Taiwan (2.4%); mostly single (91.3%), least married without kids (2.4%); mostly has monthly income of less than NT25,000 (including no income) (80.9%), and least has monthly income of 65,0001 or more (2.0%).

Measurement

Experiential marketing - The study referred to the scale developed by Schmitt (1999), consists of five aspects, sense stimulus, feel stimulus, think stimulus, act stimulus and relate stimulus, in total of 15 questions, with overall Cronbach α of .90.

Experiential value - The study used scale of Mathwick et al. (2001), consists of four aspects, consumers return on investment, service excellence, aesthetics ,playfulness, in total of 8 questions, with overall Cronbach α of .87.

Satisfaction - The study applied the scale of Kolter (1997), with modification in accordance with this study, consisting of 4 items, experiential satisfaction, effect satisfaction, product satisfaction and right choice, etc., with overall Cronbach α of .81.

Likert 5 point scales, which are assigned 1 to 5 points for answers from "very disagree" to "very agree", are used for all scales except the individual basic information. The result of analysis shows that there is a significantly positive relation between each pair of the following variables: sense stimulus, feel stimulus, think stimulus, act stimulus and relate stimulus, satisfaction, consumers return on investment, service excellence, aesthetics, and playfulness. The correlation coefficients of each variable are shown on Table 1.

<center>Results</center>

<center>*Experiential Marketing and Satisfaction (H1)*</center>

To explain from the five aspects of experiential marketing, the regression results predicts satisfaction of $\Delta R^2 = .487$. (p<0.001) The major significantly correlated aspects of experiential marketing to satisfaction are sense stimulus, (ß=.165, p<0.05) thoughts stimulus, (ß=.199, p<0.001), and relation stimulus. (ß=.389, p<0.001) Thus, H1,"There is a positive relationship between tourists' experiential marketing and their satisfaction", the hypothesis of the study, is partially supported.

<center>Table 1. Mean, SD and Correlation Coefficients of Each Variable</center>

	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Sense	4.19	0.55	–									
2. Feel	4.03	0.62	.688**	–								
3. Think	4.09	0.61	.530**	.581**	–							
4. Act	3.58	0.70	.392**	.537**	.558**	–						
5. Relate	4.11	0.59	.493**	.520**	.593**	.588**	–					
6. CROI	4.22	0.58	.553**	.553**	.615**	.484**	.559**	–				
7. Service	4.32	0.55	.553**	.557**	.568**	.482**	.580**	.673**	–			
8. Aesthetics	4.29	0.61	.458**	.421**	.595**	.420**	.563**	.543**	.713**	–		
9. Playfulness	4.09	0.63	.516**	.541**	.502**	.571**	.580**	.534**	.595**	.579**	–	
10. Satisfaction	4.25	0.52	.527**	.529**	.570**	.472**	.642**	.602**	.705**	.665**	.636*	–

Note：N＝335。*p<0.05；**p<0.01；***p<0.001

Experiential Marketing and Experiential value (H2)

To explain from the five aspects of experiential marketing, the regression results predicts four aspects of experiential value, consisting of consumers return on investment, ($\Delta R^2 = .473$) service excellence ,($\Delta R^2 = .470$), aesthetics ($\Delta R^2 = .417$) and playfulness.($\Delta R^2 = .436$) The major significantly correlated aspects of experiential marketing to consumers return on investment are sense stimulus,(ß=.199, p<0.001) think stimulus, (ß=.298, p<0.001), and relate stimulus.(ß=.191, p<0.001) The major significantly correlated aspects of experiential marketing

to service excellence are sense stimulus,(ß=.210, p<0.001) think stimulus, (ß=.209, p<0.001), and relate stimulus.(ß=.255, p<0.001) The major significantly correlated aspects of experiential marketing to aesthetics are sense stimulus,(ß=.147, p<0.05) think stimulus, (ß=.351, p<0.001), and relate stimulus.(ß=.217, p<0.001)The major significantly correlated aspects of experiential marketing to playfulness are sense stimulus,(ß=.217, p<0.001) act stimulus, (ß=.259, p<0.001), and relate stimulus.(ß=.234, p<0.001) Thus, H2, ." There is a positive relationship between tourists' experiential marketing and their experiential value", the hypothesis of the study, is partially supported.

Experiential Value and Satisfaction (H3)

To explain from the five aspects of experiential value, the regression results predicts satisfaction of ΔR^2=.586. (p<0.001) The major significantly correlated aspects of experiential value to satisfaction are consumers return on investment, (ß=.144, p<0.01) service excellence, (ß=0.281, p<0.001), aesthetics, (ß=0.246, p<0.001) and playfulness. (ß=0.248, p<0.001) Thus, H3," There is a positive relationship between tourists' experiential value and their satisfaction", the hypothesis of the study, is fully supported.

The Mediating Effect of Tourists' Experiential Value (H4)

Using experiential value as mediator, the relationship between experiential marketing and satisfaction is shown from regression result, such that the regression coefficient of the five aspects of experiential marketing to satisfaction are: sense stimulus, (ß=.032), feel stimulus, (ß=.034) think stimulus, (ß=.050), act stimulus, (ß=.050) and relate stimulus.(ß=.215, p<0.001), revealing that after inputting mediator for testing analysis, the relationship between experiential marketing and satisfaction is weakened. In comparing to the before and after the input of mediator, the sense stimulus and think stimulus are found to become insignificant from

significant, showing that experiential value has full mediating effect on sense stimulus and think stimulus. As for relation stimulus, it still shows significant status, appearing that experiential value has partial mediating effect on relation stimulus. Moreover, based on the testing analysis of mediator proposed by Baron and Kenny (1986), there actually is a significant relationship among experiential marketing, experiential value and satisfaction and after the input of mediator, the regression coefficient is smaller than the one obtained from using solely experiential marketing to predict satisfaction. Thus, experiential value actually has mediating effect on experiential marketing and satisfaction. H4, "Tourists' experiential value has a mediating effect on the relationship between experiential marketing and satisfaction", is partially supported. Empirical analysis result is illustrated in Table 2.

Table2 Regression Result for H1,H2,H3,&H4

	experiential value				satisfaction
riable	CROI	service excellence	aesthetics	playfulness	
	β R² ΔR²	β R² ΔR²	β R² ΔR²	β R² ΔR²	β R² ΔR²
Control variables	.026 .026	.023 .023	.039 .039	.059 .059	.024 .024

Experiential Marketing (H1&H2)

Sense .199*** .210*** .147* .217*** .165** Feel .103 .113 −.030 .083 .078
Think .298*** .209*** .351*** .055 .199*** Act .073 .080 .018 .259*** .027
Relate .191*** .499 .473*** .255*** .493 .470*** .289*** .457 .417*** .234*** .495 .436*** .389*** .511 .487***

Experiential Value (H3)

CROI .144**
Service excellence .281***
Aesthetics .246***
Playfulness .248*** .610 .586***

Mediating effect

Experiential Marketing (H4)

Sense .032
Feel .034
Think .050
Act −.050
Relate .215*** .639 .030***

35.Control variables include: gender, educational, occupation, income, and residence.
)5；**p<0.01；***p<0.001

Conclusion and Suggestions

Conclusion

The study finds that when tourists have good sense stimulus, think stimulus and relate stimulus, their satisfaction will rise, but feel stimulus and act stimulus cannot directly heighten tourists' satisfaction. The empirical result can infer that destination experiential marketing, when using TV drama as experiential media, can actually leave deep impression and can be highly charismatic in senses.

The study reveals that when tourists have good sense stimulus, think stimulus and re late stimulus, consumers return on investment, service excellence, and aesthetics, etc. of their experiential value would rise. When tourists have ood sense stimulus, act stimulus, and relate stimulus, the interesting level in their experiential value would also rise. The empirical result can infer that destination experiential marketing, when using TV drama as experiential media, can actually be quite refreshing and different from the experience of watching other TV drama in experiential value to know a new Kaoshong from the start via beautified idol dramas.

We had found that when tourists have good consumers return on investment, service excellence, aesthetics, and playfulness, their satisfaction will rise. The empirical result can infer that tourists can get to know the city of Kaoshong in depth by simply viewing TV drama. The professional quality and beautified style shown in this drama are non-comparable to other TV drama. Thus, the heightening of tourists' experiential value would increase their satisfaction. In addition, that experiential marketing not only has direct effect on satisfaction, it also can affect satisfaction indirectly. Thus, if tourists' have good experiential marketing, their experiential value would be heightened, then further increase overall satisfaction.

Contribution in Theory and Practice

Contribution to Academic Theory

The empirical results find that for tourists that have watched "Black and White", the destination's marketing effect of the drama actually enhances their overall experiential value and high satisfaction. They feel that Kaoshong is a satisfactory city and also develop sense of identity toward the city's infrastructure. Schmitt (1999) stated that experiential marketing theory actually has positive effect on tourists' experiential value and satisfaction. The result of study shows that experiential marketing also will affect satisfaction indirectly through experiential value. However, in previous study on experiential marketing, experiential value has never been seen as important. In future study of experiential marketing, experiential value can be added as a study variable for more in-depth exploration. On the other hands, it also deduces that TV drama is one of good experiential media. Thus, for future study in destination marketing and experiential marketing, the variable of experiential media can be explored further in depth.

Suggestions For Marketing Practice

The TV drama has shown public artwork in every Kaoshong MRT station one by one. In the experiential of sense stimulus, it has a multiplying effect on the drama and destination marketing. Thus, every level of governmental agency can refer to this experiential model for regional development and destination marketing strategy in the future.

For farther economic effects, regional development and destination marketing should not only be new, but be unique. Therefore, if the unique spots of Kaoshong city, can be integrated into the drama, there will be more people understanding and knowing that the city of Kaoshong. Ever since the starting of the TV drama, in the sites that the drama was shot, fans can be seen everywhere, taking pictures. Thus, if there is a relate stimulus connected to the plot and main

characters of the drama, there will be more idol worshipping crowd traveling to Kaoshong or the sites shown on the drama for tour or consume, more extensive economic effects will be derived.

Suggestions for Future Study

(1) In further study, the sampling can be taken among crowds that come to the City of Kaoshong or the sites shown on the drama for the first time after watching the drama for the related study of their satisfaction.

(2) In further study the sample can be compared in more depth on crowds from different residential area that come to the City of Kaoshong or the sites shown on the drama after watching the show for relative study on behavior intention.

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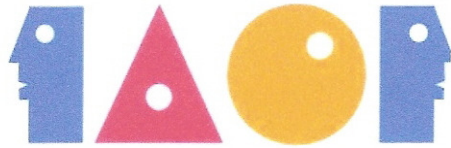
QUALITY OF WORK LIFE FOR SUSTAINABLE DEVELOPMENT

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Abstract

In this study, the concepts of a better quality of work life improvement and productivity are considered. It also addresses the quality of work life indicators for sustainable development. This is followed by a discussion of the impact of productivity on the quality of work life. Finally, factors affecting the quality of work life for sustainable development are studied.

Key Words: Work Life, Quality, Productivity

Better Quality of Work Life and Productivity

The most evident result of productivity improvement regarding the quality of work life

for sustainable development is in the industrial sector, where various improvements in applying

technology and natural resources, as well as improvements in human resources, have taken place.

To the employee, productivity improvement benefits their lives through the possibility of

procuring procurement of advancement and security. More than that, some companies share in

producing a quality product as well as provisioning a better quality of work life, such as: labor

management comprehension, a sound working environment, and a progressive career. Moreover,

productivity gains sharing is one of the strongest motivations to give maximum benefits to the

labor forces and the organization. Quality of work life is an appropriate human resource

management strategy for developing countries.

Thailand is one such nation that has shifted from an agriculture-based economy to a semi-

industry economy. Two of Thailand's key resources are their natural resources, and more

critically, their human resources. Thailand's development is made more difficult with the

occurrence of globalization. A crucial question arises as to how to keep abreast of the human

needs.

Concerning the sustainable development of human resources, managers ought to be

developed and motivated through a better work life. These plans should include actions to

develop employees to be quality workers men, motivate them, and nurture them to accomplish

organizational objectives. Productivity still remains the key factor that influences human

creativity skills or the enthusiasm needed to enhance productivity. Influencing productivity are

the creative skills of human being and the enthusiasm which make them productive. Making the

quality of work life better should further motivate employees to contribute to improving the

levels of productivity. productivity improvement. The laborer's quality of work life can also encourage and accelerate improvements in productivity improvement.

Productivity comes from the skills skillful and creativity of an employee in making use of the variety of factors affecting the production of the desired quality services and products by maximizing values added that would best satisfy to best satisfy the employees' needs to be served. Human resources are a key factor influencing productivity enhancement. Workers can be guided and developed and at the same time can be motivated through better quality of work life. Since employees spend a good part of their lives at their workplaces, a healthy working environment must be supported if productivity gains are expected. Improvements in the quality of work life are able to be accomplished through productivity gains by making the work itself a critical source of satisfaction.

Quality of Work Life Indicators for Sustainable Development

Quality of work life (QWL) includes issues such as occupational hazards and safety, human resource development through welfare measures, professional training, working conditions and consultative work as well as participative mechanisms. QWL also involves schemes for sharing the results from the gains of productivity, use of small group activities, as well as job rotations. QWL is equally concerned with the concerns quality of products and improvements in production, as well as anticipated improvements in performance, productivity and skills.

Moreover, QWL issues also address elements such as are involved high motivation, morale, healthy industrial relations and cooperation. QWL in public organizations include human resources development through training, occupational hazards and measures for safety, participative and welfare schemes as well as consultative mechanisms.

Private organizations mirror the QWL concepts of public organizations with many similar practices. The least preferred practices in public organizations are work complexity, work redesign, and job redesign as well as job enrichment. However, for private organizations, these practices include having cross-functional task forces, work complexity, work place redesign as well as autonomous work groups. Job redesign may raise basic issues of dignity, human freedom as well as participation in the decision making process. Organizations tend to apply a package of measures rather than a single and an isolated strategy to ensure productivity. Measures and strategies are focused on concern satisfying the minimal lower needs of employees, such as for example: security, safety, and welfare improving job contents, as well as participation and responsibilities in the decision making process. QWL still faces the need to focus on seeking greater productivity while considering lesser benefits in terms of high motivation, employee morale, healthy industrial relations, and cooperation.

Impact of Productivity on the Quality of Work Life

There are many factors influencing productivity such as the worker's attitudes, attitudes of workers, the operational climate, and managerial foci management. Effectively managed organizations are able to maximize both the quality of work life and their profitability for their workforces. Some of the critical factors that impact a workforces' quality of work life include for example:

1.   The physical aspects of QWL, such as working conditions the conditions of work, and managerial attitudes management attitudes towards pollution and safety, etc.

2.   The economic aspects of QWL, such as wages and salary administration and considerations for the standard of living that employees needs and enjoy.

3.   The psychological aspects of QWL such as the how and what of the assigned work, method to do work, and what kind of work.

Employees who possess worthwhile and meaningful work, who experience good working conditions and are well paid can create a total quality situation. Organizational requirements and workers' need s are different when addressing the in quality of work life. The workforces need a total quality work environment, but management requirements are different. It has the primary responsibility of maximizing the maximization owner's capital, that in turn allows them to which possesses the ability to provide continued opportunities for their workforces, and wealth creation. In some instances, the demands of the organization are too great and the compensation to the employees is too little which impacts the quality of work life. Organizations demand too much but pay too little, and do not value quality of work life issues. To react to this, employees may limit their efforts, slow down production, and in some cases, cease production completely to the frustration of the managerial efforts to maximize returns. Workers may slow down work, and withhold their labor, frustrating management's opportunity to maximize returns.

These different needs lead to "us-and-them" attitudes in workplaces and the failure of both parties to accomplish their full potential. The critical improvement of quality of life for both workers and owners is productivity linked to profitability, and the key to attaining this is management. Quality of life supports work performance and financial opportunity to maximizing the productivity of the organizations. However, organizational behaviors still influence productivity.

Many times the real importance of operational climate is neglected. To improve the quality of work life, managers should consider changes to operational climate. They should create environments in which their workers gain psychological satisfaction. In consequence, this

shall enable management to increase the economic benefits to both their owners and their employees while and improving some physical conditions, such as the reduction of pollution from production processes. Operational climates which affect productive organizations include the following:

1.   A philosophy of competency: workers at all levels are competent to do what is expected of them to them.

2.   Questioning culture: working environments support participation in problem-solving processes within the in organization.

3.   Goals and monitoring: managers need to establish clear goals and a monitoring system in terms of the results to be accomplished and the processes needed to accomplish those results.

4.   A shared vision means organizational members understand the role each person plays to achieve the established goals what their part in getting it there is.

In order to implement the above practices, the following strategies are needed:

*Developing a shared vision***:** the communication and development of a shared vision based on the organization's corporate objectives.

Re-defining roles, establishing objectives and monitoring: this concerns an evaluation of organizational structures and the establishment of establishing of agreed functional objectives and establishing a monitoring system to measure performance by:

-       understanding the vision of where the organization is going based on their corporate objectives,

-       taking actions regarding the goals and controls structures in the process of getting there,

-       the management team clarifying their corporate objectives and agreeing on their mission, and responsibilities.

Creating and participating in cultural issues: develop cultural issues in order to solve real

problems that include:

- solving actual performance issues

- developing a participative focus toward cultural issues and culture issues.

- management development

- changing attitudes.

Guarantees to individual competency and applying management by objectives (MBO: set

objectives and review performance.

Factors Affecting Quality of Work life for Sustainable Development

The following are factors affecting the quality of work life for sustainable development:

1. Competence

This refers to the ability of all managers, employees and workers to do their jobs effectively.

Competent workforces are those who possess the knowledge and necessary skills necessary to

effectively perform their jobs. In consequence, workforces are properly trained for what is

expected of them. It also refers to having have procedures for the continuous control of

performance as compared to against the agreed goals. Further training is needed. It needs training

for new situations such as when workers are transferred, when workers are promotes and when

new technologies are introduced**.**

2. Operational Climate

This involves the working environment that can encourage or discourages and motivates

employees under their current working environmental conditions. It affects employee's attitudes,

such as the relationship that exists between manufacturing and design, the attitude of sales to

production, and the management's view of personnel. These attitudes can determine the

effectiveness of competency and ensures the ability as well as methods to provide the opportunity to be productive. The operational climate influences the economic environment because of the affects it has on productivity. The operational climate further influences the psychological environment because it affects the supervision of employees. It influences the physical environment because it determines the work conditions. Through the operational climate, employees are also motivated, enjoy their work, and experience fewer accidents or incidents of illness. The operational climate also involves the relationship that exists between the boss and the subordinates, and relationships between functions as well as individual achievement. Working harder is more highly paid prized than working smarter.

3.   Managing Systems

The concept of managing systems includes procedural controls over the production processes, networking management information. They concern procedures to control, processes of production, and networking in management information organizations, as well as production planning systems, management reporting procedures, stock control systems, purchasing system, and order schedules, quality system, planning tools, recruitment procedures, job appraisal schemes, career development structures, succession planning, and communication systems, in order to manage themselves.

4.   Technology

Product technology concerns what is produced and the technology involved in that production, as well as the tools used actually makes things, and how it is made. The better the product technology, the greater the specification offered to consumers, the expansiveness of and effective designs for production, and the potential for high quality, high volume, and as well as low cost output.

Summary

The government plays a critical role in determining employment generation and provides employees with an opportunity to lead their lives life with meaning and dignity. Management need to formulate integrated human resource development plans and consider environmental changes as well as utilize the creative potential of their employee. These plans should include ideas for recruitment, performance evaluations, training, succession planning and career opportunities, two-way organizational communication systems, merit based rewards and the development of a culture of excellence and innovation.

New technologies require brain-intensive activities. With good technology, management can begin to reassess their staff's abilities to promote autonomy and innovation. Employee's skills, aspirations and knowledge need to have greater impact in the involvement in decision-making process and the establishment of higher degrees of satisfaction. Providing small group activities such as the implementation of grievance committees, and suggestion schemes, and welfare committees, encourage a strong supportive base for participation to succeed system wide. Therefore it is essential to have more attention focused in these activities to build favorable forces for participative work cultures. The introduction of new technology must consider the psychological aspects of QWL as well. It is significant to promote thinking that encourages the fulfillment of about ways for fulfilling laborer's needs through non-monetary alternatives. Management consulting with technology vendors gives higher responsibilities to laborers in the context of changing technology.

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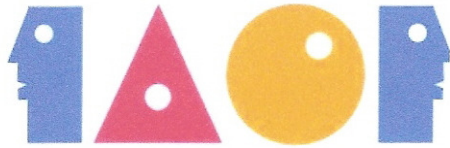
A STUDY ON PREDICTING CONSUMERS' SATISFACTION BASED ON THE FEATURES OF FURNITURE PRODUCT DESIGNS

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Abstract

The purpose of this study was to predict Taiwan consumers' satisfaction based on the features of furniture product designs. Participants of this study were Taiwan consumers who bought furniture in warehouses of Taiwan. The sample consisted of 963 participants. Each participant member completed a quantitative survey and answered questions on a Likert-type scale.

This study methodology was based on a quantitative research design. Predictive and descriptive methods were used in this study. The analysis of this study examined the variables of demographic information and the features of furniture product designs influencing consumers' satisfaction. Multiple linear regression was employed to predict consumers' satisfaction based on the features of furniture product designs.

Based on the results of the data analysis, the findings in this study include： (1) furniture product designers should employ the three product design features: the feature of human factor design, the feature of functional design, and the feature of external design for their design criteria during the design processes of furniture product designs； (2) consumers' satisfaction and the features of furniture product designs significantly revealed positive relationships； (3) designers or creators need first consider the feature of functional design in the design process. In conclusion, the feature of functional design mostly influences consumers' satisfaction. The findings provide views, insights, and suggestions for furniture product designers when designing or creating furniture for more suitable ways in order to enhance consumers' satisfaction and to fit their needs.

Keywords: The Features of Furniture Product Designs, Consumers' Satisfaction

Introduction

In this unpredictable product market, product innovations that fit consumers' desires and enhances satisfaction of consumers are very important to new product design strategies. McQuitty, Finn, and Wiley (2000) indicated that consumers' satisfaction provides the basis for the marketing trends and has been a good predictor of future purchase behavior. Kotler and Keller (2006) noted that there are mainly two types of co-branding, and joint venture co-branding refers to two companies financially cooperating to offer a co-branded product. Hence, changes or innovation of products and creating new brands are to enhance consumers' satisfaction and to fit needs of consumers.

Many research studies on the relationships between furniture product designs and consumers' satisfaction show significant relationships. This study included two basic factors which are the features of furniture product designs and consumers' satisfaction. This study was to analyze furniture product designers or product developers, during the development procedures of new furniture product designs to employ the features of furniture product designs to realize how the features influence consumers' satisfaction. This study could provide furniture product designers with valuable references when designing or creating new furniture products. Hence, this study predicted Taiwan consumers' satisfaction based on the features of furniture product

designs. This study also provided the findings for furniture designers when creating or designing

new furniture products so as to enhance consumers' satisfaction.

Purpose of the Study

The purpose of this study was to predict Taiwan consumers' satisfaction based on the

features of furniture product designs, and whether demographic information variables could

influence the relationships between the features of furniture product designs and consumers'

satisfaction. The findings of this study provided as design criteria for furniture product designers

and creators when designing or creating new furniture products in order to enhance consumers'

satisfaction. Specifically, the purposes of this study were as follow:

1. To Predict Taiwan consumers' satisfaction based on the features of furniture product designs

2. To explore consumers' satisfaction differences in views of furniture product designs of

different demographic variables.

The Limitations of the Study

This study was to predict views and cognition of consumers' satisfaction based on the

features of furniture product designs. The participants for this study were limited to select

randomly consumers in Taiwan. The participants were selected in furniture warehouses. These

limitations were provided for in the design for this study.

Literature Review

The Features of Furniture Product Designs

Bruseberg and McDonagh-Philp (2001) noted that industrial design training is embracing the need for designers to elicit user needs in order to support the development of successful new products. Concept of furniture design may then by used widely to serve the dining, storage, living, and relaxation needs of its users. Therefore, it is necessary for all furniture product designers to realize the needs of these users in order to satisfy the using ways or habits of consumers from different furniture products that they could successfully market.

McDonagh, Bruseberg and Haslam (2002) categorized the functions of product design into special functions, such as practical applications of the product, human factors engineering, and aesthetic style. Creusen and Schoormans (2005) indicated that the visual appearance of a product can influence consumer product evaluations and selections in many ways. Hence, these interactions between consumers and products, they serve as a communication link that could directly influence consumer behavior, such as functions, operation, and external appearance of the products.

In addition to the aforementioned research studies, Veryzer (1995) noted that satisfactory product designs shall not only provide the practical efficiency for consumers, but they also have to satisfy consumers' value. Veryzer (1995) noted that the following product design perspectives include:

(1) functional perspective, (2) ergonomic perspective, and (3) aesthetic perspective.

Chang and Hsu (2005) noted that product design features include three categories: (1) functional feature, (2) external design feature, and (3) operational feature. There is a positive correlation between the external appearance of a product and product cognition of consumers. Page and Herr (2002) indicated that the product preference and quality of consumers, product design was classified into the following features: product functions, human factor and external appearance of product. From the aforementioned research studies, the definitions of the features of the furniture product designs are as follows: (1) Functional design feature notes that the functions of a special product may provide consumers with operation convenience, structural simplicity, multiple purposes, and a solution to problems. (2) Human factor design feature refers to the use of design to improve user efficiency, to enhance user's realizing of the product, and to reduce the psychological burden of the user whenever product is used. In other words, human factor design includes safety, comfort, and easy-to-operate features. (3) External design feature refers to the employment of design to attract consumer purchases through the external feature of the product. The feature includes style, color, dimensions, and material. Hence, this study divided the features of product design into three parts (1) the feature of functional design, (2) the feature of human factor design, and (3) the feature of external design.

Consumers' Satisfaction

MacInnis and Price (1987) indicated that related theories have suggested that imagery

processing may influence a wide range of outcome variables, including consumers' satisfaction,

influence, trends and expectations. Despite the main implications of the processing on consumer

behavior, almost no research has examined imagery effects on consumer intention (Mitchell

1989). Schiffman and Kanuk (2004) noted that consumers' satisfaction relies on the products

matching his/her expectations which can be seen as comparing actual experience after use with

the expectation of use before the purchase. Swinyard (1993) measured the consumers'

satisfaction through the consumer spent time in searches for product information, the priority

order by which the consumer selects the product, and the probable priority order by which

consumer plans to select the product.

Schiffman and Kanuk (2000) noted that satisfaction measures the possibility that

consumers may purchase products, which are special problems. Boyd and Mason (1999) and

Fisher and Price (1992) assessed consumers' satisfaction through the length of time at which the

consumer has preferred to buy a special product. If consumers want to purchase a special product

immediately, it means satisfaction is very strong. If consumers make the buy a year later,

satisfaction is about middling, and if consumers make the buy three years later, a weak

satisfaction is indicated. In other words, the features of furniture product designs need elicit

satisfaction and preferences of consumers when they purchase furniture products. Hence, furniture product designs are very important to consumers when they make decisions to purchase furniture products. In conclusion, furniture designers need to know how the features of furniture product influence consumers' satisfaction when consumers want to buy furniture products. .

Research Methodology

This study assisted furniture product designers when designing or creating the new furniture products for consumers in order to fit needs of consumers and to enhance their satisfaction. Hence, the research methodology would explore how the features of furniture product designs influence consumers' satisfaction. This study utilized quantitative research methods. A quantitative instrument analyzed with descriptive and predictable methods were employed to predict Taiwan consumers' satisfaction based on the features of furniture product designs.

The Model of This Study

This study explored the influences of furniture product designs on consumers' satisfaction and the features of furniture product designs predicting consumers' satisfaction. The model of this study was as illustrated in Figure 1.

Predicting Satisfaction of Consumers in Taiwan

In this study, the analysis method employed multiple linear regression to predict Taiwan consumers' satisfaction based on the features of furniture product designs. Green and Salkind (2005) noted that with multiple regression analysis, each individual or case has scores on multiple independent variables (e.g. X_1, X_2, to X_n) and on a dependent variable(Y). Hence, this study would follow estimate the following regression function

$$Y = b_0 + b_1 X_1 + b_2 X_3 + \ldots + b_n X_n + \varepsilon$$

Demographic Information

The Features of Furniture Product Designs

● Functional design feature

● Human factor design feature

● External design features

Consumers' Satisfaction

Predict

The Loop of the Relationships between Furniture Product Designs and Satisfaction of Consumer
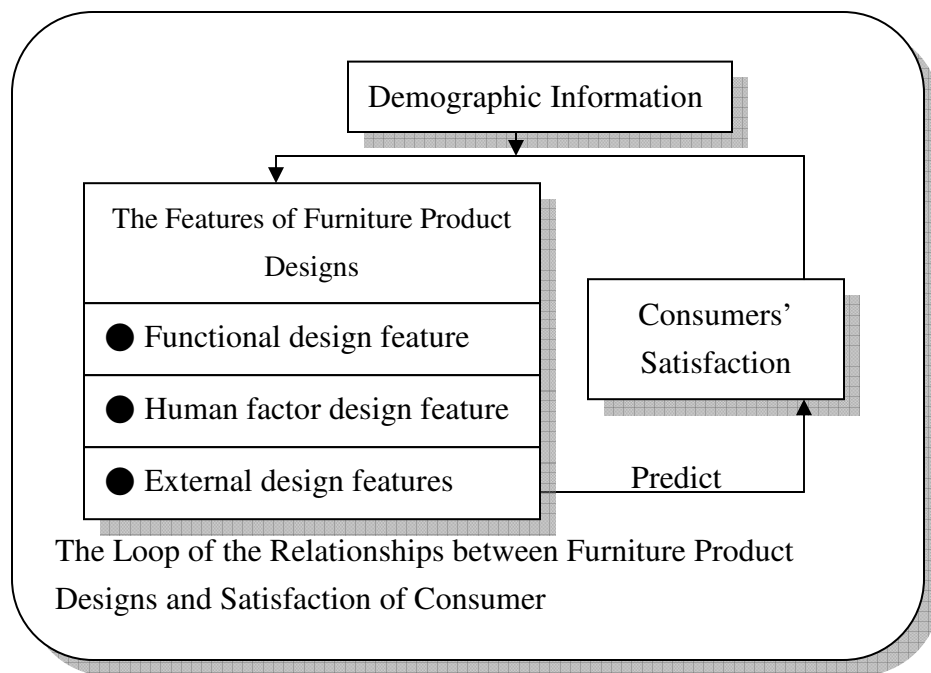
Figure 1 The Model of This Study for Exploring the Features of Furniture Product Designs
   Note. Adapted from Green, S. B. & Salkind, N. J., 2005, Using SPSS for Windows and
      Macintosh

In this study, independent variables of the multiple liner regression equation are the features of furniture product designs, and the dependent variable of the multiple liner regression equation is consumers' satisfaction. Data collection occurred at the results of each participant through administration of the survey. Data were analyzed through use of the Statistical package for Social Sciences (SPSS). Furthermore, the respondents recorded participants' demographic information and their satisfaction on the survey. Data were recorded quantitatively from the 5-point Likert-type scale. Survey results and demographic information of participants were maintained in a confidential manner. The documents were preserved.

Research Questions

Yamamoto and Lambert (1994) noted that product designs can enhance a positive preference and assessment from consumers. This study explored that the feature of furniture product designs may influence satisfaction of the consumers. Furthermore, this study also examined the demographic information variables of the consumers, which include age bracket, educational level, and salary level, to understand the differences in the consumers' satisfaction towards the features of furniture product designs among consumer groups. This study presents the following questions:

(1) How do the features of furniture product designs influence Taiwan consumers' satisfaction?

2. What are consumers' satisfaction differences in views of furniture product designs of different demographic variables?

The Variables of this study

The Variables of the Features of Furniture Product Designs

A summary of the analysis and discussions conducted on furniture product designs in the previous studies would reveal that many researchers explained the implications and nature of designs through the functions, ergonomics and aesthetic perspectives of a furniture product design. The nature designs through the functions presented by McDonagh, Bruseberg and Haslam (2002) may be divided into specific functions that including actual properties of the product, human factors engineering, the aesthetic functional perspective relayed by the product, and the perspectives of the researchers of aforementioned studies. A general compilation showed that the main area of this study includes the furniture product designs aspects, which are the feature of functional design, the feature of human factor design, and the feature of external design.

The Variable of Consumers' Satisfaction

Schiffman and Kanuk (2000) define the consumers' satisfaction as the measurement of the probability by which a consumer may purchase a special product and the degree of a consumers' inclination towards buying the product.

Demographic Information Variables

Korgaonkar, Lund and Price (1985) indicated that statistical variables of demographic

information, such as age, income, education, and ethnic grouping would influence the purchasing

behavior of a consumer. Kotler (1998) noted that statistical variables of demographic

information include ten variables; namely, age, gender, family size, family life cycle, income

level, profession, education, religion, ethnic group, and nationality. Since this study mainly

delved into the differences in the satisfaction of consumers purchasing a furniture product

towards certain the features of furniture product designs, this study has compiled and used the

following demographic information variables: age bracket, educational level, and salary income

level. The demographic information variables were to measure the differences in the satisfaction

of consumers towards certain the features of furniture product designs.

Research Subjects

This study examined the correlations between the features of furniture product designs

and consumers' satisfaction, the filed of this study focused on the different types of furniture

products. Considering this study chose consumer groups in the warehouse of furniture product as

the subjects of this study to be utilized the random selection of participants.

Data Analyses of Pilot Study

The questionnaire survey was administered to 963 consumers in Taiwan area. The pilot

study ensured the structure and content validity of the instrument. Nunnally (1995) noted that

Cronbach's Alpha value of .70 is an acceptable reliability coefficient. In other words, Cronbach's

Alpha was used to examine the internal consistency, which was confirmed by the instrument that

demonstrated high levels of internal reliability in this study. Furthermore, the Cronbach's Alpha

value of each aspect of this study is greater than 0.7. This study started to distribute the official

questionnaire. A total of 998 questionnaires were distributed; 35 were cancelled and invalidated,

thus leaving a total of 963 valid questionnaires for analysis and study. As shown in Table 1, the

Cronbach's Alpha value for the functional design feature is .87 and the Cronbach's Alpha value

for the consumers' satisfaction is .82. According to the results of Cronbach's Alpha value for the

features of furniture product designs and the consumers' satisfaction revealed enough reliability

on the questionnaire.

Table 1 Analyses of Questionnaire Reliability

Variables	Cronbach's α Value
Furniture product designs	.872
Consumers' satisfaction	.821

The questionnaire survey of this study includes two parts. The first part includes the

demographic information, which includes gender, age bracket, educational level, and salary level

of the participants. The second part includes the questions pertaining to viewpoints of the

consumers' respondent on the features of functional design, human factor design, and external

design of furniture product designs. The Likert scale ranged from 1(strongly disagree) to

5(strongly agree) and a score of 3 indicated a neutral response in consumers' satisfaction section.

The questionnaire items were used to quantify consumers' satisfaction regarding the features of

furniture product designs.

The Analyses of the Results

Results of Descriptive Analyses

The demographic information results of this study were as shown in Table 2, 3. All of the

963 respondents expressed consumers' satisfaction with the features of furniture product designs.

Table 2 Descriptive Statistics for Salary Level Based on Satisfaction of Consumers

Demographic Information Variables		Mean	Participant Size (n=963)
	Under US$600/monthly	3.93	141
	US$601 - US$900/monthly	4.18	333
Salary level	US$901 - US$1300/monthly	4.01	276
	US$1301 - US$1700/monthly	4.16	177
	US$1701 and above/monthly	4.03	36

As shown in Table 2 and 3, the mean value for salary level from US$601 to

US$900/monthly is 4.0, the mean value for gender of the female is 4.1, the mean value for

educational level of the senior high school is 4.2, and the mean value for age bracket of the 40

years old is 4.2 based on satisfaction of consumers.

Table 3 Descriptive Statistics for Gender, Educational Level, and
Age Bracket Based on Satisfaction of Consumers

Demographic Information Variables		Mean	Participant Size (n=963)
Gender	Male	4.01	369
	Female	4.13	594
Educational level	Junior high school or lower		0
	Senior high school	4.16	297
	Junior college graduate	4.12	558
	College graduate	3.66	108
	Masters graduate or higher		0
Age bracket	Under 20 years old	4.00	33
	20 - 29 years old	4.08	303
	30 – 39 years old	4.08	381
	40 years old	4.17	156
	50 years and above	3.97	90

As shown in Table 4, the mean value for the functional design feature is 4.4, the mean for human factors design feature is 4.4, and mean for external design feature is 3.8. The data of this study showed that consumers hold the highest concern for the feature of functional design, followed based on the feature of human factor design, with the feature of external design falling last in consumers' concerns. The results of this study showed that the influence degree of the features of functional design, human factor design, and external design on the satisfaction of consumers purchasing furniture products will be as in the order. Furthermore, consumers always regard the features of functional design, human factor design feature, and external design to be the three features of furniture product designs, which they need to consider when making a decision to buy furniture products.

Determining the Multiple Linear Regression Test On Consumers' Satisfaction Based On The Features Of Functional Design, Human Factor Design, And External Design

This study employed the multiple linear regression to examine how consumers'

satisfaction is predicted from the feature of functional design, the feature of human factor design

and the feature of external design of furniture product designs. The results of the multiple

Table 4 Descriptive Statistics for the Features of Furniture Product Designs
and Consumers' Satisfaction, *N*=963

Variables	Mean	Std. Deviation	N
Satisfaction	4.08	.45	963
Function	4.41	.58	963
Human	4.38	.55	963
External	3.78	.54	963

regression analysis are shown in Table 5, 6, and 7. The results of this study for the equation of

Multiple linear regression are as follows:

Predicted Consumers' Satisfaction $= .14Z_{Function} +.12Z_{Human\ Factor} + .39Z_{External\ Design} +1.48$

A multiple linear regression analysis was conduct to evaluate how well the features of

furniture product designs measures predicted consumers' satisfaction level (refer to Table 5, 6,

and 7）. The predictors were three feature measures indices, while the criterion variable was the

overall consumers' satisfaction index. The linear combination of three feature measures was

significantly related to the overall consumers' satisfaction index, $F_{(3,960)} =247.70$, $p<.01$. The

sample multiple correlation coefficient was .66, indicating that approximately 44% of the

variance of the consumers' satisfaction index in the sample can be accounted for based on the

linear combination of three feature measures.

In Table 5, 6, and 7, this study presents indices to indicate the relative the features of furniture product designs of the individual predictors. All the bivariate correlations between the features of furniture product designs and consumers' satisfaction index were positive, as expected, and three of the three indices were statistically significant ($p < .05$). The partial correlation between the features of functional design/human factor design/external design and consumers' satisfaction index were significant.

Table 5 Results for the One Set of Predictors Consumers' Satisfaction Based on the Features of Furniture Product Designs

Model	R	R Square
1	.661(a)	.437

a Predictors: (Constant), external, function, human factor
b Dependent Variable: consumers' satisfaction

Table 6 ANOVA Results for the One Set of Predictors Consumers' Satisfaction Based on the Features of Furniture Product Designs.

Model		Degree freedom	F	P
1	Regression	3	247.697	.000(a)
	Residual	960		

a Predictors: (Constant), external, function, human factor
b Dependent Variable: consumers' satisfaction

Table 7　Coefficients Results for the One Set of Predictors Consumers' Satisfaction
Based on the Features of Furniture Product Designs

Variables	Unstandardized Coefficients	Correlations		
	B	Zero-order	Partial	Part
(Constant)	1.476			
function	.142	.423	.169	.129
human	.115	.522	.118	.089
external	.392	.602	.468	.398

a Dependent Variable: consumers' satisfaction

In Figures 2, 3 and 4, the results of this study showed that the relationships among

the features of furniture product designs and consumers' satisfaction. In Figure 2, the scatter plot

showed that the relationship between consumers' satisfaction and the feature of functional design

on furniture development was positive and has the correlation of direct proportion.

In Figure 3, the scatter plot showed that the relationship between consumers' satisfaction

and the feature of human factor design on furniture development was positive. In Figure 4, the

scatter plot showed that the relationship between consumers' satisfaction and the feature of

external design on furniture development also was positive and has the correlation of direct

proportion.

Conclusions and Recommendations

The results for consumers' satisfaction differences in views of furniture product designs

are as follows:

1.   Those most satisfied with furniture products are low income, female, high school

students, and those over 40 years old.

2.   Positive correlations exist between the features of functional design feature, the features

of human factor design, the features of external designs of furniture product designs and the

consumers' satisfaction.

Figure 2. Scatter plot between Number of Consumers' Satisfaction and the Feature of Functional
Design

Figure 3. Scatter plot between Number of Consumers' Satisfaction and the Feature of Human Factor Design
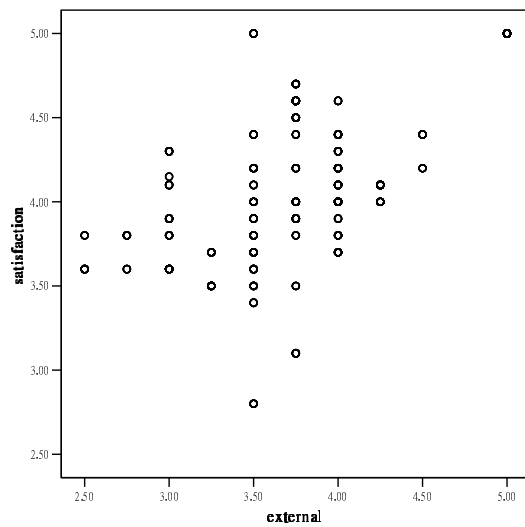
Figure 4. Scatter plot between Number of Consumers' Satisfaction and the Feature of External Design

3.   The findings showed that furniture product designs and consumers' satisfaction have

positive correlations. In other words, the feature of functional design, the feature of human factor

design, and the feature of external design of furniture product designs have significantly

influence consumers' satisfaction. Hence, furniture designers or creators need to pay attentions to issues of functional design, human factor design, and external design when designing or creating new furniture product.

4.   The relationships between consumers' satisfaction and the features of furniture product designs on furniture development were positive. In other words, the features of functional design, human factor design, and external design and consumers' satisfaction revealed direct proportional relationships. Thus, furniture designers or creators need to have regards for the features of furniture product designs when designing or creating new furniture product so as to fit consumers' needs and to enhance consumers' satisfaction.

5.   The findings of this study found that the feature of human factor design, the feature of functional design, the feature of external design all influence consumers when using or purchasing furniture products. Consumers highest concerns for the features of furniture product designs are in the following order: (1) functional design feature (2) human factor design feature (3) external design feature. That is to say, the feature of functional design mostly influences consumers' satisfaction when making decisions to buy furniture products. Hence, furniture designers need to realize how to design or create new furniture products for furniture markets.

The summary of the findings would suggest that furniture product designers should utilize the three product design features: the feature of functional design, the feature of human

factor design, and the feature of external design for their design criteria during the design

procedures of furniture product designs. Furthermore, designers or creators need first to regard

the feature of functional design in the design process. Therefore, designer or creators could

enhance consumers' satisfaction by improving levels of consumers' satisfaction based on good

quality of the features of furniture product designs. The findings provide views, insights, and

suggestions for furniture product designers when designing or creating furniture for more

suitable ways in order to enhance consumers' satisfaction and to fit their needs.

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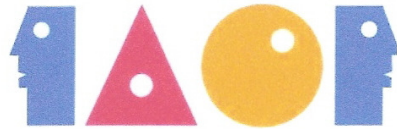
CROSS-CULTURAL DIFFERENCE AND ACCOUNTING ETHICS: AN EMPIRICAL STUDY FOR ACCOUNTING STUDENTS

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Abstract

The accounting profession has recently been faced with a crisis of trust in practice. Stories regarding unethical behavior of accounting professionals, such as the massive accounting cover-up of Enron and the fraudulent practices of WorldCom, keep happening and the situation seems not to have improved. This study investigates the impact of cultural and demographic factors on ethical attitude related to whistle blowing within the field of accounting. Hofstede's (1980 and 1991) theory was used in this study as a framework to identify dimensions based on cultural differences. To test hypothesized differences, a survey of accounting students in Taiwan and the United States was conducted. The purpose of the study was to examine empirically whether there are differences in ethical attitudes among accounting students in the United States and Taiwan and whether differences exist using demographic variables based on gender and experience with a course in ethics. The statistical analysis found that there are significant differences among accounting students in the United States and Taiwan and differences exist by gender. However, no significant differences were found based on experience with a course in ethics.

Key Words: Accounting Ethics, Cross-culture, Hofstede's Theory, Whistle Blowing.

Introduction

An important constituent of professional status is the existence of an ethical basis.

Numerous researchers have emphasized the moral commitment aspect of professionalism; many

believe that ethics is the foundation of public accounting practice. By appealing to the notion of

ethical issues in accounting, the researchers enter into the profound consideration of what

constitutes ethical behavior and how such behavior is motivated. Whistle blowing, one aspect of

ethical decision-making, has recently received a lot of attention because of the inundation of

fraud among major corporations. A whistle-blowing decision is filled with ethical, personal and

professional ramifications as well as the risk of being fired or worse (Finn, 1995). In the Enron

case, unethical behavior may have been tolerated because Andersen was afraid of losing a major

account; moreover, some internal auditors of corporations fail to report business misbehavior to

management because they fear endangering their career or personal security. The wrongful

activities severely harm the organization, investors and other corporate accounts. This study

extends prior research on cross-cultural differences in ethical perceptions by examining whether

accounting students from Taiwan and the U.S. react differently to a set of ethical dilemmas

involving whistle blowing. As the potential managers or professionals are not yet exposed to the

workplace culture, the results of this study are more likely to explain ethical variation based on

their cultural origin and related demographic variables. Dupont and Craig (1996) indicated that

ethical views demonstrated by college students shape the basis of future ethical behavior by professionals and managers.

Literature Review

In a review of empirical studies, Ford and Richardson (1994) classified the variables that predict ethical attitudes and behavior as individual beliefs originating from: nationality, religion, sex, age, education, employment and personality; and situational factors that influence ethical belief and decision-making such as referent groups, rewards and sanctions, code of conduct, type of ethical conflict, organization effect, industry, and business competitiveness. Generally, these two categories can also be subdivided into three categories: personal/demographic, cultural or economic factors (Adler, 2002; Cohen, et al., 1992; Ford and Richardson, 1994). Further subdivisions demonstrated from the evidence that differences in ethical attitudes and perceptions of the respondents may be explained by personal/demographic variables such as culture, age or academic status, gender and ethical education.

Cultural Influences on Ethical Conduct

Culture plays an important role in defining ethical standards because "Ethical orientations are strongly related to cultural backgrounds" (French and Weis, 2000, p.125). Ethical diversity is related to cultural diversity. Culture affects ethical decision-making by interacting with other variables such as gender, education and personality (Christie et al., 2003). For the

operationalization of specific culture, Hofstede's cultural dimensions have been extensively

accepted and have been frequently validated over time (Sondergaard, 1994). Whistle-blowing is

defined as "the disclosure by organization members (former or current) of illegal, immoral, or

illegitimate practices under the control of their employers, to persons or organizations that may

be able to effect action" (Near and Miceli, 1995, p.4). Culture differences affect ethical decision-

making related to whistle blowing. Brody et al. (1998; 1999) employ Hofstede's cultural

typology to examine the effect of national culture on whistle-blowing perceptions in different

cross-cultural comparisons. Additionally, in an empirical study of managers from Croatia and the

United States, Tavakoli et al. (2003) explain the effect of cultural differences in reported whistle-

blowing by using Hofstede's typology and suggest that culture has an enormous effect on

managerial ethics and whistle-blowing and further cross-cultural research on ethical decision-

making is warranted.

According to Hofstede's typology, in individualistic cultures, individuals are concerned

predominantly with their own interests, while in collectivistic societies individuals tend to regard

themselves as members of a larger group. A group's benefits come before personal interests.

They exchange loyalty and obligation for social or group protection. When using Individualism

dimension to compare the United States and Taiwanese cultures, Hofstede (1991) found the

United States to be a highly individualistic country whereas Taiwan a more collectivistic one. In

the United States, individuals tend to focus constantly on personal achievements and

competitions. Taiwanese, on the contrary, view the family and cohesiveness as more important

than individual accomplishment. A Taiwanese (a collectivist culture) may be willing to

participate in a cover-up to save face and protect the reputation of the group, whereas an

American (an individualist culture) may view this type of influence as negative or unethical.

According to Hofstede (1980), members in countries with a larger power distance such as

Taiwan are more likely to accept inequality in power and authority than those from a country

with a smaller power distance such as the United States. Consequently, individuals in the United

States with a low power distance culture may be more inclined to approach a superior and less

likely to accept their superiors' questionable practices than those in Taiwan (larger power

distance). People in high power distance countries tend to cover up questionable actions of their

superiors in turn to show their loyalty and therefore they would be more tolerant of corrupt

practices than those in low power distance countries (Husted, 1999). Therefore, individuals in

low power distance countries are expected to be more likely to report questionable acts by

superiors than those in high power distance countries. Miceli and Near (1992) support the view

that less hierarchical, less authoritarian, and more participative organizations exhibit higher

internal reporting frequencies. Individuals in low power distance cultures would be more likely

to whistle blow because they tend to approach supervisors, make decisions based on their own

judgment and challenge authority (Tavakoli, et al., 2003). In the study of Cohen et al. (1996),

they argue that individuals in low power distance societies would be less likely to view a

questionable practice as ethical than those in high power distance societies.

According to Hofstede's typology, people in high uncertainty avoidance societies such as

Taiwan feel uncomfortable or insecure with risk-taking and unknown situations and prefer to

have formal rules and regulations (Hofstede, 1980). And individuals reflecting a high uncertainty

avoidance culture tend to focus more on legality than ethicality of their actions. They might view

the unethical business practices that are done legally as less unethical than those in low

uncertainty avoidance culture (Christie, et al., 2003). Compared to the culture of the United

States, Taiwanese with higher uncertainty avoidance scores tend to be more conservative and

take a negative view of risk and conflict. People in the United States, a low uncertainty

avoidance culture, tend to be more tolerant of ambiguity and job mobility and are more flexible

than those in Taiwan, a high uncertainty avoidance culture. People in a strong uncertainty

avoidance culture may view the absence of a rule as license to do what may be concerned as

unethical, compared to those in low uncertainty avoidance cultures (Goodwin and Goodwin,

1999). Cultural differences suggest that supporting colleagues by not blowing the whistle is

likely to be more acceptable in a high collectivist country such as Taiwan than the United States,

a strong individualist society (Hofstede, 2001). Hofstede (1984) posits that the combined impact

of power distance and uncertainty avoidance underlies the expectations of reporting behavior.

Taiwanese people, high in both dimensions, are expected to be less likely to report questionable

acts of superiors than U.S. people, low in both dimensions. Members in a society with

collectivism, high power distance and strong uncertainty avoidance may be afraid to blow the

whistle. Understanding Hofstede's cultural dimensions will help managers to predict whistle

blowing probability or acceptance (Tavakoli et al., 2003).

A profession's code of conduct serves as a foundation to examine ethical issues. By

adjusting the code of professional ethics to current societal needs, roles of professional members

will be redefined and, as a result, public acceptability will be enhanced. The accounting

profession in different countries may have different attitudes about the goals and values due to

the differences in cultural and legal environments, which further reflect different levels of

professional commitment or standards regarding ethical behavior. Cohen, Pant and Sharp (1992)

stated that the effectiveness of an international code of ethics might be restricted by cultural

differences even a relatively homogeneous profession such as accounting cannot be excepted

from the rule. Basic similarities are found in ethical standards. This implies that certain ethical

standards are indeed universal, and the differences in the codes related to ethical rules can be due

to cultural, economic and legal differences between countries (Jakubowski et al., 2002). For

example, charging a fee lower than the rate set by the Accounting Association is strictly

prohibited according to the rule of the Taiwanese code since intra-professional competition in a collectivist society might be considered unethical whereas American business, in an individualist society, thrives on competition. In addition, looking for partners who are not members of the Accounting Institute is prohibited in the Taiwanese code while the U.S. code allows non-CPAs to have ownership in accounting firms. The differences in the code are somewhat consistent with the implication of the cultural dimension "Individualism/collectivism."

Demographic Variables and Ethical Attitude

Whether there are gender differences in ethical perception has been debated and investigated in the literature. Some studies have supported the findings that women take more ethical positions than men (Luthar et al., 1997; Sims et al., 1996; Weeks et al., 1999). Conversely McCuddy and Peery (1996) as well as McDonald and Kan (1997) found no significant correlation between ethical perception and gender. In an empirical study of ethical judgment on selected accounting issues, Stanga and Turpen (1991) found no gender differences in ethical judgments. However, much of the existing research implies that female accountants and female accounting students tend to be more ethical than their male counterparts (Ameen et al., 1996; Lampe and Finn, 1992; Shaub, 1994). Although the findings in the literature are mixed, the predominance of experiential evidence suggests that there are gender differences in ethical perceptions and attitudes (Franke et al., 1997; Weeks et al., 1999; Whipple and Swords, 1992).

Kohlberg's (1984) theory of moral development hypothesized that ethical development continues

throughout life when enhanced by ethical education. There is substantial evidence in research

that ethical education develops the moral perception of students (Rest, 1986). For example,

Armstrong (1993) conducted an experiment to examine the effect of ethics education in

accounting and found a significant increase in students' moral development after ethics courses.

Other studies in ethical education are also significantly associated with the two perceptions of

"current ethical climate" and "what the ethical climate should be" (Luthar et al., 1997). On the

opposite side, Arlow (1991) argued that students' ethical beliefs are determined more by the

large socio-cultural norm than by academic education. This may give less importance to business

ethics instruction if the media transmitted culture more than education. Although the arguments

are inconclusive, researchers continue to advocate "ethics be integrated into the spectrum of

business courses" (Tavakoli et al., 2003). Eynon, Hill and Stevens (1997) in their investigation of

professional accountants as respondents found that an ethical course has a positive impact on

moral reasoning abilities and subjects strongly support including ethics courses in business

curriculum.

Methodology

This study investigates whether responses to ethical dilemmas differ between Taiwan and

the U.S. Moreover, differences in student responses were examined using selected demographic

variables. Therefore, we hypothesized that there would be differences in the ethical attitude of accounting students based on their nationality, gender and experience with a course in ethics. The subjects of this study were students enrolled in accounting courses at selected business colleges in Taiwan and the U.S. The scenarios in this research covered different agents, such as internal auditors and accountants. Whistle-blowing dilemmas in regard to various stakeholders (colleagues, supervisor and owner/managers) are situations accounting professionals normally encounter.

Hypotheses

Hofstede (1980; 1991) identified that the value patterns in the U.S. culture are individualist, small power distance and weak uncertainty avoidance. In contrast to the U.S., the culture values held by Taiwanese are collectivist, large power distance and strong uncertainty avoidance. Since the U.S. and Taiwan differ on Hofstede's cultural dimensions, it is expected that accounting students in these two nations would respond differently to questions posed to them in given ethical scenarios (Cohen et al., 1996; Gernon, 1993). Whether there are gender differences in ethical perception has been debated and investigated in the literature. In general, we can represent across cultures the differences between male and female ethical perception as success-orientation versus relationship-orientation (Franke, Crown and Spake, 1997). While it is evident that ethical behavior changes with age and experience, ethical education can effectively

enhance moral development of individuals at almost any stage of their life (Kohlberg, 1984).

Therefore, in this study, we examined differences between the two cultures and difference based on demographic variables.

Null Hypothesis:

H1: There are no significant differences in the responses to whistle-blowing dilemmas between Taiwanese and U.S. accounting students.

H2: There are no significant differences in the responses to whistle-blowing dilemmas between male and female accounting students.

H3: There are no significant differences in the responses to whistle-blowing dilemmas between accounting students' experience with a course in ethics.

Instrumentation

The survey used in this study consists of six scenarios. Each scenario depicts a different ethical dilemma involving whistle blowing found in the workplace. The survey questions measured the accounting students' ethical attitudes regarding each scenario. Respondents were asked to express the likelihood that they would take the action described in the question following each scenario on a 10-point Likert-type scale (1 = Very unlikely; 10 = Very likely). Scenarios involving different ethical situations were modified from prior ethics research (Brody et al., 1998; Goodwin and Goodwin, 1999; Nyaw and Ng, 1994). The scenarios depict potential conflicts that students may encounter in their professional careers, thus, making the decision-making situations more real.

The first scenario (Goodwin and Goodwin, 1999) described a situation where the subjects have recently graduated from a university and have commenced working as an accountant for a medium-sized consulting firm. The owner/manager sometimes received cash checks for services performed and these checks were deposited into his personal bank account. Whenever this occurred, students were asked to cancel the invoice and other documentation and to pass all the paperwork to the owner. Subjects know this practice was designed to evade taxes. Students were asked to indicate the likelihood that they would raise the matter directly with the employer. The objective of the first scenario was to test whether students from a high power-distance oriented society would be less likely to challenge or question upper management than those from a low power-distance oriented society. Individuals in large power distance societies tend to believe that superiors are allowed to have special privileges and would; therefore, be reluctant to disagree with their superiors, compared to individuals in low power distance cultures (Hofstede, 1991).

The second scenario continuing with Scenario 1 assumed that they had raised the matter directly with the employer. The employer stated that his action was common business practice and subjects were warned by the employer that they would immediately lose their job if they raised the matter again with him or anyone else. Students were asked to indicate the likelihood that they would raise the matter with the authorities. The second scenario was to test whether students from high uncertainty avoidance oriented societies would be less likely to change or quit

their job for whistle blowing than those from low uncertainty avoidance oriented societies. Individuals in strong uncertainty avoidance cultures were averse to taking risk and intolerant of ambiguity (Armstrong, 1996).

The third scenario (Goodwin and Goodwin, 1999) described a situation where the subjects had been employed for two years as an internal auditor for a chemical producing company. Subjects had become aware of a cover-up, by an executive in the refining division, regarding evidence that a chemical dump may be potentially unsafe. While no legislative requirements had been breached, there was a chance that the chemicals could leak and seriously contaminate the water supply of the district at any time during the next ten to fifteen years. Students were asked to indicate the likelihood that they would report this matter to the managing director if they believe that the chance of leakage was 60%.

The fourth scenario continued with Scenario 3 and assumed that they did report the situation to the managing director, but were told that there was nothing to worry about. Subjects were considering advising the appropriate authorities, but knew that it could not be done anonymously. Students were asked to indicate the likelihood that they would advise the authorities even though they knew that this could cost them their jobs. The objective of these scenarios was to test whether students from a high uncertainty avoidance culture suspend their ethical objectives when legislative requirements are not broken or their job security is at stake,

that is, whether students from a more high uncertainty avoidance oriented society were less willing to blow the whistle. People in a strong uncertainty avoidance culture may be more likely to view the absence of a rule as license to do what may be considered as unethical, compared to those in low uncertainty avoidance cultures who may break the rule for society's interests (Goodwin and Goodwin, 1999).

The fifth scenario (Nyaw and Ng, 1994) simulated an ethical dilemma related to covering supervisors' questionable actions. Students go on a long business trip with their senior colleague. Evidence led subject to believe that their senior colleague is claiming much more than the amount he actually spent on the trip after they return. One week later the accounting office telephones subject and asks if subject can give verbal confirmation that their supervisor actually spent the money, he is claiming for the trip. How likely are students to conceal that their supervisor is claiming more money than he spent? This scenario was to determine the differences between students from a collectivist-oriented society and those from an individualist-oriented society. Supporting colleagues by not blowing the whistle is likely to be more acceptable in a collectivist country (Brody et al., 1998). Therefore, the stress associated with covering up a supervisor's illegal action, such as cheating on expense accounts or paying or accepting bribes, might also be different.

The sixth scenario (Brody et al., 1998) described a situation regarding the whistle-blowing dilemma. Student just graduated from university and recently accepted a staff accountant position. They suspect that the assistant manager was taking advantage of a poor internal control system in order to embezzle cash. Subjects are new to the company and not familiar with the owners, senior manager or the assistant manager. How likely are they to discuss the problem with the senior manager? The objective of this scenario was to test whether students from a high power distance oriented society would be more likely to perceive inequality between their managers and subordinates and thus be less inclined to approach a superior and to "blow the whistle." Individuals in high power distance cultures were less willing to blow the whistle because they were less likely to question established authority patterns defining behavior (Tavakoli et al., 2003).

Findings

The populations for this study were accounting students at several colleges in the United States and in Taiwan. The sample consists of 286 American students and 263 Taiwanese students. Female subjects comprised the main group compared to male (60.3% and 39.7%, respectively). Accounting students (accounting majors) were also asked to respond to whether they have ever taken a course in ethics. In the total sample, 57.3 % have taken a course in ethics. There was a noticeable difference in that 74.4 % of the Taiwanese students have taken a course

in ethics, which is much higher than their U.S. counterparts (41.5 %). It reflects the fact that

courses in ethics are very common in Taiwan and, in facts, the ethical education starts in

elementary school. Although more than 96 % of the subjects believe ethics is very important in

accounting professionals, only about 86% of the total students sample support Accounting

Professional Ethics as a required course.

The t-test measuring statistical significance of the difference in the mean response for

each survey question was analyzed. The mean and standard deviation for each survey question

with the higher values indicate the more likelihood of ethical behavior. The total sample was

included in this analysis. To score the item 5 required using reverse values for the question. The

mean values for all items ranged from 5.75 to 8.77. This shows that the scores tended more

toward the ethical position (> 5.5) in a scale of one to ten.

Results

The results show that there are significant differences in the responses to whistle-blowing

dilemmas between the two cultures. The results confirm the implication that students from a

more collectivist-oriented society would be more inclined to cover for their superior/colleague's

questionable activities than those from an individualistic-oriented society. The results suggest

that Taiwanese accounting students would be less likely to challenge the owner directly; more

likely to cover up the unethical behaviors of their superior and less inclined to approach a

superior than American accounting students. The results imply that Taiwanese accounting

students tend to be less likely to evaluate questionable practices as unethical if no rules have

obviously been broken and thereby are less inclined to blow the whistle. Therefore, the

accountant types in Taiwan may place more emphasis on legality than the ethics of their actions.

The results are also consistent with the implications of Hofstede's cultural dimensions

"Individualism," "Power distance," and "Uncertainty avoidance." Therefore, null hypothesis one,

there are no significant differences in the responses to whistle-blowing dilemmas between

Taiwanese and U.S. accounting students, was rejected.

The results show that a significant difference was found between the means of the two

groups (Male and Female). This implies that male students are less willing to blow the whistle

than female counterparts when no legislative requirements had been breached and place more

concern on job security than environmental security. In addition, the results also imply that

female students tend to have higher scores for ethical dilemmas than male students, which

supported the findings of Okleshen and Hoyt (1996) that female students are less tolerant of

situations involving ethical dilemmas than their male counterparts. Therefore, null hypothesis

two, there are no significant differences in the responses to whistle-blowing dilemmas between

male and female accounting students, was rejected.

Based on the results of the t-test, the mean scores of subjects who have taken a course in ethics are not significantly different from those of their comparative counterpart. In this sample, the mean scores were about 6.0 and above, meaning that in general the subjects' attitudes tend to be ethical whether they have or have not taken ethics courses. This implies that the experience with a course in ethics does not seem to affect the ethical attitude of the subjects (accounting students) significantly. Overall the mean scores of U.S. students in response to the ethical dilemmas are higher than those of the Taiwanese subjects no matter whether they have taken a course in ethics or not. Therefore, the educational experience in an ethical course seems not to produce significant homogeneity which is helpful in understanding cross-cultural ethical issues. The finding does not support the study of Okleshen and Hoyt (1996), which implies that ethical education is beneficial in order to obtain cross-cultural agreement in ethical values. Therefore, null hypothesis three, there are no significant differences in the responses to whistle-blowing dilemmas between accounting students' experience with a course in ethics, was accepted.

Summary of the Findings

The results of this study suggest that Taiwanese accounting students respond differently to whistle-blowing dilemmas than U.S. accounting students. The results of this study confirm the finding of Lu et al. (1999) that in unethical situations, members in a society with collectivism, high power distance and strong uncertainty avoidance values tend not to blow the whistle. The

results of hypothesis one support that the Taiwanese subjects may do nothings compared to the

U.S. subjects who are more likely to inform the authorities about their concerns (Brody et al.,

1999). The results of the study implies that male students are less willing to blow the whistle

when no legislative requirements have been breached and are more concerned with job security,

compared to female students. The results are consistent with the implication that the male tend to

value materialism, success and money and, therefore, they might be more likely to encounter

unethical situations such as potential corruption (Weaver, 2001). This research also supports the

notion that experience with a course in ethics does not significantly affect the ethical attitude of

accounting students, which is consistent with the findings of Arlow (1991) that students' ethical

attitudes are influenced more by exposure to the large socio-cultural norms than by education in

specific disciplines.

Conclusions and Recommendations

Several limitations of the research are noted. First, the sample was not drawn at random.

Second, a quasi-experimental study does not bring out real-world pressures. Third, the results

will be based on self-reported responses that can be subject to social desirability bias. The recent

exposure to the media about the massive accounting cover-ups and fraudulent practices may

have an influence on students' responses. American students may have been more likely to

report higher ethical judgments than Taiwanese students under different circumstances.

The rapid change to a global culture and its concomitant ethical decisions has become as one of the great problems for the accounting profession. To restore confidence in the accounting profession, it is necessary to return to the fundamental basics. Systematically understanding how culture influences ethical decision-making such as whistle blowing will help accounting professionals have a better defense against potentially unethical behaviors. The results of this study will help to revise accounting curriculum in order to help students become more sensitive to specific ethical accounting dilemmas thus affecting tendencies to engage in unethical activities. The findings of the present study are essential to training the new generation in learning how to avoid the pitfalls of inappropriate decision-making that have underlying cultural differences and will increase the understanding of the impact of culture related to whistle-blowing decision-making within the field of accounting. This research is laying the foundation for further research in cross-cultural ethics in accounting.

Future research could expand the findings of the present study by examining differences in ethical perceptions and decision-making as student's progress through accounting course work. One important direction would be to explore differences in the ethical perceptions between accounting and non-accounting students throughout the country or across countries and to trace why these differences may exist. Future research may also examine other potential covariates of ethical decision-making such as organizational culture, codes of conduct and legislation. Further

analysis could be conducted considering ethnic origin within a nation that is becoming multi-

cultural.

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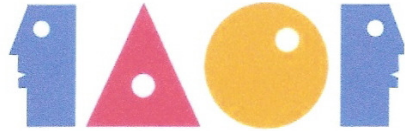
Applying the Strategic Approach to Assess Customer Relationship Management

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Abstract

Customer relationship management (CRM) has become a popular information system to assist companies in increasing their competitive advantage. Because of the focus of customers, they provide customer-centered instead of product-centered products. In order to properly and correctly implement CRM, understand how to use strategic approaches to influence an organization. The study examines the following: 1. causes of failure associated with CRM including of unplanned project budget revisions, inadequate return on investment, loss of employee confidence and diversion of key management time. 2. Managers failure to implement CRM due to lack of adequate change management. 3. How essential may be for organizations. Most top managers regard CRM as a very important and adopt it for creating competitive advantage even thought their companies are never properly implementing it. 4. How to treat customers is difficult. Most CRM projects end up focusing on wrong targeting customers or using wrong approaches to treat right customers.

Keywords: Customer Relationship Management, CRM, Customer Strategy,

Introduction

In recent years, companies have focused more and more on customer service due to increased business competition. Retaining a long-term customer relationship and improving service quality have become important goals which organizations are trying to achieve (Walton and Xu, 2005). Therefore, adopting customer relationship management (CRM) approach has become a trend. Chou et al. (2002: 442) point out, "customer relationship management (CRM) has became the number one focus while competitive markets nowadays are getting more competitive and saturated."

CRM is a 360 degree projection which requires not only technology implementation but also strategic making and other integration in an organization (Sin et al., 2005) However, Bull (2003 cited in Dickie 2000; 2003 cited in Giga 2001) found that "only 30.7 per cent of companies described that they had achieved their goals which they sell and serve customers because of well utilizing CRM." Thus, CRM has a reputation as difficult IS to adopt for organizations. In fact, approximately 70 per cent of organizations eventually fail to implement it properly. As a result, even though CRM benefits organizations, it still can result in failure if companies do not know how to properly utilize it.

Literature Review

Definitions and Characteristics of CRM

"CRM is an information term for methodologies, software and usually Internet capabilities that help an enterprise manage customer relationships in an organized way" (Chou et al., 2002: 443). It is also defined as "all the tools, technologies and procedures to manage, improve, or facilitate sales, support and related interactions with customers, prospects and business partners throughout the enterprise" (Wen, Yen and Zeng 2003 cite in Davenport et al. 2001)

CRM can be used to analyze and distinguish individual customers and groups of customers and, therefore, it can assist an organization in building a complete customer database for accurately targeting markets (Chou et al., 2002). In addition, it helps organizations to gather data swiftly, identify its most valuable customers and increase customer loyalty by providing customized products and service (Reichheld, Rigby and Schefter, 2002) Wen, Yen and Zeng (2003: 39) suggest that a well-designed CRM includes 4 characteristics.

1. Relationship management which increases customer satisfaction and customized service attracts and maintains customers due to instant service response, one- to- one solution to customer requirements and direct communication with customers.

2. Sale force automation which can track clients account history and automate of sales promotion analysis. Thus, it provides information for future sales and repeated sales to assist predicting sales to decide if they should increase or decrease sales.

3. Useful of technology including data mining and data warehouse to provide differentiated

and customized service. Thus, it assists in keeping a leading position among competitors.

4.   Opportunity management. It provides to manage unpredictable sales growth and demand so

can better meet customer needs and optimize the supply and demand.

The Application of CRM

In order to understand CRM systems, Figure 1 demonstrates how CRM operates and

integrates other systems in an organization. CRM front office applications include marketing,

customer service and sales. Its function is to raise revenues by increasing customer loyalty and

boost sales volume. Its back office application supports internal administration activities and

supplier relationships, including human resources, financial, logistics and operation. In addition,

CRM integrates company touch points which contain the Internet, e-mail, direct mail, call

centers, advertising and stores (Chen and Popovich, 2003; Knox et al., 2003). That means CRM

is a medium which links back office and customer touch points so the back office can efficiently

receive customer suggestions via front office. It also helps companies to create competitive

advantage and effective decision making.

Data warehousing technology plays an important role in this information flow because it

consolidates, correlates and transforms customer data into customer intelligence that can used to

form a better understanding of customer behavior (Chen and Popovich, 2003). Therefore, from

the description above, it indicates that a complete CRM is built up in a framework which

integrates customer touch points, front office and back office.

Impact of CRM in an Organization

After mentioning characteristics of CRM and its operation, it is clear to understand that

CRM is an approach which can assist an organization increase profits and enhance its

competitive advantage.

Due to the impact of CRM, organizations begin to re-engineer their strategies and

organizations in order to align with an implementation of CRM. They are aware that

management is an important organizational asset and customers should be differentiated because

every customer has different needs. Understanding what customers need can provide a business

with a competitive edge over their competitors (Knox et al., 2003: 6).

This awareness has increased the number of organizations interested in implementing CRM

systems. However, according to statistics, 55 per cent of all CRM projects fail (Boddy, Boonstra

and Kennedy, 2005). This data indicate that even though CRM is a very helpful approach for

organizations, it still can result in a large number of companies failing if not implemented

properly. For this reason, in order to investigate what causes their failure, it is crucial for an

organization to understand how CRM affects the micro-environment.

The Strategic Approach

The Socio-technical Approach to Assessing CRM

Social, technical and organizational factors have an interdependent relationship which

cannot be separated (Figure 2). It means it is impossible to neglect or abandon one of them since

they are key elements to construct a complete IT organization. Due to considerable advantages of

CRM, organizations commence to adopt then as their new competitive edge. Nevertheless, a

well-designed CRM operation should requires other technology, including data mining and data

warehouses.

Socio-technical Approach - Technical Factors

In order to acquire accurate and effective data which can be analyzed, data mining plays is

essential to the implementation of CRM. Chaffey and Wood (2005: 106) define data mining as

"a technique used to identify patterns within data that may prove value in understanding

customer behavior or enable targeting." Because of these characteristics, data mining assists

CRM in gathering and recognizing useful data in order to efficiently focus on targeting markets

or consumers.

Data warehouses are large databases which contain a variety of detailed business data. Their

main function is to analyze customer behavior and needs. In addition, data warehouses assist

CRM in supporting customer data integration, customer data analysis and customer interaction

personalization (Chou et al., 2002). Data mining and data warehouses have improved the quality

of data so organizations can utilize CRMs to serve their customers more specifically and

accurately. In sum, these technologies which are operated by CRM to help a company to gather

individual customer insights, efficiently respond to individual requirements and integrate the

business processes around individual customers (Knox et al., 2003: 6).

Technology, however, is merely a section of implementation of CRM. People are key to

making a CRM successful. According to CRM research which analyzes more than 200

companies in a wide range of industries, most executives do not know what they are

implementing, let alone how much money they will spend and how long it will take (Reichheld,

Rigby and Schefter, 2002). Chen and Popovich mention that top management support and

involvement as a key success factor for CRM implementations (2003 cited in META Group

Report 1998). If they do not fully understand CRM and adopt it without careful consideration, it

is difficult for subordinates to properly apply it. Therefore, if CRM is to be successfully

implemented in an organization, it should focus primarily on organizational social factors.

Socio-technical Approach-Social Factors

Before adopting CRM in an organization, top managers should clearly understand why their

purposes for implementing it, as well as the benefits for their organizations. When approving a

project which CRM project team schemes out, top managers should continuously support and

authorize them to achieve the objective.

However, top management should emphasize not only CRM systems itself but also

arrangement of personnel. Customer-centric management requires top management support and

commitment to CRM throughout the entire CRM implementation (Chen and Popovich, 2003).

Top management should sufficiently empower customer-centric managers to implement

CRM as well as provide adequate resources. Furthermore, employees should receive training

which helps them understand CRM and how to solve problems and communicate with their

customers.

In order to efficiently implement and manage CRM, top management should collaborate

and communicate with customer-centric management and all other levels of employees. Top

management should build job evaluations and reward systems to ensure successful

implementation of CRM and quality employee performance (Chen and Popovich, 2003).

These changes mentioned above can accelerate and advance to form CRM systems. In sum,

re-engineering a customer-centric business model requires cultural change and an expectation

that all employees anticipate the new innovation (Chen and Popovich, 2003).

Socio-technical Approach- Organizational Factor

Frow and Payne (2005) suggest that in order to apply CRM systems successfully, a cross-functional integration of processes, people, operations and marketing capabilities enabled through information, technology and applications are needed . Integrating of social factors and technology will facilitate an organization's adoption of a new innovation such as CRM. Therefore, well- designed CRM systems rely on cooperation between cross departments and an organization which well integrates social factor and technology.

The Strategy of CRM

The Relationship Between CRM and Strategy

Understanding how CRMs functions in organizations and how they affect an internal environment will assist adoption of the innovation. A successful implementation and management of CRM, however, derives from a well-planned strategy. Grant (2005) mentions that strategy is an approach in leading an organization or an individual to achieve objectives. Thus, if strategic approaches can be well utilized, they are as keys to success.

Proter's Five Forces Analysis of CRM

For the purpose of integration of CRM and strategies, primarily assessing what competitive advantage of CRM can provide an organization is crucial. According to Proter's five forces model, for an organization to implement a new technology (Figure 3), it must carefully analyze five aspects before adopting a new information system.

1. Bargaining power of customers: Does new IS increase or decrease bargaining

   power? Are customers switching coasts or barriers changed?

2. Threat of substitutes: Can new IS be used to generate new or replacement products or

   service?

3. Threat of new entrants: Does IS increase or decrease the barriers to entry to a market sector?

4. Extent of rivalry between existing competitors: Does new IS change the basis of competition

   with a market?

5. Power of suppliers: Does new IS increase or decrease bargaining power? Can an organization

   switch suppliers more or less readily? (Chaffey and Wood, 2005:306).

Utilizing Proter's Five Forces to Analyze Boots Advantage Card

Due to competition Boots Advantage Card, for example, they combines CRM systems with

cards which can record and analyze customer buying behavior and provide service recovery to

maintain customer loyalty. The points below explain the relationship between CRM and Boots

by assessing Porter's five forces.

1. Bargaining power of customers. Boots Advantage Card reduces customer switching cots

   and customer bargaining power since it offers points to encourage customers to purchase

   again. Furthermore, customers can redeem points on future purchases so more and more

   customers become loyal to Boots.

2. Threat of substitutes. Except CRM, there are a variety of IS (Information Systems) that can be adopted. Nevertheless, owing to differentiation of implementation, CRM systems focus on specific approaches and therefore increases the difficulty for other IS to replace CRM. Boots utilizes CRM approaches to understand their customers and build a high quality database.

3. Threat of new entrants. Boots Advantage Card has successfully retained customer loyalty and therefore increased the barriers to entry to this market sector for new competitors.

4. Extent of rivalry between existing competitors. CRM has drastically changed the business macro- environment. Boots, however, is not the only one which implements CRM. Other rivals in the same market sector find it difficult to compete due to CRM's well-planned integration and information and customer strategies.

5. Power of suppliers. Boots has successfully implement CRM to enhance its competitive edge and retain customer loyalty and thus has a stronger bargaining power for its suppliers (Bocij et al., 2003; Curry and Kkolou, 2004; Chaffey and Wood, 2005).

The Stages of IS Strategy Development

After analyzing the influence of CRM on an organizational internal and external environment, the next stage is to develop a strategic process. Chaffey and Wood (2005) suggest

that using a strategic process to implement IS is essential and if an organization is to obtain a

clear concept to implement CRM systems (Figure 4).

Stage 1. Strategic analysis. In this stage, they should analyze and understand the organization's

strengths and weakness by analyzing its external environment and internal resources. From

analysis, top management can assess if the organization can implement new IS to create a

competitive edge.

Stage 2. Strategic objectives. Making a clear strategic statement can offer a clear future direction

and assist organization performance.

Stage 3. Strategic definition. After identifying clear objectives, they should select and evaluate

their proposed IS.

Stage 4. Strategic implementation. This is final stage which means they implement the new IS.

However, they should continuously detect problems and adjust their strategy.

The Relationship Between Customer Strategy and CRM

The strategic process is merely a framework to used implementation IS. A successful CRM

should more focus on business strategy which is designed to effectively segment, target and

position customers in order to compete with other rivals (Curry and Kkolou, 2004). Creating a

customer strategy is crucial because every customer has different needs and behaviors (Rigby,

Reichheld and Schefter, 2002).

It is essential to understand how customers differ and how to create a unique and relevant

value proposition to address and exploit these differences (Knox et al., 2003: 11). Most

organizations fail to implement CRM because they only focus on IS and do not understand

customer needs and what services to provide (Rigby, Reichheld and Schefter, 2002). Therefore,

organizations need a differentiated strategy to research varying customer requirements, buying

behavior and motivations. Furthermore, they should utilize strategies to encourage or persuade

customers to share their information in order to implement CRM well.

Recommendations and Conclusion

Recommendations

Most CRMs fail because of unplanned project budget revisions, inadequate return on

investment, loss of employee confidence and diversion of key management time. In addition,

they fail because of a lack of clear strategies needed to efficiently and properly implement CRM.

Therefore, before implementing CRM systems, companies should carefully plan what strategies

to adopt and perils to avoid.

In order to avoid peril, we suggest attention to 4 key points. First, creating a customer

strategy is crucial. Implementing CRM without creating a strategy to clearly target their

customers, conduct segment analysis and decide marketing objectives is like building a house

without engineering measures or architectural plans. Most executives believe CRM systems can

fully meet their needs and achieve their goals. As a result, they do not create customer strategies in advance.

Second, organizations much change to match CRM systems. A survey indicates that 87 per cent of managers failed to implement CRM due to lack of adequate change management. This reason relates to the organizational social issue mentioned above.

Third, executives should estimate if CRM is essential for their organizations. Most top managers regard CRM as a very important approach and adopt it to create a competitive advantage even thought their companies are not prepared to implement CRM.

Finally, treating customers properly is difficult. Most CRM projects focus on the wrong target customers or use wrong approaches to treat proper customers.

The recommendation is to analyze previous failure and therefore organizations should bear these experiences in mind in order not to make the same mistakes again.

Conclusions

1. Implementing CRM can help an organization to analyze customer data swiftly, increase information quality, make decisions efficiently, increase customer loyalty, improve customer satisfaction and reduce costs.

2. Although CRM is beneficial for organizations, there are a number of barriers which lead to failure. For instance, those do not understand or assess its risks and expenses, top

management who lack sufficient CRM knowledge, organizations which do not integrate

technologies, strategies and management, and employees who do not have sufficient CRM

knowledge and trainings may fail.

3.　　Because of these barriers to implementing CRM, the report indentified key points which

organizations should avoid and strategic approaches which assist they in strategic making.

4.　　　CRM provides more opportunities for organizations to compete with other rivals. The

impact of CRM in organizations is inevitable; however, its proper implementation is crucial.

CRM continue to grow. However, just adopting CRM does not ensure an organization's

competitive edge. In addition, CRM is an expensive, time- consuming and complex and

therefore, before implementing it, organizations should carefully study its potential impact on its

internal and external environment. Executives should focus on long- run vision rather than short-

run profit (Bose, 2002).

Implementing CRM should not merely consider technologic issue because CRM is not

only an information system but also an integration of technologies, management and strategies.

Organizations need to understand the theoretical and practical implication of the organizational

perspective of CRM before embarking on a CRM package implementation (Light, 2003: 616).

Although CRM can assist organizations in reducing costs, increasing customer

satisfaction, maintaining customer loyalty and gaining new customers, its successful

implementation relies on a complete organizational micro-environment, proper strategic

approaches and integration of technologies.

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Appendix
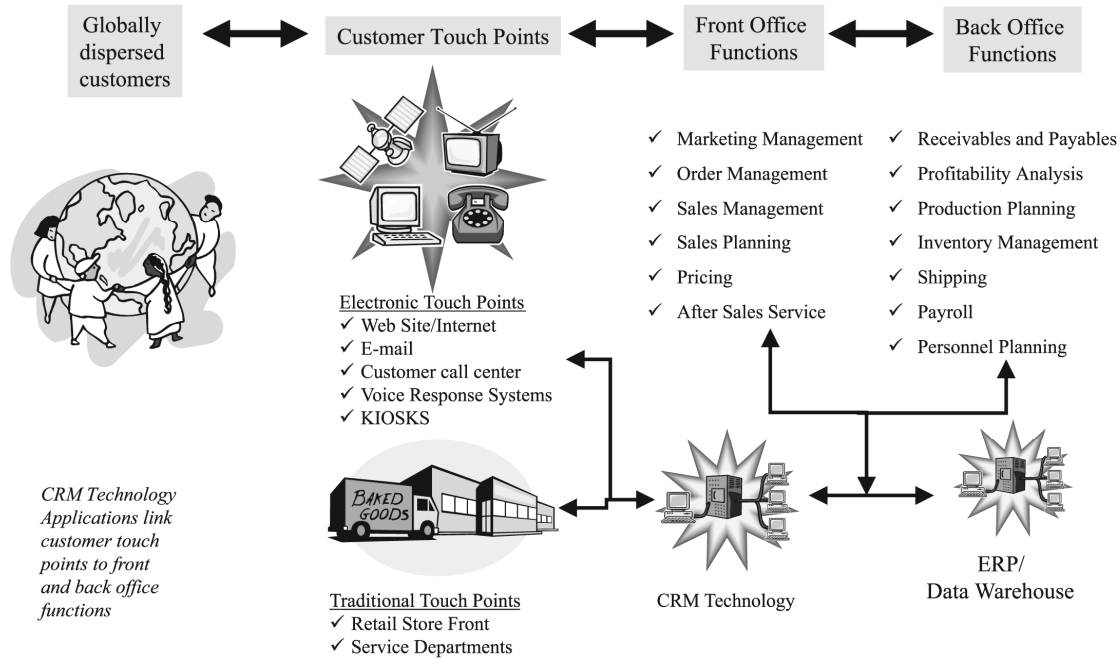
Figure 1. A CRM implementation model

[Adopted from Chen and Popovich (2003:680)]
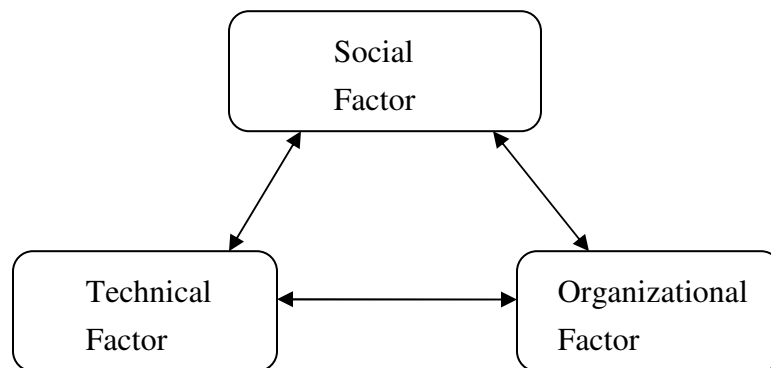
Figure 2. The Socio- technical Approach

[Adopted from Boddy, Boonstra and Kennedy (2005)]
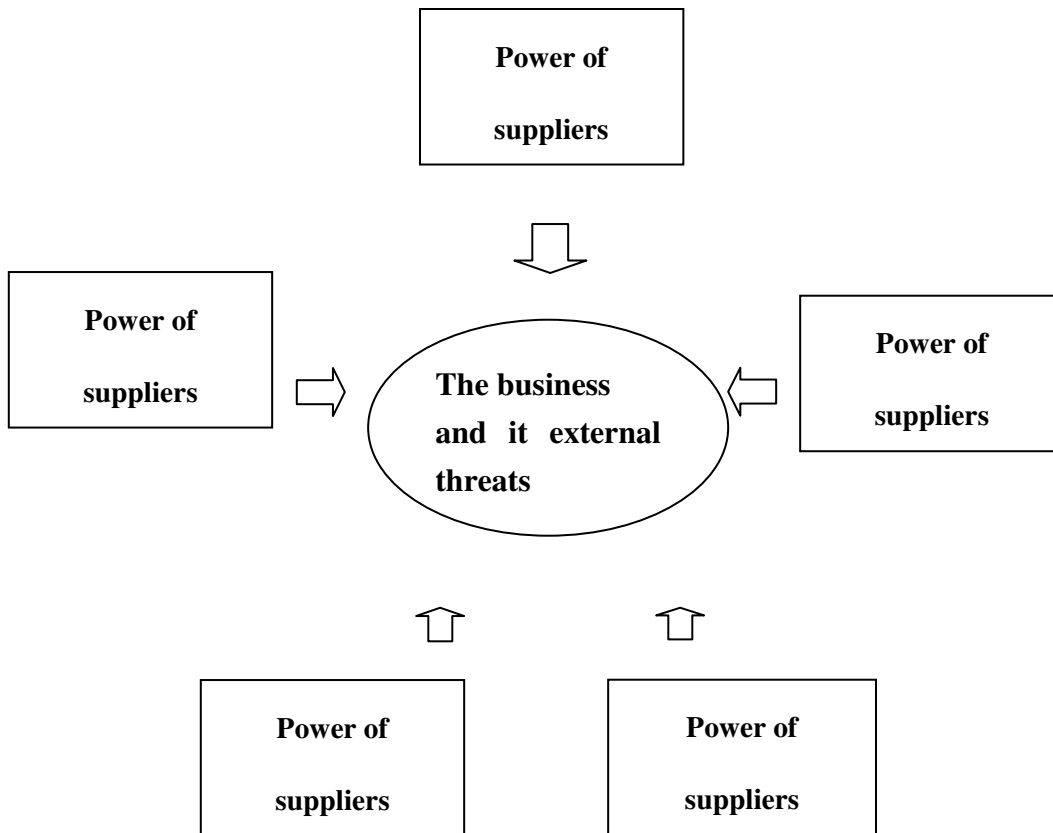
Figure 3. Proter's Five Forces Model

1.STRATEGIC ANALISIS

EXTERNAL   INTERNAL

ENVIRONMENT   ENVIRONMENT

2. STRATEGIC OBJECTIVES

VISION MISSION   OBJECTIVES

3 STRATEGIC DEFINITION

OPTION   OPTION   OPTION

GENERATION   EVALUATION   SELECTION

4 STRATEGIC IMPLEMENTATION

PLANNING   EXECUTION   CONTROL
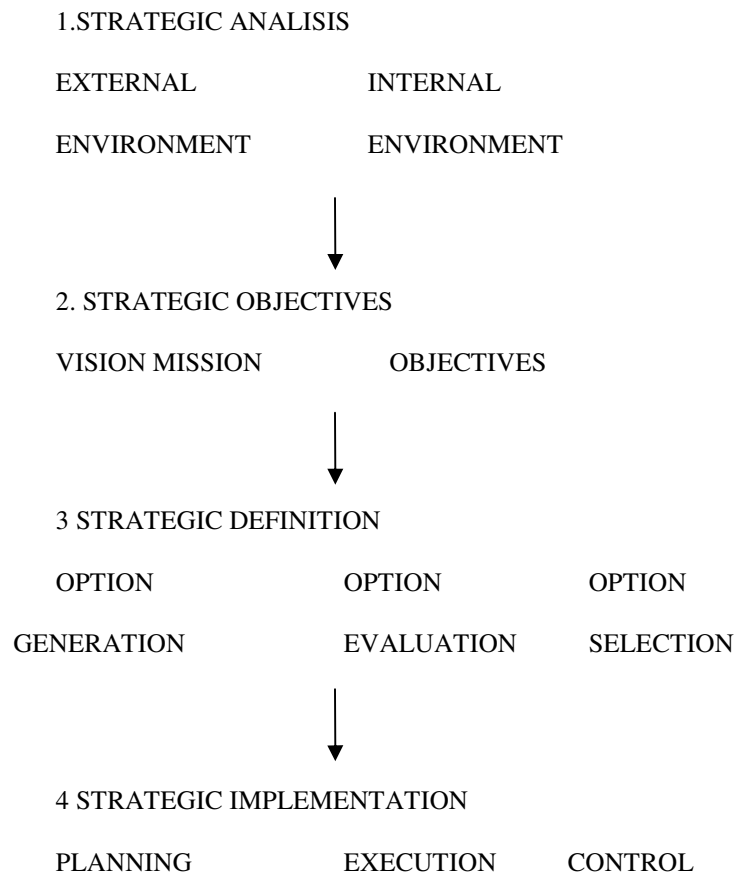
Figure 4. The Process of Strategic Implementation
[Adopted from Chaffey and Wood (2005:293)]
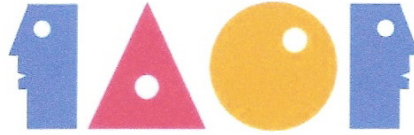
THE EFFECTS OF ANTIDUMPING MEASURES ON THE FDI: A PRE-MARKETING BEHAVIOR ASPECT ANALYSIS IN CHINA

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Abstract

In order to sustain its development, China is at a critical time of needing more foreign investment and advanced technologies. But China needs to make use of the anti-dumping measure to keep the order of fair trade in international trade. In the existing cases, there are some big multinational corporations involved, which are investing or planning to invest in China. Whether the anti-dumping measures affects their investment interests in China and cause them to retreat or divert their investment, thus it will possibly affect the development of China's economic growth. In this paper, we analyze the essence of the pre-marketing behavior and the general effects of the antidumping measures to the pre-marketing; analyze the relationship between the pre-marketing behavior and its investment strategy, then, we describe a theoretical model by using the game theory. We finally, found out that the Pre-marketing compliant is in essence a contemporary way of the multinational corporations enlarging the its interests under China's anti-dumping measures; and the pre-marketing is only an extra-favor that the Chinese government given to the multinational enterprises and it plays little role in its decision making of FDI in China when other conditions of the foreign investment remain unchanged. Based on the above findings and the remaining statistics, the FDI of the multinational corporations will not be

affected when China imposes fair antidumping measures to keep a fair international environment and sustainable economic growth in China in the long run.

Keywords: Antidumping, FDI, Pre-marketing, Effects

Introduction

Since 1978, China has been sustaining its development with many successful policies, and has reached remarkable achievements. Among them, the most highlighted policy is the opening policy of attracting foreign direct investment (FDI). In recent years, statistics showed the FDI related export has played a very important role in China's export and the economic growth. But after China's accession to the WTO, as china has more of the FDI, the effects of FDI in China became one of the hot issues in nowadays. Since 1997, China has imposed more than 30 anti-dumping (AD) measures towards the imported goods, these are the rightful undertakings of the WTO AD measures and brought positive results of keeping a fair trade and protected home enterprises. Among the products involved, there are some products of the companies that are making or planning making investment in China, thus when there is a dumping duty to the pre-marketing goods, the prices will definitely arise, and the FDI companies complaining their lawful pre-marketing goods had been charged an extra AD duty. And there is a doubt of whether the AD measures will make the FDI divert their investment direction. What really pre-marketing

mean to the FDI companies in their investment strategy? And will AD affect adversely the FDI

in China?

Pre-marketing and AD Analysis

What is Pre-marketing?

In the common textbook of marketing, Pre-marketing means the performance of a

company's selling the target product from another market to the target market before the

company can produce, it is quite normal to do so when it is a domestic company performs pre-

marketing on the home market. The purpose is to prepare for the future production and selling. In

essence, this is a kind of marketing tactics. If there is the anti-trust regulation, it will not do harm

to the market system.

The pre-marketing that was caught in the anti-dumping measures in China is a little

different from what is mentioned above. This time the pre-marketing comes from abroad, and the

quantity is quite huge that caused market injury and it hit the high tension line of dumping. What

make it even worse is that the pre-marketing was permitted by the government. So the companies

argue that it will do harm to their investment and some even imply canceling the plan. In fact,

since the investment of such enterprises may last for several years, the pre-marketing will

continue to be a lasting flow of import goods. The foreign company will make use of the market

share and low price tactic, thus affected the industrial development of the host country, and even

impact the structure of the existing industries.

Generally, when the Multinational Enterprises (MNEs) sign the contract of investment, they

may require selling the same products they will produce to China from a third market before they

can make it, so pre-marketing is permitted by the authority. The common operation in the pre-

marketing stage is done by penetrating pricing (PP), by which the new products were sold at an

intentionally low price, so the new product will take a bigger market share and receive an

immense demand[1] At the beginning stages, holding and maintaining the market share is placed

at high priority in the competitive tactics, so most of the MNEs will take PP as the main tactics in

the pre-marketing period of its investment.

Pre-marketing - One Policy Arrangement of China

The pre-marketing agreement is a policy arrangement that China provided to help the

MNEs to invest in China, since the duration of the investment is quite long and the scale is often

quite big, it is quite natural to provide pre-marketing when the import license policy is still

operating. This is an extra-favor that china given to the MNEs in the early 1990s.

These MNEs are mainly in the trade of Chemical and petroleum. The production line is

very long and highly vertical integrated, so the investment requires high safety. Under the former

foreign trade law of China, the company that has not begun its production has no right to import

and export goods besides the needed material for constructing and investment. So if pre-marketing was not given to the MNEs, maybe they were still justifying the investment. By pre-marketing, the MNEs would know the market demand and prepare its future sales as well.

But beyond the expectation of the Chinese government, the pre-marketing volume is so big and the price is so favorable to the customers in China that the domestic enterprises may suffer from this low price competition. The MNEs are at a favorable market position because of their scale and advanced technology and superior cost advantage compared to Chinese counterparts. The entry of MNEs in the field will definitely cause material injury or impede the establishment of the domestic industry in that trade. So the pre-marketing becomes a dumping performance in China, and it met the anti-dumping measures. According to the present AD law, this pre-marketing is under the governance of the AD law. The problem is that when the formerly agreed pre-marketing encounters AD measures whether it will affect the investment decision.

Pre-marketing and AD

In China, we have begun launch AD since 1997, there are only 30 more the cases, and mainly in 4 industries. Most of the AD measures brought about positive protection effect. But some MNEs argue that the AD towards the pre-marketing is inadequate, and it will affect their investment decision.

What is AD?

AD is the common trade policy in protecting the domestic enterprises under the WTO framework. Firstly, let's get the recognition of dumping. Dominick Salvatore (1997) defines dumping as the export of a commodity at below cost or at a lower price than sold domestically. Article Ⅵ of GATTS (Hanlin Zhang,2003) has that an industry in one country is materially injured or threatened with material injury, or that the establishment of an industry is materially retarded, by reason of imports that are being, or are likely to be , sold in this country at Less Than Fair Value (LTFV).

Here we analyze the relationship between pre-marketing and Dumping. 2 more elements need to be considered, the dumping should cause material injury to the domestic market or cause the establishing of the companies difficult; and the injuries are directly caused by the dumping of the like products.

The Effects of AD to the FDI

The Effects of an AD to the Exporters

The imposition of AD may cause multiple results to the interested parties. The most prominent result the price of the imported goods would be corrected to the fair trade level, and superficially the exporters may face a reduction of demand to its goods due to the raised price.

Thus the volume of export will sharply decrease or force the products out of the domestic market. There have been some related empirical literatures.

Dutz (1998) finds that antidumping cases led to a decrease in import competition faced by domestic firms as a consequence of the increase in prices resulting from this trade remedy. He estimates that less than 0.6 percent of manufacturing shipments were covered by antidumping duties in 1990, but that this does not include the costs of a decrease in competition for the domestic industries, nor the ripple effect on downstream industries, as users of the products subject to antidumping duties face a decrease in the availability of low-cost inputs.

Prusa (1999) estimates the effect of antidumping for the United States. His findings are that antidumping investigations have a substantial effect on imports, whether or not antidumping duties are applied. The decrease of the value of imports for the countries targeted by antidumping investigations is in the 50 to 70 percent range. For those cases that are turned down, there is a decrease of imports of 15 to 20 percent. Prusa also mentions the high level of protection that results from the application of antidumping duties, particularly when compared to the currently low levels of average tariffs: the level of the median antidumping duty was 16 percent, when the industries thus protected faced MFN tariffs of 4 percent in average. There were antidumping duties of over 50 percent (20 percent of the cases) and of over 100 percent (10 percent of the cases).

The main and direct AD effect which is related to Pre-marketing (PM) is the price effect.

When imposing AD measures, the AD duty added to the PM Price may cause it rise, thus it will

make the PM volume decrease. In fact, there is possibility of keeping the same level of revenue

even after the AD**.** Then we need know how much does PM matter in the FDI in China.

The Role of Pre-marketing in FDI

What Are the Factors That Determine a FDI in China?

Modern theories about the motives of FDI denote that there are 4 kinds: market –oriented

motive; factor searching motive; potential advantage motive; global strategic development

motive. (Weiguo Xiao, 2002) If we analyze the economic situation in China, we can find

abundant evidences for each of the specific motives for the MNEs to invest in China.

As China has the largest population in the world, the potential demand will definitely

enormous if China can sustain its development, so the market is irresistible to the MNEs in the

world. Thus the potential market is the first important factor that attracts FDI from the other part

of the world. This is consuming aspect of the issue.

In relating to the investment, production is one of the core procedures. In China, we have

the most valuable and advantageous factor in the 21st century human resources, which is quite

expensive in the home country. Although what the MNEs need most in China is the well-

educated employees, the low cost of labor is still attractive to the labor –intensive industries.

From a dynamic view, China is now undergoing a healthy developing, the potentialities of China will be the realistic advantage to the MNEs in the near future. The possible potentialities would be same luring to the MNEs. From the strategic view, China has been a member of the WTO; China is now going to a more liberalized economy, and emerging to be one of the largest economic bodies in the world. Most of the 500 world biggest MNEs (more than 400) have invested or investing in China to cater to their needs of global development strategy.

So, the fact that matters most to the MNEs in China is the market capacity; the cheap and abundant labor forces; promising potentialities and the increasing role of China in the strategy of its global development.

The Role of Pre-marketing in FDI

The above analysis shows that the most decisive matter in the FDI decision making is their STRATEGIC interest in China. And the problem of PM that caught in the Chinese AD measures is only a tactics in the FDI. Will that AD duty powerful enough to drive the FDI away from China? Before we get to this question, we should know the general risks for an FDI.

 If we consider the whole process of the investment, there will be building risks, production risks, and management risks, sales risks; if from the elements of the operation, there are human resource risks, market risks, financial risks, technology risks, and systematic risks (external risks), contract risks, exchange rate risks.

Among the risks, PM could do little help in avoiding them, it can only make the investment a bit easier to undergo. But when signing the contract, the Chinese government did not restrict the price and quantity of the PM, thus left room for the PM to be a negative element in the FDI process to the domestic enterprises (became a dumping.)

How to Prevent the PM Behavior into Dumping

The Monopolistic Market Power of the PM Enterprises

According to economic theory, dumping occurs when the PM enterprises (PME) can affect the prices of the PM goods in the host country market, so it is likely to happen in an incomplete-competitive market. From the micro-economics theory, if the PME wanted to acquire optimal profit, there are two conditions need to be realized: the average revenue of the product equals to the total average variable cost, i.e. AR≥AVC; and the marginal cost equals to the marginal revenue, i.e. MC=MR. (see Appendix 1).

This graph is about short term equilibrium of the Pre-marketing of the MNEs in China under the monopolistic competition. According to rule of maximizing profit, the equilibrium point of production point is $B(P_2, Q_2)$, while the MNEs wanted to expand the demand to their products, they sell the products at a lower price P_1, if there is no quantity restriction, the whole sales is Q_1, thus a dumping is happening.

The Trivial Quantity of the PM-causing Dumping Control

There is a rule about the trivial quantity control. If the import of the products is less than 3%

of the whole import of the like products in China, and the total sum of those under 3% is no more

than 7% of the general imports of the nation, and the margin of the dumping is less than 2%, this

kind dumping is forgivable. Also, we take the average increase rate of China's GDP as the

increase rate of the trade, and assume that if the increase rate of the PM is less than that of the

trade, it will be no harm to the domestic enterprises. Since the PM is a previously authorized

policy to the MNEs, if apply this rule to PM dealing, it will be suggestive. The above deduction

can be shown by the following equations:

`$\Sigma dq^{im}_i / \Sigma dq^{im}_T)_t \leq 10\%$ （$i=1, 2, 3, \cdots, n$）(1)

$Q^{im}_i / \Sigma Q^{eim}_i)_t \leq 3\%$ （$i=1, 2, 3, \ldots, n$）（2）

$Q^{im}_i / \Sigma Q^{im}_T)_t \leq 7\%$ （$i=1, 2, 3, \ldots, n$）（3）

（$P^p_i - P_n) / P_n \leq 2\%$ （$i=1, 2, 3, \ldots, n$）（4）

among them：

ΣQ^{im}_i stands for the total imports of i product, which is the like product of the PM goods in

    China;

Σdq^{im}_i stands for the increase of the total imports of i product of a certain PME

$dQ^{im}{}_T$ stands for the increase of the total imports of i product in China

$Q^{im}{}_i$ stands for the quantity of the imported i product of a certain PME

$P^p{}_i$ stands for the price of the imported i product of a certain PME

P_n stands for adjusted normal value of the imported i product of a certain PME

From equation (1)-(4) we can easily calculate the PM price and Volume that does not cause any material injury. If the equation changed, the PM should be under the investigation of Anti-dumping. We also need to take a dynamic look, if the volume of PM and the market share are increasing along with the reduction of the PM price continues.

The Effectiveness of an AD Measure

Here we make use of the Nominal and effective tariff method to analyze the effectiveness of AD duty, and the Price undertakings can also be transformed into AD duties. Assume the price of the product of trade j is X_j, the value added is V_j, and V_j can be calculated by the following equation (before the imposition of AD duty):

$$V_j = X_j - \sum a_{ij} X_j \quad (5)$$

After the imposition of taxes, the price will be $X_j + X_j t_j$ for this trade, then V_j is:

$$\begin{aligned} V_j &= X_j(1 - t_j) - \sum a_{ij}(X_i + t_i) \\ &= X_j - \sum a_{ij} X_i \end{aligned} \quad (6)$$

If we assume the ratio of input and production remain the same before and after AD duty, then

relationship between t_j', the real effectiveness of AD duty and, t_j, the nominal duty can be shown

in the following:

$$t_j' = \frac{V_j' - V_j}{V_j} = \frac{(X_j' - \sum a_{ij} X_i') - (X_j - \sum a_{ij} X_i)}{X_j' - \sum a_{ij} X_i} \qquad (7)$$

$$= \frac{t_j - \sum a_{ij} t_i}{X_j' - \sum a_{ij} X_i}$$

if $X_j' = 1$,

then, $t_j' = \dfrac{t_j - \sum a_{ij} t_i}{1 - \sum a_{ij} X_i}$ (8)

From (8), we can see the clear relationship between nominal and real effectiveness of the

AD duty. To a trade that has little V_j, an increase of the nominal duty brings a bigger increase in

the same direction; and the variance of the nominal duty of the input goods that has a bigger the

input-production coefficient will cause the effectiveness of the AD duty go to the opposite

direction even further. To a trade that has bigger V_j, the situation is just the adverse case.

So if we need to provide protection to the trade injured by the dumping of the MNEs, we

can make use of the above method. Thus it will a comparatively certain effect.

An Analysis Of The Conflict Between PM And AD In The FDI Of The MNES In China From
The Angle Of Game Theory

In the game, the two parties are the MNEs and the Chinese authorities, the game can be differentiated into two stages, the stage before and after the actual investment. We assume that this is a game of complete information game and the MNEs as the first movers. α stands for MNEs, β stands for Chinese side (Ministry of Commerce)

In the first stage of the game, the action set and payoff of α and β are found in Appendix 2 and Appendix 3. The above payoffs are based on the general analysis of the investment environment of China, thus it is the common information. And in this round of negotiation, β is always to grant α, the super-national treatment, here it is the unrestricted Pre-marketing (PM) (no restriction to the quantity and price). So the equilibrium of this cooperatives game can reach is (3, 1.5).

In the second stage of the sequential game, we use the game tree to show it(see Appendix 4).In this game stage, if there is a restriction to the quantity and price of the PM goods, the PM will not become dumping, but it isn't the case. So the reality is it does dump to China by PM, we just take the dumping confirmation process a black box, that is to say we assume the PM is confirmed to be dumping in China. Then whether AD will cause the FDI divert its direction of investment that depend what role of PM in the FDI performance.

As we discussed earlier in this paper, FDI is a strategic option of the MNEs, PM is just a tactics of realizing the profit in a short time (before the MNE produce the like product in China). So we amend the game in the first stage.

If China take the AD measure, then the payoff of the MNE is 3- γ(γ is the AD duty) (see Appendix 5).Then what matters is how much is γ? One comparison should be made between γ and the already paid investment c and the whole gaining s of the MNE. That is: If there is 3-γ-c > 0, the MNE will not be affected in continuing its investment although there is an AD duty; if there is 3-γ-c< 0, the MNE will be affected in continuing its investment when there is an AD duty, especially when c is almost 0; that means γ is too great that it guards off the FDI. According to the common information about China's policies, it isn't the case.

As shown in the game tree, the only equilibrium in the game is (3-γ, 1.5-γ), (1.5-γ) is the payoff is the adjusted gain, and (3-γ) is that MNEs should pay for the FDI.

Conclusion

By the above analysis, we can see the essence of the PM is a tactics in the MNEs FDI strategy, We finally, found out that the Pre-marketing compliant is in essence a contemporary way of the multinational corporations enlarging the its interests under China's anti-dumping measures; and we also find ways of guarding the domestic enterprises from this dumping. AD is the way to correct the absence of the restrictions to the quantity and Price of the PM in the

investment contract. It will not affect the investment of the MNEs if we can sustain a promising

growth in the future or at least the investors can expect the trend will continue, which we take

this precondition as a presumption. So what is more attractive to the MNEs is the prosperous

Chinese economy and the immense market demand.

Thus the government needs to take practical action to foster the realization of the goal of

both China and the MNEs. According to WTO regulations, China should improve its market

system by amending the legal system, such as integrating the laws of investment, trade, and anti-

dumping, anti-trust and countervailing. Especially, the absence of the anti-trust law is the most

urgent.

In dealing with the PM related dumping, in order to get an accurate assessment of the AD

duty, we can integrate the minimum control of the imports of the AD with the growth of the

market, and the increase of the imports. And we need to make use of the effectiveness of the AD

duty so as to keep the side effect to the FDI to the minimum degree. In order to avoid this

dispute, we should contain this information in the investment contract. As contract perfected,

these disputes can be largely reduced.

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Appendix 1: The Pre-marketing of the MNEs in China Under Monopolistic Competition
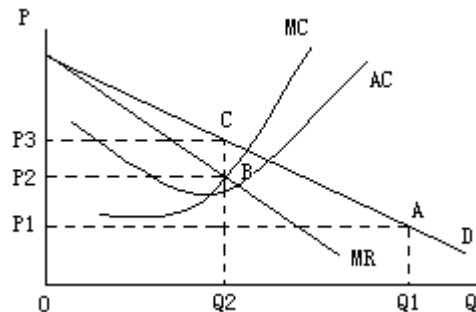
α	β
invest in	succeed in
China	attract FDI in
	China
invest in a	fail to attract
third country	FDI in China

Appendix 2: The Action Set

α	β
Profit and	Growth and
development(3)	development(1.5)
invest in a third	fail to attract FDI in
country(1.2)	China(0)

Appendix 3: The Payoffs of the Game

Appendix 4: The Game Tree of the Anti-dumping and FDI
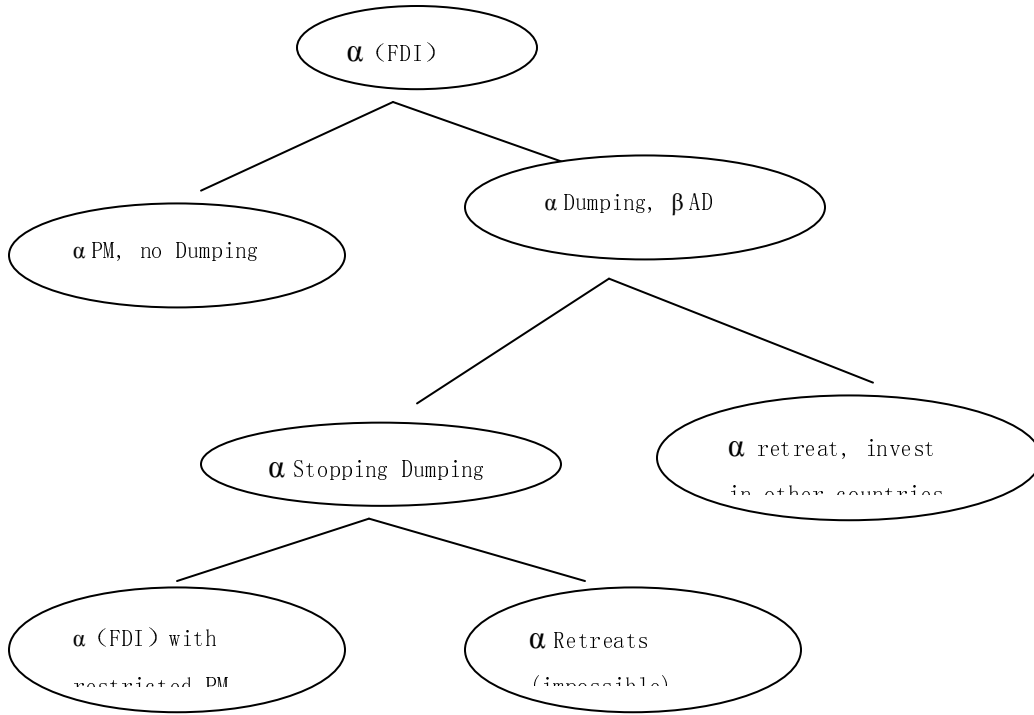
α
Profit and
development(3-γ)
    invest in a third
country(1.2)

β
Growth and
development(1.5+γ)
    fail to attract FDI in
China(0)

Appendix 5: The Payoffs After Antidumping Duty
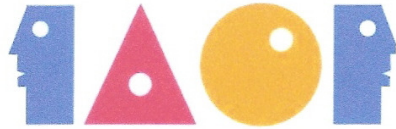
APPLYING DEA INVESTMENT PORTFOLIO EFFICIENCY INDEX AND GA TO THE ESTABLISHMENT OF THE FUND OF FUNDS IN TAIWAN

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Abstract

The objective of the study is to provide an effective method of creating a successful fund of funds, as well as better strategies for fund managers to choose sub-funds and the way to allocate weighted capital. There are two methods for choosing sub-funds: one is DPEI and the other is Genetic Algorithm (GA). By means of GA, the best distribution of weighted capitals in the two experiments can be achieved so that the fund of funds model can then be formulated. The period of experiment of the study was January 2004 to December 2006. The study's experiment results and tests of variation show that the rate of return of a fund of funds chosen by DPEI_GA is remarkably superior to HV_GA, Taiwan Weighted Stock Index (TWSI) and the present fund of funds with the best performance. It is hoped that the fund of funds model proposed by this study will serve as an effective reference for fund managers.

Keywords: DPEI, DEA, GA, Fund of funds

Introduction

While applying a traditional performance assessment index (e.g. Sharpe or Jensen) to assess mutual fund performance, investors often overlook the influence on return that transaction costs have. In order to take transaction cost into consideration, this study uses the "DEA investment portfolio efficiency index (DPEI)" to assess fund performance. The result reveals that there is a significantly positive correlation between DPEI applied by the study and the Sharp index used in academic and business circles, indicating DPEI's broad applicability in assessing fund performance. The accumulated rate of return for the former is 27.86%, 2.39% in excess of the accumulated rate of return of the fund of funds' 25.47%, selected by HV_GA. This means that the investment portfolio, which consists of sub-funds chosen according to their efficiency value, has better performance. This, therefore, demonstrates that transaction cost has an effect on returns. This study first estimates the DPEI of mutual funds, choosing several sub-funds with relatively good performance, and tests DPEI and Sharpe performance index, observing their effectiveness. When the performance of the investment portfolios built up by the study, as well as the TWSI and the best existing fund of funds' rate of return were all compared, it was found that the performance of the fund of funds designed by the study was superior to that of other funds. Finally, this study will also discuss the influence of transaction cost on performance,

based on the difference between the rate of return of the sub-funds chosen by h value and DPEI in the present study.

Review of Literature

Today, financial products in great variety and number, as well as countless sources of information, make it difficult for investors to pick a well-performing investment target to pursue an ideal rate of return. Entrusting fund managers to invest in mutual funds to attain returns is a smart choice for investors. The choice of well-performing mutual funds is based on their profit capability and the result of the performance assessment of mutual funds. Forthergill and Coke (2001) investigated the performance and risks for 450 European funds of funds. The results showed that the system risks involved in a fund of funds were lower. If the fund of funds includes 15 to 20 hedge funds, the risk is reduced to the level of a bond risk, while the annual rate of return is a stable 10% to 15%. Based on the Data Envelopment Analysis (DEA) concept, Murthi et al. (1997) drew up a new mutual fund performance assessment index: the DEA Portfolio Efficiency Index (DPEI). The concept, derived from the transaction cost of mutual funds, involves assessing the investment efficiency of funds which provides investors with another index to assess fund performance, and more useful reference information. The study utilizes artificial intelligence which can acquire the optimal solution while dealing with capital distribution. In order to meet various needs in the complicated mutual fund market, the use of

artificial intelligence is preferable to that of the human brain. *Genetic* Algorithm (GA) is a mature artificial intelligence which is capable of acquiring optimal solutions. GA itself can be applied to the choice of sub-funds and to the distribution of weighted capital. With the intention of applying the GA feature of combinational optimization to designing a fund of funds, this study engages with the complicated and varied nature of the financial aspect of such a project. In brief, this study allocates funds with better DPEI to the investment portfolio and, by means of GA, acquires the best weighted distribution of capital with which to form an investment portfolio. The study, by means of experiments, aims to form a fund of funds as a strategic investment technique for future investors or fund managers to follow. In order to offer investors or fund managers an applicable fund performance index and design a well-performed fund of funds, the study comes up with a stricter approach to building a fund of funds, thereby suggesting a better strategy of investment.

McMullen & Strong (1998) conducted research on 135 American funds in 1997 and the result showed that mega funds lacked efficiency, as their output could not match their input. Tarim & Karan (2001) applied the (Weight-Restricted) DEA model, scattering restrictions on factor weight in different categories to avoid disregarding important factors with a weight of zero. The result showed that bond funds' average performance was better than that of equity funds. With no DPEI restrictions, the efficiency value was higher than was the case with

restrictions. From a group of 2083 mutual funds in the 3rd quarter of 1993, Murthi et al. (1997)

used the traditional performance index to pick out 731 mutual funds for empirical analysis. They

also referred to Grinblatt and Titman's (1994) researches to divide the funds into seven

categories according to their investment targets: Aggressive Growth, Capital Distribution,

Equity, Income, Growth, Growth Income and Balanced, as well as taking excess returns as the

output and expense ratio, commission, turnover rate and standard deviation as the input and

assessing the performance by means of the DPEI. The result showed that the acquired DPEI had

a positive correlation to the Sharp and Jensen index and the assessment made by Morning Star.

Besides Aggressive Growth, the DPEI of other categories was negatively correlated to

coefficient β, revealing that, the more efficient the funds, the lower their risk. The result

mentioned above attested to the effectiveness of this new index.

GA is a method of optimization developed by John Holland (1975) which utilizes the

biological concept of Natural Selection to search for optimal solutions to problems (Wong &

Tan, 1994). By the process of natural selection, crossover rate and mutation rate, chromosomes

of evolving generations tend toward an optimal solution in terms of survival of the species. In

recent years, many researchers have tended to conduct investment portfolio research with the

help of GA (Orito & Yamamoto, 2003; Xia, Liu, Wang & Lai, 2000). In literature concerning

financial products designed by means of GA, it is seen that GA is a mature concept having

gained global acceptance. <u>Bian</u> (1996) addressed an unconventional coefficient β analysis model

in linear regression to form an investment portfolio in the Taiwan stock exchange index with the

help of the GA concept. When the number of the investment portfolios formed by GA is fewer

than 50, the correlation coefficient with the Taiwan stock exchange index is 97%; meaning GA

has a better command of search. Oh, Kim & Min (2005) proposes a GA portfolio scheme for the

index fund optimization. The scheme exploits GA and provides the optimal selection stocks

utilizing fundamental variables-standard error of portfolio beta, average trading amount, and

average market capitalization. King (2007) shows through adjustment to the objective function to

alter levels of portfolio diversification using the quadratic programming methodology used in the

standard portfolio optimization process. The ideas can be extended to target differential levels of

diversification at multiple levels of asset categorization and can thus be used in a variety of

settings.

Research Design

Research Methods

The purpose of the study is to design a mutual fund, applying DPEI and GA to form a

well-performing investment portfolio.

DEA Investment Portfolio Efficiency Index

This study is based on the input-oriented model of CCR, which was created based on the DEA

Portfolio Efficiency Index addressed by Murthi et al. (1997); it assesses the efficiency value of sub-funds. The formulation that the study applies to calculating DPEI is as follows:

$$Max \quad DPEI \quad = \frac{R_0}{\sum_i w_i x_{i0} + \upsilon\sigma_o}$$

$$s.t. \quad \frac{R_j}{\sum_{i=1}^{I} w_i x_{ij} + \upsilon\sigma_j} \leq 1 \tag{1}$$

$$w_i, \upsilon \geq \varepsilon \quad ; \quad \varepsilon > 0$$

I : 1,2,…,I; I is the amount of input
J : 1,2,…,J; J is the number of funds
R_0 : The total rate of return in the course of assessment
R_j : The total rate of return of the jth mutual fund
x_{i0} : The transaction cost of individual fund, including charge ratio
x_{ij} : The ith transaction cost of the jth mutual fund
σ_0 : The standard deviation of individual fund
w_i : The weighted value of the ith transaction cost
υ : The weighted value of the standard deviation of the rate of return
ε : A non-Archimedean constant unlimitedly smaller than any positive real number

DPEI's definition is the returns acquired on condition of certain risks and transaction costs. The value, in the sense of economics, is the residual returns acquired after risks in market investment and the estimated charge arising from transactions. The concept is consistent with production economics' formation of an index with input-output ratio to assess the way managers make use of resources to acquire maximum output; the study uses this to design the method of choosing sub-funds by fund of funds.

Genetic *Algorithm*

Genetic Algorithm (GA), addressed by John Holland in 1975, is a concern of studies on

Artificial Intelligence, based on the mechanism of biological evolution and Darwin's (1809-

1882) Natural Selection. GA follows the example of Darwinian Evolution, roughly speaking:

The organism better suited to the environment than most, through random genetic changes, will

give rise to a filial generation that suits the environment even better. This filial generation will be

better able to survive and thus will be more successful at breeding, thereby passing those

successful genetic qualities to its offspring who will also undergo genetic change, which will

effectively hone and refine the original qualities needed for success and survival.

GA makes use of three main mechanisms to imitate the heredity process in Nature:

Selection, Crossover and Mutation. Through these three processes, new filial generations

propagate from the population. The more successful chromosomes of each filial generation

symbolize better competitiveness and success (survival). The principle of the selection is based

on the Fitness Function. After the calculation of each filial generation, respective values will be

obtained. Individuals with better values of adaptability can continue to the next generation and

continue their evolution until the conditions that were set in advance are met. Therefore, in the

evolution of GA, the main factors are: "Coding", "Fitness Function", "Selection", "Crossover",

"Mutation", "Termination Condition" and "Control Parameter".

The advantage of GA is that it is able to identify optimal solutions and procedures with high efficiency, as well as able to attain the solutions from a set of optimal parameters or an optimal model. The full capacity and efficiency of GA searching becomes especially apparent when the effective space of the solution is very large.

However, the flaw of GA is that it cannot ensure that the solution acquired is the optimal one; it can merely give approximately optimal solutions. This approximate solution is effectively the most suitable solution, considering evolution of the vast solution space. When predicting the optimal solution is not possible, GA can quickly find a solution which meets with a certain degree of satisfaction, which means GA is suitable for seeking solutions to non-linear and multi-variable questions.

Experimental Design

This study contains two experiments, each of which consists of two phases, namely sub-fund selection and weighted distribution of capital.

Experiment 1: In the first phase, DPEI is used for selecting funds with high efficiency; in the second phase, the weighted distribution of the investment portfolio is conducted and formed through the evolution of GA.

Experiment 2: h value is used for selecting sub-funds in phase 1 and the weighted distribution of investment portfolio through the evolution of GA in phase 2 in order to form the investment portfolio for Experiment 2.

Selection of Funds

This study applies DPEI and h value to the choosing of funds with high efficiency.

Application of DPEI.

As per the DPEI model addressed by Murthi et al. (1997) (as shown in equation 1), funds

Table 1 Operative Definition of Variables

Item	Variable	Description
DEA Output	Funds' rate of return $(R_{j,t})$	Monthly accumulated return rate of each fund's net value
DEA Input	Accumulated turnover ratio	The ratio of accumulated buy-in to sell-out turnover
	Annualized standard deviation (σ)	The influence of the external environment and the fund itself on the performance
	Charge ratios include: 1. commission 2. transaction tax 3. management charge 4. storage charge 5. other charges	*transaction direct cost: commission and securities transaction tax *charges listed in accounting items: management charge, storage charge and other charges *charge ratio=each charge/net capital of funds
Other related variables	The market's rate of return	Monthly return rate of Taiwan weighted stock exchange index
	fund of funds' rate of return	Monthly return rate of Sheng Hua global fund of funds
	Coefficient β	Assessment of each fund's market risks
	Sharpe value	The premium acquired by funds in each unit of total risks

Source: Securities Investment Trust & Consulting Association of the ROC

with a higher rate of return under a fixed transaction cost structure and risk are funds with higher efficiency. This study uses DPEI to indicate each fund's performance. The input and output mentioned in the researches of Murthi et al. (1997) and Richard Tan (1998) are taken as conditions with which to assess the performance of mutual funds in the study. Based both on the selection of best-performed (the value equal to 1 or close to q) funds by means of DPEI, and on the literature of the target number of best investment portfolios, the first 20 funds in DPEI are chosen as the study's targets.

Application of h value.

The eight assessment indexes used to select funds by professors and Li (2003) are to be the parametric standardized factors employed to assess the h value in this study. The equation of the formulation of the h value is as follows:

$$h = (FR_d + \sum_{j=1}^{7} I_j) \qquad (2)$$

$$FR_d = \sum_{m=1}^{12} e_m \qquad (3)$$

$$I_j = \sum_{m=1}^{12} i_{jm}, j = 1 \sim 7 \qquad (4)$$

FR_d: equity funds' 12-month accumulated return rate
e_m: the monthly return rate of equity funds
I_j: the performance assessment index of each fund's 12-month accumulated value
i_{jm}: the performance indices of each fund:

i_{1m}: standard deviation

i_{2m}: β value

i_{3m}: Sharpe index

i_{4m}: Jensen index

i_{5m}: Treynor index

i_{6m}: information ratio

i_{7m}: fund turnover ratio

In view of the fact that each performance index has different standards, each index has to be simplified by means of Min-max normalization, in order to select funds on the same basis. The equation of Min-max is shown in the following:

$$e_m = \frac{e - e_{\min}}{e_{\max} - e_{\min}}(e_{\max}^{new} - e_{\min}^{new}) + e_{\min}^{new} \qquad (5)$$

$$i_{jm} = \frac{i - i_{\min}}{i_{\max} - i_{\min}}\left(i_{\max}^{new} - i_{\min}^{new}\right) + i_{\min}^{new} \qquad (6)$$

Equations (5) and (6) are the ones of extreme value normalization. The standard value is set as [0,1]. Values that fall into this range will be compared with each other to achieve the same standard.

Besides analyzing and calculating the historical return rate, other fund performance indexes have to be taken into consideration when assessing the h value. Among them, the standard deviation and β value negatively correlate with fund performance. For other indexes, like Sharpe, Jensen and/or Treynor, information ratio and fund turnover rate positively correlate with fund performance. To apply the same standard, the values of negative correlation are normalized into positive ones. This

study selects fifteen funds with the highest h value in the equation and takes Sharpe as the basis of stock selection.

Capital Distribution of Investment Portfolio

This experiment aims to investigate capital distribution of the fund of funds with the assistance of GA. The study defines each chromosome forming an investment portfolio in which the weight of each sub-fund and the possible solutions are mentioned. The adaptive value attached to each chromosome is defined as the degree of goodness of the solutions represented by that chromosome (Adeli & Hung, 1995). A comprehensive investment strategy includes "stock selection", "timing selection" and "capital distribution". This study focuses on "capital distribution", while simplifying the "timing selection" strategy and "stock selection". At phase 1, "stock selection" is conducted by using DPEI to select 20 funds to form a fund of funds, or by using GA to select sub-funds directly for risk dispersal. The "timing selection" strategy is defined as "buy-in means holding" to count the returns of the stocks held each month. The investment amount of each sub-fund, i.e. the weight distribution in the experiment, is set to go beyond zero but cannot exceed 30% of the net capital value of the fund of funds.

GA Experiment Steps and Parameter Setup

1. Initialized Population: The initialized population is 160 chromosomes, with each

carrying 20 to 49 genes, meaning 160 investment portfolios, each carrying 20 to 49

sub-funds.

2. Coding: The coding applies real numbers in order to fit the data mode, save time

for calculation, enhance the accuracy of the system, and increase the possibility to

find optimal solutions.

3. Fitness Function Value Calculation

$$Max \ R_P = \sum_{j=1}^{m} \sum_{i=1}^{n} W_i \cdot \alpha_j R_{ji} \tag{7}$$

$$s.t. \ 0 \le W_i \le 0.3 \ \ \forall i \quad and \ \sum_{i=1}^{n} W_i = 1$$

    R_p : fund of funds rate of return
    I : the ith sub-fund
    J : the jth month
    M : 36 months
    n : number of sub-fund

    W_i : weight

α_j : risk fluctuation parameter

R_{ji} : the rate of return of the ith

  sub-fund of the jth month

4. Termination Condition: 5000 generations of process <u>algebra</u>

5. Selection Procedure: *Roulette* Wheel Selection *Method*

6. Crossover procedure:

(1) Crossover rate: 0.5, as set in experiment method

(2) Crossover: Two-point crossover. Two-point crossover calls for two points to be selected on the parent organism strings. Everything between the two points is swapped between the parent organisms, rendering two filial organisms.

(3) Chromosome A and B produce filial generation's chromosomes a and b after the crossover. The weight is limited to make the sum 1. In order not to make the variance of the new chromosomes' genetic weight too large, values are selected randomly by the system between -1 and 1 multiplied by the crossover rate. The acquired value is called dlt, a real number, shown as follows:

$$-1 \sim 1 \times crossover\ rate = dlt$$

$$\therefore\ -cor \leq dlt_n \leq cor$$

For example:
Chromosome a
Chromosome b

$W_1 + dlt_a$	$W_2 + dlt_a$	$W_3 + dlt_a$	…	$W_n + dlt_a$
$W_1 + dlt_b$	$W_2 + dlt_b$	$W_3 + dlt_b$	…	$W_n + dlt_b$

dlt: a positive or a negative real number
cor: crossover rate, 0.5
$W_{1 \sim n}$: the weight in each chromosome's genes
$\sum w_i$: the sum of the weight of sub-funds in each chromosome

(4) After crossover, the weighted sum of new chromosome, which can be beyond or below 1, will be standardized.

i. If $\sum W_i > 1$, a difference of 0.3 will be imposed on each gene and the maximum weight limit. Random numbers ($<$0.3-Wi) will also be added until the part over 1 is reduced to 0.

ii. If $\sum W_i < 1$, the genes in the chromosome ($W_i / \sum W_i$) will first be standardized. If the difference is more than 0.3, then it is taken as 0.3. If the difference is less than 0.3, then a random number ($<$0.3-Wi) will be added to the difference between the standardized number and 0.3.

7. Mutation Procedure:

   0.03 is the preset mutation rate. After mutation, the evolution of adaptive value assessment will continue until the termination condition is met.

8. Calculation of adaptive fitness value: The adaptive value will be recalculated until the convergence is seen.

Table 2 GA Parameters

Item	Value
Initial size of population	160
Termination condition	5000 generations
Crossover	Two-point crossover
Crossover rate	0.5
Mutation rate	0.03

Source: collected by the study

Data Collection and Selection.

To form the fund of funds in this study, the return rate of Taiwanese domestic equity, balanced and bond funds are referred to. A few conditions of selection are set up so as to meet the experiment's requirements in the study.

1.	The data used in the research should be based on normal conditions, it exclude abnormal conditions. The research period is from 2004 to 2006 for 36 months. Funds having been in the market since 2004 are chosen as the subjects of the study. Funds which were established after the beginning of 2004 or liquidated before the end of 2006 are ignored.

2.	To avoid DPEI selecting sub-funds that are relatively efficient but have a poor return rate, the return rate of the selected sub-funds has to be better than the annual return rate of the weighted stock index, or better than the annual average return rate of the fund category to which it belongs. The result of selection is: 21 equity funds, 7 balanced funds and 21 bond funds. In total, there are 49 sub-funds to form a new investment portfolio. prospectus

Results

Experiment 1

The study uses DPEI to select sub-funds, and GA to distribute capital. 49 sub-funds were selected to meet the conditions, and the efficiency index of DEA investment portfolio was calculated by means of their annualized standard deviation, accumulated turnover rate and total transaction charge ratio. With the assistance of four-phase sliding window, 20 sub-funds with relatively good efficiency were selected by DPEI. The assessment was conducted by studying the quarterly performance. The number of sub-funds in the investment portfolio set in the study was 5 to 20; therefore, 20 sub-funds were selected in order as the objects of weight distribution. In Quarter 1 2006, among the 20 sub-funds selected by DPEI, the Phase 1, Phase 2 and Phase 3 sub-funds' capital distributed by GA is shown in Table 3.

In experiment 1, weight distribution was applied in at least 5 sub-funds in each phase's investment portfolio, and the maximum weight distribution was controlled in 30% to reflect the applicability of GA, and echo the conditions for forming funds of funds. The mutual fund, whose

DPEI is 1, can be given higher weight value by GA which means mutual funds with higher efficiency have the potential to be invested.

Table 3   2006 Q1 fund of funds DPEI_GA

Quarter	1 (Jan, 2006)		2 (Feb, 2006)		3 (Mar, 2006)	
Number	Fund code	Weight Distribution	Fund code	Weight Distribution	Fund code	Weight Distribution
1	10310012	29.61%	10060022	26.78%	10050009	29.03%
2	10060022	27.01%	10100002	23.45%	10060022	25.95%
3	10050009	18.76%	10220001	22.97%	10300002	25.70%
4	10220001	17.85%	10300002	15.71%	10220001	17.84%
5	10320006	5.90%	10320006	11.09%	10110025	1.36%
6	10300011	0.64%			10170001	0.12%
7	10270009	0.22%				

Source: collected by the study

Experiment 2

In experiment 2, the funds are selected by h value and the capital is distributed to form up fund of funds HV_GA, and the investment portfolio is assessed by its quarterly performance. The Phase 1, 2 and 3 sub-funds' weight distributions made by GA in Q1 2006 are shown in Table 4.

Only the Q1 figures are shown. Among the sub-funds in the investment portfolio HV_GA, equity funds take up the largest share, while balanced and bond funds are minor; however, the weight distribution in the three categories does not show significant difference. These three types of funds are respectively given higher weight in different phases, which means higher weight distribution is not necessarily applied to only equity funds with high returns. When balanced and bond funds with low risk are given higher weight, a better ability to avoid risk can result.

Table 4 Q1's Fund of Funds HV_GA Investment Portfolio

Phase	1 (Jan, 2006)		2 (Feb, 2006)		3 (Mar, 2006)	
Number	Fund code	Weight Distribution	Fund code	Weight Distribution	Fund code	Weight Distribution
1	10060022	16.51%	10060022	11.32%	10060022	18.73%
2	10050010	15.28%	10050009	10.42%	10060009	17.35%
3	10010010	14.46%	10010003	10.23%	10300002	16.61%
4	10310012	13.92%	10100002	8.82%	10100002	14.86%
5	10320006	12.67%	10170006	8.78%	10130005	10.57%
6	10050009	12.16%	10310012	8.10%	10010010	4.78%
7	10060002	4.87%	10030008	7.02%	10130004	4.44%
8	10270004	3.81%	10130005	6.28%	10220001	3.82%
9	10220001	3.75%	10220001	4.69%	10170006	3.51%
10	10180007	2.20%	10100003	4.59%	10060004	1.97%
11	10130001	0.36%	10300002	4.30%	10120011	1.79%
12			10300001	4.24%	10150001	0.92%
13			10060022	3.77%	10320006	0.65%
14			10130001	3.11%		
15			10130004	2.52%		
16			10050010	0.92%		
17			10320006	0.60%		
18			10230001	0.27%		

Source: collected by the study

Experiment Result Analysis

The study applies DPEI and GA to assess the investment strategies for funds of funds. The purpose is to develop well-performed fund of funds with the expectation that the performance will be better than the stock market and the present fund of funds. The result of either experiment 1 (fund of funds DPEI_GA) or experiment 2 (fund of funds HV_GA) conducted from Jan to Dec 2006 is better than the first-ranked Sheng Hua fund of funds and the accumulated return rate of Taiwan stock exchange index. The comparison of return rates

Table 5 Experiment Result of Return Rate

Month	Fund of funds DPEI_GA Rate of return (%)	Fund of funds HV_GA Rate of return (%)	Sheng Hua Global Fund of Funds Rate of return (%)	TWSI Rate of return (%)
Jan, 2006	-2.14	-1.44	-0.57	-0.25
Feb, 2006	2.98	0.15	-1.04	0.20
Mar, 2006	10.48	7.31	0.27	1.00
Apr, 2006	18.28	15.14	2.72	9.43
May, 2006	15.18	12.73	0.81	4.90
Jun, 2006	8.99	6.71	-0.68	2.82
Jul, 2006	9.30	6.87	-1.04	-0.91
Aug, 2006	15.52	12.89	1.14	1.53
Sep, 2006	19.81	15.66	2.72	5.63
Oct, 2006	18.93	17.16	3.13	7.64
Nov, 2006	23.95	21.49	6.43	15.42
Dec, 2006	**27.86**	**25.47**	**9.27**	**18.80**

Source: collected by the study

is shown in Table 5. The trend of the accumulated return rate is shown in Chart 2.

The Comparison in the Accumulated Return Rate

The fund of funds is a kind of hedge fund, focusing not on immediate high returns, but also to see if the interaction between the fund of funds and returns is able to generate stable profits. The test duration is one year and the accumulated return rate is calculated by month.

In Table 7, the accumulated return rate of the fund of funds DPEI_GA in experiment 1 is 27.86%, while the fund of funds HV_GA in experiment 2 is 25.47%. Compared to the accumulated return rate of 9.27% in Sheng Hua Global fund of funds and that of 18.8% in the weighted stock price, the performance of the fund of funds designed by this study is clearly superior to the standard of the return rate. It reveals that models designed in the study are able to create a return rate better than that of the stock market and the existing fund of funds with the best performance.

The main reason for using DPEI to select sub-funds in the study is to explore the influence of transaction costs on the performance of mutual funds. In experiment 1, the 20 DPEI-selected sub-funds with relatively good efficiency are weighted by GA. The purpose is to select sub-funds with better efficiency and performance to be the investment target. There is a performance difference from experiment 2 where sub-funds are not selected by their efficiency value. On the whole, the DPEI in transaction costs has an influence on performance. The trend of the accumulated return rate is shown in Figure 1.
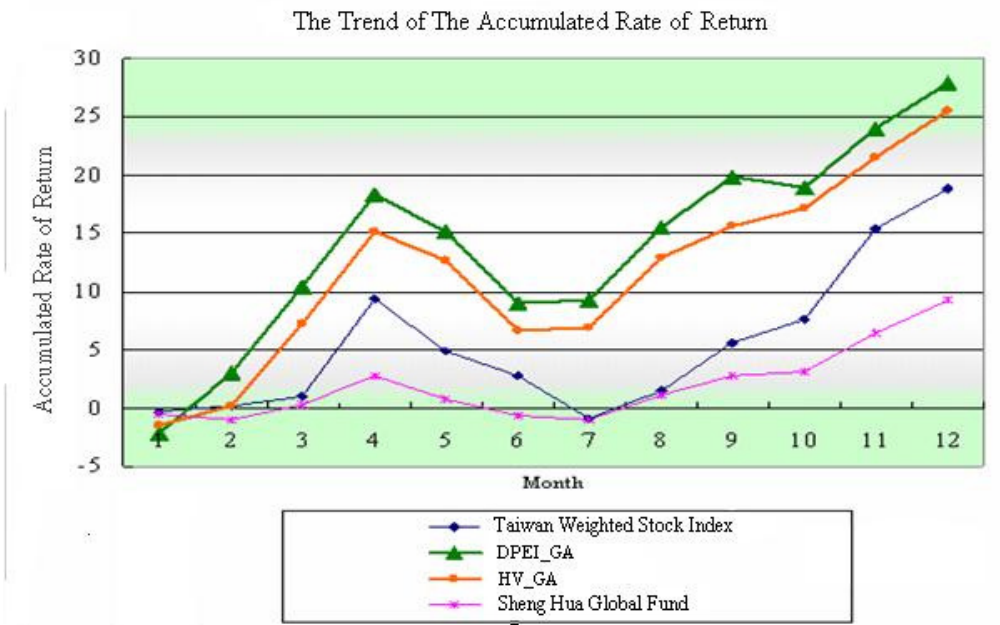
Figure 1 The trend of the accumulated return rate

Fluctuation Analysis

Besides analyzing the differences between the accumulated return rates, the study also conducted fluctuation analyses. In Chart 2, we see that the trends of return rate in both experiment 1 and 2 echo the stock index. When a bull stock is seen, the investment portfolio in the study rises in value, while when a bear stock is seen, the investment portfolio in the study drops. Compared to the return rate of Sheng Hua Global fund of funds, the trends of experiment

1 and 2 are similar to the curve of the highest return rate, albeit with a higher fluctuation. This means that experiments 1 and 2 also echo the best existing fund of funds in the market; the investment portfolio designed in this study clearly reflects the trend in the market.

The difference between DPEI_GA and HV_GA is that the former takes the transaction costs into consideration. The trends of the two experiments are slightly different, which means that the applicability of the two experiments is almost equal. However, when it comes to the difference in return rate, the sub-funds selected by DPEI_GA are higher in efficiency and better in performance.

Summary and Conclusions

Based on the three-year data collected in the experiments conducted from 2004 to 2006, this study built up DPEI and GA investment decision-making systems respectively. The study proves that selecting sub-funds by referring to mutual funds' transaction costs and the efficiency value of input-output return rate is effective. Moreover, it also proves the applicability of GA in fund of funds decision-making. The results are as follows.

In this study, DPEI is an index of performance value that covers the transaction cost of mutual funds. Mutual funds with better efficiency are selected by their charge ratios and return rates, which are directly relevant to investors. The study applies the Data Envelopment Analysis's CCR model, which estimates DPEI under the condition of a fixed scale of returns. The result shows that mutual funds whose relative efficiency value is 1 are: *Prudential* Financial High Growth Fund, ABN AMRO Singapore & Malaysia Fund, Capital Marathon and Ta Chong Gallop Bond Fund. These four mutual funds, compared to others during the same period, exhibit the best efficiency because the maximum output can be achieved based on their present level of cost input. The study examines the performance of a fund of funds by using the weighted stock

index and the highest return rate as standards. It also discusses the influence of transaction cost on performance, based on the difference in return rate after sub-funds are selected by DPEI and h value. The result shows that during the period of experiment, the total return of funds of funds formed by sub-funds selected by DPEI and allocated weight by GA, is remarkably superior to the Taiwan weighted stock index and the present best-performing Sheng Hua Global Fund of Funds. This echoes the trend of funds of funds and that of the market. The return rate shows a better performance than the comparison standards.

The fund of funds DPEI_GA system formed in the study sets DPEI as the standard for sub-fund selection, while GA can allocate weight to mutual funds with better efficiency, echoing the concept to set DPEI as a condition of forming funds of funds. Meanwhile, the applicability in weight distribution of mutual funds with better efficiency is also taken care of. The experiment results show that the accumulated return rate of fund of funds DPEI_GA is 27.86%. Compared to that of the fund of funds HV_GA, 25.47%, the difference is 2.39%, indicating that the investment portfolio consisting of mutual funds selected by DPEI has an excess return rate of 9%. Therefore, it is necessary to take transaction cost into consideration.

Through the experiments and the testing of differences, the effectiveness of DPEI and h value are shown, as the return rates of fund of funds DPEI_GA and fund of funds HV_GA perform far better than do the stock exchange index and the best existing fund of funds. Even if the present study is an academic one, the selection of investment targets and the weight distribution of capital are based on practical situations. Therefore, transaction costs are taken into consideration when funds are formed, and it is fair and objective to assess the performance by means of efficiency value. DPEI, unlike traditional indexes that ignore transaction costs, becomes a multi-faceted and applicable assessment index. GA, on the other hand, can help to

acquire higher returns and disperse risks based on the information given in the training period, making it a good tool to best distribute the weight of capital.

In conclusion, the way the study constructs a fund of funds can be an effective reference for fund managers to design more successful funds of funds. Professional fund managers can refer to the primary investment portfolio designed in the study and integrate the practical needs and their professional judgment to create an ideal fund of funds. Besides applying DPEI to assess the performance of mutual funds, other investors can also use the methods presented in the study to establish their own investment strategies.

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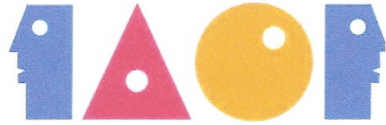
NEURAL NETWORK BASED APPROACH FOR PREDICTING LEARNING EFFECT IN DESIGN STUDENTS

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Abstract

This study examines a neural network based approach for predicting learning effect in design students. This investigation takes the percentile-grades of all courses taken by first-year design students, including Introduction to Industrial Design, Engineering Graphics, Basic Design, Technical Drawing, Chinese, English and Mathematics, and uses these percentile-grades as the input of the back-propagation neural network (BPNN). Additionally, the percentile-grades of professional core courses at the upperclassman level, including Form Design, Product Design and Thesis Project, are used as the output of the BPNN. Analytical results demonstrate that the BPNN model offers relatively accurate predictions for the student learning effect in the professional core courses, especially Thesis Project, with average accuracy of 93.54%. These analytical results indicate that BPNN is a suitable instrument for predicting the learning effect of design majors. Design instructors or student career consultants can use the BPNN model to identify individual students as having particular potential in design, and thus can tailor their teaching strategies, and provide additional guidance and assistance for individual students.

Keywords: Percentile-Grade, Artificial Neural Network, Back-Propagation Neural Network, Learning Effect, Decision-Making

Introduction

Student learning in school significantly influences future career, particularly for design students, whose field of specialization combines artistic and practical considerations. However, many students enroll in design departments without properly understanding the department, and consequently receive low grades in their professional design courses. Even though some students try transferring to other departments at this point, but with a low grade average, most are unsuccessful. Frequently, students drop out of their design courses and retake the university entrance exam the following year, resulting in a wasted year. Some students complete their design studies, and end up spending a few years of study to receive a mere diploma, but do not go on to develop a career in design.

Individuals must make numerous decisions during their lives, and inappropriate decisions can significantly influence their future. Notably, the field of study that students choose directly affects whether they can develop a future career in an area in which they are interested and have ability. Therefore, it is important that students consider carefully when choosing a department for study. However, most students lack adequate information on different departments before enrollment at university, and typically choose a particular major with only vague knowledge and without careful consideration. Frequently the result is an unsuitable choice of department, leading to subsequent regret and consideration of transferring to another department.

Many researchers have put considerable effort into studying student choices regarding their majors (such as Galotti 1999; Galotti et al. 1994; Hossler et al. 1989; Weiler 1994). Yamashita (1997) developed an effective system for supporting students in making career choices based on fuzzy reasoning and fuzzy structural modeling. Moreover, Aldosary and Assaf (1996) indicated that on the whole the most important factors in major selection were job

availability, prospective salary, social status and prestige, in that order. The factors contributing to whether students could continue their studies or should be expelled also deserve attention from educators. Some dissatisfaction also exists with facilities, grades and course appeal, and instructors generally are the major contributors to decisions to either persist with a particular major or drop out (Aldosary & Garba 1999). Halpern-Felsher and Cauffman (2001) indicated that the decision-making competence of adolescents and adults differs, and adults outperform adolescents. Specifically, compared to the adolescents, adults were more likely to consider the risks and benefits associated with their decisions and also to seek advice. Therefore, educators should utilize their own teaching and life experience to advise freshmen on the suitability of their chosen departments. Educators also should help novice decision-makers clarify their goals, and should use this clarification to obtain criteria and weight them appropriately (Galotti 2001). Influences on student decision-making have received significant attention in the literature.

However, these influences can vary with national culture, technological development and society. Regardless of the department chosen, grades in professional core courses should be a favorable reference. Teachers can improve their understanding of student learning effect through student performance in professional core courses, and thus can adjust their teaching techniques to individual students to improve student learning efficiency.

The main purpose of this study is to clarify the relationship between the first-year courses and the professional core courses at the upperclassman level for design students based on students' percentile-grades of courses. Also, the high correlations among different courses might cause multicollinearity if traditional statistical methods, such as multiple regression analysis, are applied. Multicollinearity (i.e. correlation among predictor (x) variables) is problematic in that it can produce model instability (Lapin 1993). Considering the above problems, artificial neural

networks (ANNs) are suitable choices for predicting student learning effect in design. ANNs are known for the absence of a hypothesis and restrictions, and a lack of involvement of multicollinearity. Besides, ANNs are ideal for processing nonlinear data, making it the perfect candidate for information forecasting and classification. Owing to the advantages of adaptive learning, fault tolerance and real-time operation, ANNs have become powerful tools in numerous research fields, such as pattern recognition, quality inspection, signal processing, financial forecasting, dynamic task allocation, function approximation, and optimization (e.g. Swarup 2008; Lolas & Olatunbosun 2008; Khashei et al. 2008; Hansen & Nelson 1997; Lin & Hwang 1999; Marren et al. 1990; Mashinchi & Selamat 2009). Problems that are characteristically sparse and noisy, with highly complex nonlinear relationships, are suitable for ANNs applications. Therefore, this study wants to apply the back-propagation neural network (BPNN), the most representative model of ANNs, to establish a prediction model for student learning effect. The prediction results of the BPNN model provide design educators with an insight into student learning effect in professional design, allowing them to tailor their teaching strategies to individual needs. For students with poor learning effect, teachers or student career consultants should also apply other complementary indicators, such as the aptitude scale and Strong Interest Inventory (SII) (Harmon et al.1994), to provide students with suitable suggestions and counseling. Moreover, the student learning effect should be followed continuously for improvement.

Artificial Neural Networks (ANNs)

The utilization of artificial neural networks (ANNs) is a relatively new computational modeling technique, yet it has an established record of applications and developments (Kasabov 1996). Like the biological brain, the neural network comprises a network of interconnected

nodes (also referred to as neurons or processing units) which adjust their memory via weights, which link nodes together (Picton 1994). Nodes are the most elementary units of any ANNs. Rosenblatt (1958) conceived of the perceptron which the basis for the operations of a single node.

The main objective of ANNs is predictive modeling. That is, the accurate prediction of non-sample data using models estimated to sample data. With cross-sectional data, this typically means the accurate prediction of outcome measures (dependent variable) of one data set generated by a given process, by providing input measures (independent variables) to a network trained to a separate data set generated by the same process. The great advantage of ANNs is contained within its inherent ability to generalize. Having been trained, the network is able to produce an optimum output on previously unseen data (Van Rooij et al. 1996). Moreover, when compared to traditional statistical predictive techniques, ANNs have shown promising results, hence their application in this instance (Hua 1996).

Overview of Back-Propagation Neural Network (BPNN)

The back-propagation neural network is a multi-layer feed forward fully-connected network. This neural network is the most representative model of the ANNs due to its documented ability to model any function (Funahashi 1989; Hornik et al. 1989). The BPNN is composed of three or more layers, including an input layer, one or more hidden layers, and an output layer. Each layer has a number of nodes, called processing units or neurons. Figure 1 diagrammatically illustrates a three-layer BPNN. A node simply computes the sum of the weighted inputs, subtracts its threshold from the sum, and passes the results through its transfer function (also referred to as the activation function). The transfer function can be expressed mathematically as follows:

$$o_i = f_i \left(\sum_{j=1}^{n} w_{ij} \, x_j - \theta_i \right) \qquad\qquad (1)$$

Where

o_i : output value of the node

w_{ij} : weight associated with the input j

θ_i : threshold value of the node

f_i : transfer function

The value of w_{ij} decides how strongly the input affects the activity of a node. The magnitude of a
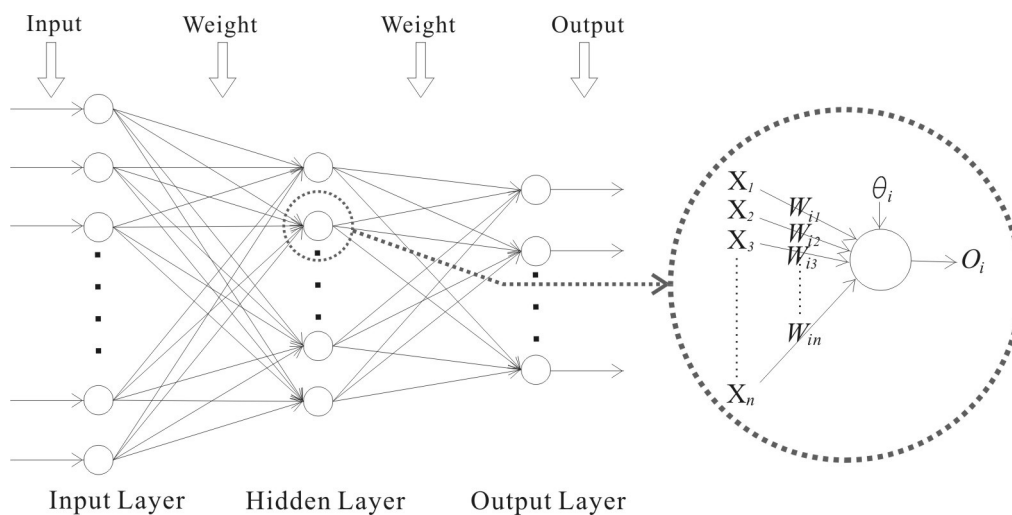
Figure 1. Concept of Three-layer BPNN

weight can be changed during the training process. It is mainly through this mechanism that the node is made adaptive to new information presented to it and hence the learning process is accomplished. The total weights of a network reflect the knowledge that it has learnt through previous training and determine how the network will react when an unknown is presented to it.

One of the most important characteristics of the BPNN is its ability to learn by training samples. Proper training enables the network to memorize the knowledge involved in problem solving in a specific domain. Back-propagation learning uses a gradient-descent algorithm

(Rumelhart *et al.* 1986), plus hidden layer and nonlinear transfer function to minimize error function. The training data set is initially collected to develop a BPNN model. Through a supervised learning rule the data set consists of an input and an actual output (target). The gradient-descent learning algorithm enables a network to improve the performance through self-learning. Two computational phases exist, namely the forwards and backwards phases. In the first phase, the BPNN receives the input data and directly passes it to the hidden layer. Each node of the hidden layer then calculates an activation value by summing the weighted inputs and then transforming them into an activity level using a nonlinear transfer function. One of the most common types of transfer functions is the sigmoid function which is continuous, nonlinear, differentiable everywhere, and monotonically non-decreasing. Each node of the output layer is used to calculate an activation value by summing the weighted inputs attributed to the hidden layer. A transfer function is then used to calculate the network output (i.e. predictive value). In the next phase, the actual network output is compared with the target value. If a difference (i.e. an error term) appears, the gradient-descent algorithm is applied to adjust the connected weights. Meanwhile, if no difference appears, then no learning is proceeded. This training process is also called supervised training since the target output for each input is known.

The training process of BPNN generally involves five steps:

(1) Select representative training samples and turn them into the input layer as the input value.

(2) Calculate the predictive value of the network.

(3) Compare the target value with the predictive value to obtain the error value.

(4) Readjust the weights in each layer of the network according to the error value.

(5) Repeat the above procedure until the error value of each training sample is minimized, meaning that the training is finished.

Furthermore, Cybenko (1989) noted that provided sufficient nodes exist, one hidden layer can overcome any problems. Since the problem analyzed in this study is not complicated, one hidden layer is adopted. Besides, Funahashi (1989) and Hornik et al. (1989) have shown that the multilayer feed-forward sigmoidal architecture can approximate any continuous function, given a sufficient number of hidden nodes.

Methods and Procedures

The research methodology adopted in this study aims to explore the utilization of the BPNN model as a supportive decision-making tool for predicting learning effect for design students.

Data Collection

The study collected the grade information of students who graduated from the Department of Industrial Design. The information comprises not only the first-year grades of the students in all courses, including Introduction to Industrial Design, Engineering Graphics, Basic Design, Technical Drawing, Chinese, English, and Mathematics, but also the professional core course grades at the upperclassman level, including Form Design, Product Design, and Thesis Project. Brief descriptions of the courses are shown as Table 1 and Table 2. Grade information was recorded for a total of 396 students. Additionally, the grade information in this study is presented in percentile form to express the relative position represented by each grade. Showing the relative percentile of a student's score in one course can help teachers understand the relative performance of single students compared with the rest of the class. Afterwards, the transformed percentile-grade information is employed for the training and testing stages of the BPNN. Figure 2 illustrates the process for transforming grade information data.

Architecture of BPNN in this Study

To assess the ability of the BPNN model to predict learning effect in design students, the 317 data sets (80% of the total percentile-grades information) were randomly selected from the 396 data sets of the total percentile-grade information used for BPNN model building; i.e. the

Table 1. Brief Descriptions Of The First-Year Courses

Year	Course	Introduction
First year	Introduction to Industrial Design	Introduces the substantive areas within the field of industrial design. These areas include ergonomics, industrial design technologies, design practice and management, and history and theory.
First year	Engineering Graphics	Fundamental concepts of multi-view projection drawing and application of drawing conventions. Includes sectional views, dimensioning, pictorial representation, fastener specifications and drawings for various engineering disciplines. Computer applications include data structure for computer modeling, plotting routines for computer drawing and an introduction to CAD principles.
First year	Basic Design	Builds understanding, sensitivity, awareness and confidence in creative thinking and introduces the familiarization, research, technical, management and presentation skills required to generate and communicate design ideas.
First year	Technical Drawing	Develops the ability to translate ideas into perspective drawings quickly and clearly. Introduces students to various freehand drawing techniques to represent and generate forms, express ideas, and interpret spatial structures.
First year	Chinese	Improves knowledge of Chinese through listening, speaking, reading, writing and real world application of Chinese language skills.
First year	English	Aims to give students the ability to use English to express their opinions with confidence in everyday situations, and to enhance their major skills in English, including listening, speaking, reading and writing.
First year	Mathematics	Teaches students the limits and the derivations of algebraic, trigonometric, exponential, logarithmic functions. Also covers applications of derivatives, anti-derivatives, the definite integral and its application to area problems, and the fundamental theorem of calculus.

training samples. The remaining 79 data sets (20% of the total percentile-grades information) then were used to test the prediction accuracy of the BPNN model; i.e. the testing samples.

Figure 3 illustrates the architecture of BPNN used in this study, which is described as follows:

Input layer：

The first-year courses, including Introduction to Industrial Design, Engineering Graphics, Basic Design, Technical Drawing, Chinese, English, Mathematics, are taken as input variables (i.e. input nodes) in the input layer of the BPNN. Therefore, the input layer contains a total of seven nodes.

Output layer:

The professional core courses at upperclassman level, including Form Design, Product Design, and Thesis Project, are used as the output variables (i.e. output nodes). The percentile-grades of the professional core courses are used to predict the learning effect of design study. The output layer thus contains three nodes.

Table 2. Brief Descriptions Of The Professional Core Courses At The Upperclassman Level

Year	Course	Introduction
Second year	Form Design	Approaches form and color systematically by exploring basic design elements and principles. Form giving properties such as structure, proportion, composition and static and dynamic symmetry are also studied. Additional topics include object typology, surface transitions, and color specification.
Third year	Product Design	Utility design methodology from proposal to working pre-prototype, including planning, research, development, model making, manufacturing and documentation.
Fourth year	Thesis Project	Product design projects involving all design phases, including planning, research, development, finalization, specification and marketing.

Raw data: Grade information

Subject	Introduction to ID	Engineering Graphics	Basic design	Sketch	Chinese	English	Mathematics	Form Design	Product Design	Thesis Project
1	77	67	88	83	78	78	71	78	70	78
2	59	80	81	76	68	64	90	84	74	72
3	77	66	80	75	86	96	90	83	76	80
4	67	81	82	76	78	87	74	80	70	74
5	78	73	85	77	64	83	88	83	76	73
6	72	66	82	69	78	93	75	72	76	72
7	73	53	78	64	73	75	56	75	74	75
8	65	46	58	69	64	81	46	60	57	65
9	72	64	68	73	85	86	70	73	63	73
10	70	73	77	78	72	97	65	84	67	83
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

Percentile-grade information

Subject	Introduction to ID	Engineering Graphics	Basic design	Sketch	Chinese	English	Mathematics	Form Design	Product Design	Thesis Project
1	70.30%	42.20%	96.70%	95.10%	40.00%	60.20%	62.00%	73.40%	34.60%	82.50%
2	3.20%	90.80%	82.70%	59.70%	11.30%	25.30%	96.40%	93.90%	54.90%	49.30%
3	70.30%	36.70%	78.70%	53.10%	80.50%	97.90%	96.40%	91.60%	65.80%	89.30%
4	22.70%	91.60%	85.50%	59.70%	40.00%	82.20%	68.30%	81.20%	34.60%	64.00%
5	74.60%	67.80%	93.40%	67.00%	5.80%	73.60%	93.10%	91.60%	65.80%	56.40%
6	49.30%	36.70%	85.50%	25.80%	40.00%	94.60%	69.80%	45.50%	65.80%	49.30%
7	56.40%	5.80%	69.80%	9.30%	24.00%	47.00%	11.10%	57.90%	54.90%	68.80%
8	16.20%	2.20%	2.20%	25.80%	5.80%	67.30%	6.00%	3.00%	2.20%	14.60%
9	49.30%	29.30%	21.20%	42.70%	75.60%	80.20%	57.40%	48.80%	9.30%	56.40%
10	36.90%	67.80%	62.70%	73.90%	22.00%	98.70%	45.00%	93.90%	22.20%	94.60%
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

BPNN

Input Layer Hidden Layer Output Layer

Figure 2. Transforming Process of the Grade Information Data

Hidden layer：

The problem dealt with in this study is not complicated, and thus only one hidden layer is used.

The principle for determining the number of nodes in the hidden layer is as follows:

$$N_h = (N_i + N_o) / 2 \tag{2}$$

Where
N_h: number of nodes in the hidden layer
N_i: number of nodes in the input layer
N_o: number of nodes in the output layer
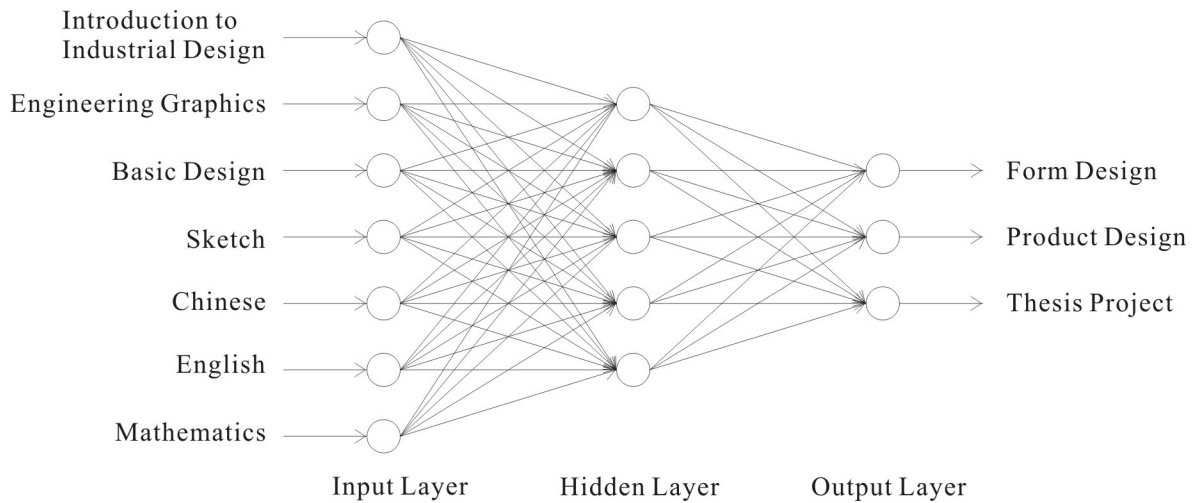
Figure 3. Architecture of the BPNN in This Study

The BPNN model in this study has seven nodes in the input layer, and three nodes in the output layer. Therefore, the hidden layer contains five nodes, as inferred from equation (2). Furthermore, the nonlinear transfer function employed in this study is the sigmoid function. The unipolar form of the sigmoid function squeezes the input values in a range of (0, 1). This function can be expressed mathematically as follows:

$$f(x)=1/(1+e^{-x}) \tag{3}$$

To raise the convergence speed, both momentum term and adaptive learning rate are employed in the training process (Jacobs 1988). The choice of the learning rate of the network is significant in locating the global minimum of the error surface. A very small learning rate increases the chance of the network finding a global minimum, but usually requires an excessive amount of training time. On the other hand, a large learning rate will be faster but may cause the network to oscillate widely and provide poor solutions. Based on past researcher experience, a learning rate between 0.1 and 1.0 can achieve good convergence. Therefore, this study uses the five learning rate values of 0.1,

0.3, 0.5, 0.7 and 0.9. Besides, the concept of momentum holds that previous weight changes should influence the current weight space movement direction. Momentum causes weights that have started moving in a particular weight space direction to continue moving in that direction. Imagine a ball rolling down a hill that reaches a depression half way down the hill. If the ball has sufficient momentum, it will roll through the depression and continue down the hill. Similarly, when applied to weights in a network, momentum can help the network 'roll past' a local minimum, and can also accelerate learning. This study sets the momentum values to 0.2 and 0.4 to increase the vibration during the convergent process and accelerate convergence.

Results and Discussion

The first-year courses are served as the input variables of the BPNN, and the professional core courses at the upperclassman level as output variables. This study aimed to obtain a better understanding of the relationship between variables. The correlation matrix between variables (Table 3) demonstrates that correlations exist between the first-year courses and professional core courses at the upperclassman level, such as Form Design, Product Design, and Thesis Project. This study has some weaknesses related to the intervention of multicollinearity. Traditional statistics are ill suited for establishing relationships among variables, whereas the neural network model does not involve multicollinearity. The neural network model thus is selected in this study to predict student learning effect. Furthermore, Table 4 indicates that males do better than females in Engineering Graphics (t=-3.467, $p<0.01$), a subject that requires strong spatial comprehension. Meanwhile, females are better than males at English (t=4.421, $p<0.01$). However, in mathematics males once again display an edge over females (t=-3.444, p<0.01). For the other courses (i.e. Introduction to Industrial Design, Basic Design, Technical Drawing and Chinese), no significant differences were noted between the two gender groups. Notably, despite

the gender difference in basic first-year courses, no gender differences are found in the professional core courses at the upperclassman level, such as Form Design, Product Design and Thesis Project. Thus learning effect of design majors does not appear to differ along gender lines.

In this study, the training samples in the BPNN model comprise 80% of the total data (317 data sets), while the testing samples comprise 20% of the total data (79 data sets). Adjusting the learning rate and network momentum enables network testing. To test network performance, prediction

Table 3. Correlation Matrix Between Variables

Variable	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}
Gender (X_1)	1.000	-0.010	0.172*	0.013	0.032	-0.039	-0.217*	0.171*	0.014	0.026	0.006
Introduction to ID (X_2)	-0.010	1.000	0.273*	0.282*	0.341*	0.448*	0.249*	0.362*	0.340*	0.325*	0.342*
Engineering Graphics (X_3)	0.172*	0.273*	1.000	0.431*	0.367*	0.261*	0.023	0.419*	0.374*	0.420*	0.437*
Basic Design (X_4)	0.013	0.282*	0.431*	1.000	0.412*	0.320*	0.193*	0.250*	0.468*	0.487*	0.421*
Technical Drawing (X_5)	0.032	0.341*	0.367*	0.412*	1.000	0.322*	0.192*	0.246*	0.506*	0.392*	0.399*
Chinese (X_6)	-0.039	0.448*	0.261*	0.320*	0.322*	1.000	0.173*	0.309*	0.430*	0.273*	0.244*
English (X_7)	-0.217*	0.249*	0.023	0.193*	0.192*	0.173*	1.000	0.149*	0.102*	0.181*	0.258*
Mathematics (X_8)	0.171*	0.362*	0.419*	0.250*	0.246*	0.309*	0.149*	1.000	0.307*	0.328*	0.328*
Form Design (X_9)	0.014	0.340*	0.374*	0.468*	0.506*	0.430*	0.102*	0.307*	1.000	0.462*	0.328*
Product Design (X_{10})	0.026	0.325*	0.420*	0.487*	0.392*	0.273*	0.181*	0.328*	0.462*	1.000	0.365*
Thesis Project (X_{11})	0.006	0.342*	0.437*	0.421*	0.399*	0.244*	0.258*	0.328*	0.328*	0.365*	1.000

Values in the cell indicate correlation coefficients (r)
*: $p<0.05$

accuracy (i.e. PA_{EV}（%）) is employed as the guide and its definition is described as follows:

Error value:
       If difference □ 0.1, then EV=1 or match
       otherwise, EV= 0 or mismatch
then
       PA_{EV}（%）= (n/N)×100

Where

difference =(│ error │ / tv) =(│ predictive value-target value │ /target value)
error = (predictive value-target value)
tv = target value
n = number of matches
N = total number of testing samples (N=79 in present study）
i= 1, 2, … , N-1, N.

Table 5 shows that the BPNN model has average prediction accuracy of 91.27% for Form

Design, 92.03% for Product Design, and 93.54% for Thesis Project. Notably, BPNN_3 and

BPNN_5 have even higher prediction accuracy, reaching 94.94% for Thesis Project. The figure derived

from the network training is exemplified by BPNN_3. The assumed learning rate is 0.3, and the

momentum is 0.2. Figure 4 shows the connection and bias weights after the network training

stage.

Table 4. Gender Differences In Course Performance

Variable (Course)	Mean grade (Female)	Mean grade (Male)	t-value	df	p
Introduction to Industrial Design	71.90	71.74	0.192	394	0.84760
Engineering Graphics	66.75	70.21	-3.467	394	0.00058 **
Basic Design	73.49	73.71	-0.257	394	0.79745
Technical Drawing	72.78	73.24	-0.627	394	0.53076
Chinese	78.44	77.74	0.778	394	0.43678
English	75.19	68.72	4.421	394	0.00001 **
Mathematics	66.08	70.79	-3.444	394	0.00064 **
Form Design	72.26	72.48	-0.269	394	0.78798
Product Design	72.26	72.71	-0.522	394	0.60212
Thesis Project	71.32	71.41	-0.117	394	0.90703

**: $p<0.01$

Table 5. Predicted Results Using BPNN Models

Prediction Model	Learning rate	Momentum	Accuracy PA$_{EV}$（%）		
			Form Design	Product Design	Thesis Project
BPNN_1	0.1	0.2	89.87	92.41	93.67
BPNN_2	0.1	0.4	89.87	92.41	93.67
BPNN_3	0.3	0.2	92.41	91.14	94.94
BPNN_4	0.3	0.4	92.41	92.41	93.67
BPNN_5	0.5	0.2	92.41	91.14	94.94
BPNN_6	0.5	0.4	91.14	92.41	92.41
BPNN_7	0.7	0.2	92.41	92.41	93.67
BPNN_8	0.7	0.4	91.14	92.41	92.41
BPNN_9	0.9	0.2	91.14	92.41	92.41
BPNN_10	0.9	0.4	89.87	91.14	93.67
		Mean	91.27	92.03	93.54
	Standard deviation		1.11	0.61	0.93
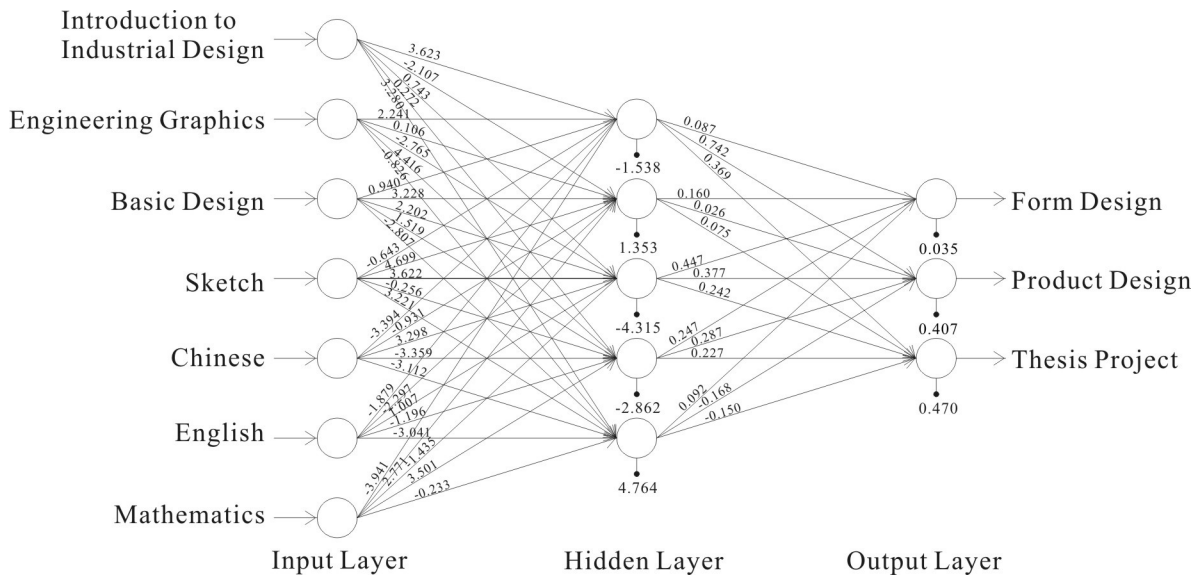
Figure 4. Connection Weights and Bias Weights After Training the Network for BPNN_3 (learning rate=0.3 & momentum=0.2)

Although BPNN makes accurate predictions for all of the professional core courses, significant differences (F (2, 27) =16.317, $p<0.01$) exist among BPNN predictions for the different professional core courses, as shown in the analysis of variance (Table 6). Scheffé's test (Scheffé 1953) demonstrates that BPNN makes more accurate predictions for Thesis Project than

for Form Design and Product Design, as displayed in Table 7. However, the predictions of BPNN for Form Design and Thesis Project do not differ significantly.

Thesis Project is an integrated course on design principles, methods, techniques and practices. Moreover, student performance in Thesis Project frequently serves as an indicator of student leaning effect in the department of design. The predictions of the learning effect of the design majors are more accurate in the BPNN model, implying that the BPNN model should be a suitable assistant instrument for predicting the learning effect of design majors. Therefore, the predictions of the BPNN model may enable design instructors or student career

Table 6. Result of The Analysis Of Variance

Source of variation	Sum of Squares	df	Mean Square	F	p
Professional core course	26.919	2	13.459	16.317	0.000023**
Error	22.272	27	0.825		
Total	49.191	29			

**: $p<0.01$

Table 7. Scheffé's Test on Three Professional Core Courses

	Form Design (91.27%)	Product Design (92.03%)	Thesis Project (93.54%)
Form Design		0.1932	0.0003**
Product Design	0.1932		0.0036**
Thesis Project	0.0003**	0.0036**	

**: $p<0.01$

consultants to see the potential of students in design, and thus tailor their teaching strategies, and provide additional guidance and assistance for individual students.

To understand the learning effect of a student in the professional design class, a design instructor should check the first year grade information of that student. The student grade information first is transformed into the relative percentile-grade information, and then the

percentile-grade information is entered into the BPNN model. The collected network output from the BPNN model, i.e. the prediction value of the percentile-grade of the professional core courses at the upperclassman level, shows the learning effect difference compared to other students. If the student has poor learning effect, teachers should also apply other complementary indicators, such as aptitude scale and Strong Interest Inventory (SII), to provide appropriate suggestions and counseling. Furthermore, the student learning effect should be followed continuously and efforts made to improve it.

Conclusions

The back-propagation neural network applied in this study has high prediction accuracy for predicting learning effect in design students. The prediction results of the BPNN model provide design educators with an insight into the student learning effect, enabling them to tailor their teaching strategies to meet individual needs. Additionally, design educators or student career consultants may also consider other factors related to student choice of major. Other complementary indicators, such as aptitude scale and Strong Interest Inventory (SII), should also be considered to help students make judgments regarding whether they should continue with their current program or switch majors.

To achieve improved results in follow-up studies, a holistic scope should be considered that includes influences on student learning effect other than the first-year grades included in this study. Other factors might include financial condition of the family of the student, educational background of the parents, supportiveness of the parents, and the social status enjoyed by designers. These factors could all be quantified and then inputted into the BPNN. Additionally, the network output does not only have to be the learning effect. A more accurate prediction network might be designed by adjusting learning rate and momentum. Future studies could have

their directions set in determining an accurate, reliable prediction network for helping instructors, students, and parents in decision-making. Although only 396 data sets are used in this study, a future study will continue to collect student grade information and follow student job performance to demonstrate that the BPNN model is a useful method for predicting learning effect for design students.

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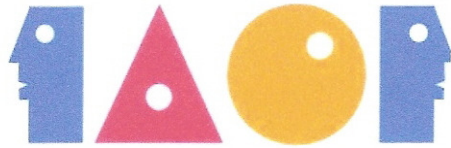
A STUDY OF CORRELATIONS AMONG YOGA ENHANCEMENT DESIGN AND COGNITION OF COLLEGE STUDENT LEARNING AND PRACTITIONER SUCCESS

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Abstract

In this study, this researcher investigated the extent to which incorporating yoga into the occupational therapy curriculum influenced student academic achievement and success and whether yoga enhanced the practitioner's practice with positive outcomes of the client's treatment. With the inclusion of yoga methods, students were able to concentrate better and focus on their required material to prepare them for the demands of academia and the future workforce. By establishing a yoga foundation in the students' higher education program of occupational therapy, they would be better prepared to interact or provide treatment to individuals with special needs. Students who become practitioners may need to have a method to cope with the stressors encountered from their work environment.

Occupational therapy in the treatment arena may at times be too repetitive and routine. Yoga may bring about a gentle and relaxed method that may also increase interest and energy. As practitioners, their focus is in providing the necessary treatment to clients and completing their workload that often may result in burn out. As students graduate and become practitioners in the field of occupational therapy, it also becomes essential to maintain a healthy lifestyle to instruct their clientele in such methods.

Findings of this longitudinal study indicated that students receiving the yoga intervention design did not have reduced test or reduced computer anxiety in comparison with the control groups of participants. Qualitative data revealed concerns in both groups of participants regarding taking tests and using computers. Difficulties implementing yoga into their busy lives were noted to be an issue.

A problem that confronts the college-level student today is the amount of anxiety interfering with academic performance. A need is present for educational interventions that could be lifelong in nature yet manageable for implementation and of low cost as with the use of yoga. Stein and Cutler (2002) indicated that a problem confronting society today is the inability to relax or to partake in health or wellness programs that will enhance or improve one's well being.

Practitioners and college students in the practice of occupational therapy and clients as recipients of occupational therapy often are surrounded by the demands of practice or treatment outcomes whereby wellness and joy are limited, thereby causing stressors to occur.

In this study, this researcher intended to examine the influence of an educational intervention, yoga, on student anxiety in computer usage and test-taking. Findings from this study may add to the existing literature on ways of reducing student anxiety in learning situations. Moreover, information was obtained on the extent to which yoga itself may contribute to improved student outcomes. In this study, this researcher showed that by incorporating yoga into occupational therapy, practitioners/college students provided a more enhanced treatment environment not only for their clients but for themselves as well. Practitioners managed stress more effectively in their workplace and established a more cohesive working relationship with colleagues. College students were able to improve or enhance their learning capabilities and cognition and have higher outcome results in coursework and tests. Clients were able to achieve more control over their therapy regime and have more satisfactory results.

Key Words: Yoga, Test Anxiety, Occupational Therapy, Complementary
                    and Alternative Medicine

Introduction

Test Anxiety

According to studies conducted by the National Institute for Mental Health (NIMH,

2000), about 7 to 10% of college students report suffering from anxiety disorders. The

counseling staff from the University of Notre Dame identified the most common of anxiety

related disorders that would interfere with concentration and performance. Test anxiety can be

normal for students even if they are well prepared. However, it is not normal for them to feel

dizzy, nauseous, fight back tears, and experience a rapid heart rate throughout the test-especially

if they are well prepared. What often occurs to students who experience test anxiety is that they have talked themselves into believing they do not have the resources to respond to the challenge posed through the test. Students may also believe there will be a negative outcome that will be devastating to their future (Connections, 2005).

The Division of Student Affairs and Services from the University of Cincinnati (n.d.), listed information on test and performance anxieties and described these anxieties as responses specific to evaluative situations (e.g., being observed or evaluated by others). The primary threat in these situations is the possibility of failure and loss of self-esteem. Depending on the intensity of the anxiety response, the emotional, behavioral, and cognitive components of anxiety can interfere with the ability to perform the task at hand (e.g., test score, athletic or artistic performance). Approximately 20% of US college students experience symptoms of test anxiety and most athletes and artists experience performance anxiety at some point in their careers. Supon (2004) emphasized that a balance in various methods to master content must be established because this balance is the key to learning. At times, it is difficult to motivate students to explore content or subject areas of interest. Other avenues must be discovered that show mastery of content. It is necessary to seek better solutions for engaging students in the learning experience and cognition. Although a variety of methods exist that will alleviate test anxiety from teaching test-taking skills to teaching students to be better organized in study habits; relaxation exercises is also recommended to desensitize a student's anxiety.

Complementary and Alternative Medicine

The literature review indicates that the usage or incorporation of yoga in everyday life definitely provides a change in outlook towards life for the individual. A position paper from the American Occupational Therapy Association (AOTA) and published in the American Journal of

Occupational Therapy (2005) asserted that the usage of complementary and alternative medicine (CAM) can be used by occupational therapists and occupational therapy assistants to enhance the engagement of occupation with clients within the scope of occupational therapy practice (Giese, Parker, Lech-Boura, Burkhardt, & Cook, 2003).

There are five domains of CAM practice according to the National Center for Complementary and Alternative Medicine (NCCAM) of the National Institutes of Health listed (NCCAM, 2002). They are 1. Alternative medical systems, 2. Mind-body interventions, 3. Biologically-based treatment, 4. Manipulative and body-based methods, and 5. Energy therapies. The terms complementary and alternative tend to be used interchangeably. For the purposes of this study, the term complementary will be used since the distinction between alternative refers to practices in place of and complementary indicates practices are accessed in conjunction with allopathic medical practices. Therefore, occupational therapy and yoga would be complementary with each other. Giese (2005) also indicated that it is important to conduct research to determine the efficacy and effectiveness of CAM practices in health and wellness arenas. The current number of studies is small.

Preparatory methods, such as CAMs, are being widely used by occupational therapists and occupational therapy assistants as purposeful activities to facilitate the ability of clients to engage in their daily life occupations (Giese, 2005). The profession of occupational therapy's core mission is to value engagement in occupations by supporting participation in context. Our everyday occupations encompass activities of daily living, instrumental activities of daily living, education, leisure skills, play, social participation, and work. It is appropriate to incorporate CAMs into occupational therapy as a means to encourage a client's engagement in meaningful occupation (AOTA, 2002).

As practitioners in occupational therapy, a determination must be made regarding whether or not to use CAMs in the delivery of occupational therapy services, by conducting evaluations that an occupational therapist is able to gain an understanding of the client's needs and priorities and thereby provide an appropriate intervention for treatment. It is with the evaluation and intervention that practitioners will be able to determine whether the use of CAMs would be consistent with the client's cultural practices, priorities and needs, is safe to use, and is an appropriate approach to facilitate the ability of the client to participate in daily life occupations (Giese, 2005).

Caplan, Harrison, and Galantino (2003) explained how practices within the holistic pattern range from A to Z—from acupuncture to Zen meditation and nearly everything in between. The belief of many holistic practitioners stems from a harmonious relationship between the body's internal and external environments. Health is the proper balance among mind, body, and spirit, along with the surrounding physical and social environments. Caplan et al. mentioned how complicated and difficult tracking of CAM use by therapists has been because, traditionally, occupational therapists have a rich history of holistic treatments.

According to Deutsch and Anderson (2003), challenges to CAMs approaches include the difficulty in validating usage because of the intricacy in measuring successful outcomes. Much relies on the sound decision-making process of practitioners who can systematically identify the problem and make decisions about efficacy. It is the skilled practitioner who will explore the possibility of including yoga as a complement to the existing plan of care for clients. Deutsch and Anderson (2003) also explained how many diagnostic groups are treated with yoga, for example, respiratory, pain management, cancer, along with areas of wellness, cognition, and

emotional well being. Many of these areas can be identified with the college-level student or the health care practitioner who is faced with a new environment and challenges.

McKenna (2003) described yoga as a technique that fulfills the ultimate destiny of life. The different forms of yoga seek a union with a higher power that can offer ways by which inner consciousness can grow. Although yoga is an internally focused discipline with spiritual connections, it is not a religion. Some yoga postures and exercises are designed to activate certain functions of the body and mind. Therefore, the ultimate aim of yoga is to attain the "realization of life," (p. 90) not merely to cure mental or physical ailments.

Methods

The purpose of this study was to measure the impact of a yoga enhancement design and intervention on college student test anxiety and computer anxiety within the occupational therapy curriculum. Also studied was the extent to which the enhancement promoted a difference in lifestyle that would influence practice as well as one's well being. According to Bandura (1982), people may misjudge their abilities and therefore become angry, frustrated, and lost in their focus on the task. It is likely that they may believe things or situations are more difficult than they really are. Yet, some individuals may see a difficult situation as a challenge and this may result in a strong sense of self-efficacy.

According to Gall et al. (2003), in a qualitative study the sample size is usually small. That is, a sample might consist of a single case. For this investigation, containing both quantitative and qualitative data collection procedures, the sample was relatively small for a quantitative study and relatively large for a qualitative study. The sample for the current study consisted of approximately 12 college-level students within an occupational therapy assistant program as the experimental group and 33 college-level students within an allied health program

as the control group from a south Texas community college. Within the students selected, some students used yoga and some students did not use yoga.

For the practitioners, a list of the previous five graduating classes was accessed to acquire a purposeful sample selection based on criteria of approximately 10 participants who are currently in practice. Participants were then randomly selected until the desired number of 10 students was achieved. Interviews were scheduled during times conducive to both parties (participant and researcher). Schedules were determined with the students and practitioners to arrange the best meeting times for interviews. The selection of such a small sample is suited for this type of study, because the purpose will focus on the depth of qualitative inquiry (Patton, 2002).

Through use of a Likert-format survey, participants were asked to check their level of agreement with various statements. Likert scales are a common type of attitude scales (Gall, Gall, & Borg, 2003). It is important for individuals within the sample to have sufficient knowledge and understanding to express meaningful opinion about the topic, otherwise, the responses to the scale would be of questionable value. Gall et al. (2003) expressed the importance of dealing with individuals who lack familiarity with a topic by including a "no opinion" option (p. 229). However, individuals with little or no information about the topic might express an opinion to conceal ignorance, or because a feeling of social pressure exists to express a particular opinion.

Patton (2002) indicated that the use of qualitative methods could be helpful in research. There is a systematic collection of information regarding the activities, characteristics, and outcomes of programs that then are used to make judgments about the specific program, improve its effectiveness, and/or provide decisions about future programming. "Evaluative research, quite

broadly, can include any effort to judge or enhance human effectiveness through systematic data-based inquiry" (p. 10).

This current study followed the heuristic inquiry method (Patton, 2002) that is described as a form of phenomenological inquiry. One of the elements of heuristic inquiry is that the researcher must have personal experience with and intense interest in the phenomenon under study. A focus is also present on intense human experiences. Results are from discoveries, personal insights, and reflections of the researcher. Through interviews, participants provided the researcher with information through verbal interchange or conversation. Non-verbal behaviors and the interview context were noted by the researcher and became part of the data (Law, Stewart, Letts, Pollock, Bosch, & Westmorland, 1998). Participant observation is useful when the focus of interest is how activities and interactions within a setting give meaning to beliefs or behaviors. Differences may exist between what people say and what people do (Law et al., 1998).

By combining questions and information from different sources, some adaptations and modifications were made to address the issues pertinent to students from the South Texas Community College. The final Likert scale for this study consisted of 20 questions. According to Gall et al. (2003), the usage of a Likert scale provides for content analysis with an objective systematic description involved in collecting data with simple classifications of specific information related to the anxiety level of students during computer test-taking. Green and Salkind (2005) described the use of repeated measures with an analysis-of-variance (ANOVA) based design that allows the participant to be measured several times. For instance, data collected through analyzing the anxiety levels of students weekly prior to testing would make for a powerful analytic technique.

The instrumentation also consisted of semi-structured interviews as well as informal conversations to gather perceptions of the participant with regard to their overall performance with successful completion within their program. Hoepfl (1997) explained that qualitative interviews may be used either as the primary approach for data collection or in combination with observation and document analysis. This study included semi-structured interviews, observation, and document analysis. Additionally, the viewpoints from practitioners were gathered to assess their perceptions on approaches and lifestyle experience. The interviews were created for this study so participants (college-level students) could self-report their viewpoints and interest level of using yoga to enhance their academic performance. Practitioners were also able to self-report their satisfaction within practice and the effects of patients with debilitating conditions. Qualitative data were collected via semi-structured interviews and observations of participants during stressful activities; for example, while test taking. This process provided a deeper understanding and clearer explanations. Demographic practitioner data collected were the years of clinical practice, gender, and usage of yoga practice within the clinical arena. Questions generated were reviewed by three experts in the field of occupational therapy by practitioners who also practice yoga. According to Patton (2002), hermeneutic researchers create certainty for interpretation of data with the assistance of participants.

Green and Salkind (2005) described that in one-way repeated-measures Analysis of Variance (ANOVA) each participant in a study would have the same measure, in this case a Likert-format survey, administered repeatedly. In a Likert scale, participants are asked to respond to a series of statements by indicating whether there is a sense of anxiety. Each response was associated with a point value, and the participant's score was determined by summing the point values of each statement (Gay & Airasian, 2003). Aggregated responses across the survey

items were analyzed between the experimental and control groups across the weeks of the yoga intervention design.

Patton (2002) referred to the usage of an interview guide to ensure that basic lines of inquiry are pursued with each participant interviewed. The usage of an interview guide allowed for the freedom to explore, probe, and ask questions that will clarify any information related to the topic area. Conversation can then be built or elaborated depending on the format of spontaneous responses. The combination will allow for flexibility in probing and exploration on subject matters to greater depth. The interviewer can establish a conversation style yet remain focused on the identified topic.

The qualitative open-ended interview data were analyzed and interpreted by looking for patterns and integrating differences in responses from the participants. Data were collected and recorded as fully and fairly as possible from the participant's perspective (Patton, 2002). The audio recordings were transcribed for content analysis and coded for any emerging themes that occurred. The raw data, placed into logical and meaningful categories, were then examined in a holistic fashion. Words, phrases or events that appeared to be similar were grouped in the same category or theme and color coded. The purpose of coding is to not only to describe, but more importantly, to acquire new understanding of a phenomenon of interest (Hoepfl, 1997). The researcher transcribed all notes taken from interviews into a word document file, which provided the opportunity to become familiar with the cumulative data as a whole. A master copy of the file was kept in a safe and secure place with one hard copy kept handy throughout the analysis. An additional copy was used to write on and additional copies saved on separate computer discs were used to cut and paste. The master copy remained as a key resource for locating materials and to maintain the context for raw data (Patton, 2002).

Results

The findings are divided into two major categories. First, the quantitative findings are presented, including an analysis of the scale items of the questionnaire. Second, the results of both the open-ended questionnaire items and responses are presented providing a deeper understanding of the results from the survey. The study's research questions were evaluated using both quantitative and qualitative data analysis techniques.

Essentially, the participants (both from the experimental and control groups) realized that being prepared prior to an exam was necessary. For the most part, many of the participants practiced some form of stress release. However, most participants did not practice on a regular basis and as a result, their anxiety levels tended to fluctuate periodically depending on the amount of preparation for testing. Many participants did express an interest in learning correct deep breathing techniques. Some participants from the control groups who were familiar with and who practiced deep breathing techniques were pleased with the results.

In the quantitative portion of this study, findings were that the experimental group differed from the control group both at the beginning of the intervention and at the finish of this study. The analysis yielded a statistically significant result, t (18.914) = 3.643, $p < .002$. Table 1 shows that the experimental group's test anxiety score was over 8 points higher than the control group's text anxiety score. At the conclusion of the yoga intervention design, another independent samples t-test was conducted, with group membership serving as the independent variable and test anxiety serving as the dependent variable. This analysis also yielded a statistically significant result, t (30.135) = 3.525, $p < .001$. Table 1 again showed that the experimental group's test anxiety score was still over 8 points higher than the control group's test anxiety score. Thus, the initial difference in test anxiety was still present between the two

groups at the conclusion of this intervention, indicating that the intervention was not effective in reducing the test anxiety of these participants.

Table 1   *Descriptive Statistics for Test Anxiety Scale Across All 10 Measurements*

		n	M	SD
Experimental Group	Test Anxiety One	12	40.750	6.757
	Test Anxiety Two	12	38.667	6.759
	Test Anxiety Three	12	39.667	6.429
	Test Anxiety Four	12	41.167	5.622
	Test Anxiety Five	12	41.750	6.621
	Test Anxiety Six	12	40.417	6.259
	Test Anxiety Seven	12	40.417	6.259
	Test Anxiety Eight	12	40.750	6.757
	Test Anxiety Nine	12	40.750	6.757
	Test Anxiety Ten	12	40.417	6.259
Control Group	Test Anxiety One	32	32.531	6.411
	Test Anxiety Two	33	32.000	7.762
	Test Anxiety Three	33	32.485	8.635
	Test Anxiety Four	33	31.727	7.775
	Test Anxiety Five	32	31.500	7.792
	Test Anxiety Six	33	31.758	9.890
	Test Anxiety Seven	32	31.938	9.658
	Test Anxiety Eight	32	32.469	6.486
	Test Anxiety Nine	33	32.061	7.697
	Test Anxiety Ten	33	31.758	9.562

In the qualitative portion of this study, the findings indicated similarities in factors affecting test anxiety within the experimental and control groups. Although, the experimental group utilized deep breathing techniques prior to test taking, consistency with practice appeared to have an impact. Participants from the experimental group expressed being timed or running out-of-time would tend to raise their test anxiety and affect performance. The most participants within the control group seemed to have set routines for preparation of testing. This preparation allowed

the participants from the control group to monitor and diminish their test anxiety, which would show better performance in testing.

As practitioners in the field, many participants indicated the awareness and importance of practicing relaxation methods for improved health benefits. Yet, few actually continued practiced of any relaxation methods post graduation. The three participants included in this study expressed a realization of improved work performance and therapy practice was carried out more smoothly.

Conclusion

Data about yoga intervention design used to reduce test anxiety and computer anxiety indicated that participants were fully aware of the benefits from yoga or any relaxation method. Yet, consistency in practice or establishing a regular routine tended to be difficult for most students. Lack of consistency in carrying out any form of regular exercise for reducing stress becomes complicated with the many course demands, for example, preparation for homework assignments, class presentations, and studying for exams. Previous researchers had suggested that students are able to enhance learning and concentration skills with regular yoga practice. As instructors, providing an environment that is conducive to learning is critical. Students must be able to learn methods that will help them balance the necessary day-to-day requirements (college life, family life, and work schedules, if any). Relaxation exercises have been a recommended strategy to desensitize a student's anxiety (Supon, 2004).

The findings suggest that most students experienced difficulty balancing their schoolwork and their personal time. Participants recognized the importance and value of test taking and being part of an allied health profession. Some participants expressed that alternate methods for test taking should be considered, such as practical demonstrations from their clinical settings. No

difference was present in computer anxiety across the repeated measurements. The amount of computer anxiety reported by students did not change across the 10 repeated measurements; the average scores for the experimental and control groups were very similar across the repeated measures. What this similarity signifies is that when asked about their test anxiety and computer anxiety, students in general experience a moderate amount of test anxiety. Students have a strong desire to incorporate some type of relaxation technique but lack the organizational time management skills for incorporating some form of relaxation technique.

This research has delineated some issues with test anxiety and computer anxiety among college-level students. It was found that most students are aware of their anxious behaviors and limitations related to testing. Further research is needed, however, on the consistency of practicing some form of relaxation for building student's confidence factor. The literature showed that yoga has been incorporated in many schools across the country. By incorporating yoga in the early school years, students at an early age would learn habits that would instill automatic routines for yoga practice. The yoga practice would then become a daily regime, such as grooming, dressing, and studying.

The sample for this current study included only three practitioners who continued with either yoga or deep breathing methods to reduce their anxiety levels. The challenge remains to incorporate a simple yoga relaxation regime within the curriculum so students build a routine of relaxation techniques that will continue throughout their coursework and into their professional careers. More research, both quantitative and qualitative, is needed in which group comparisons can be made. Possible study topics include the following:

- Gender-based differences in the perception of relaxation techniques for lowering test anxiety.

- Campus-based differences in the perception of anxiety with computerized testing.

- Cohort-based differences in the consistency of implementing relaxation techniques for reducing test anxiety.

Only through further research on the experiences of students who have successfully incorporated relaxation techniques to lower test anxiety symptoms and those who have not established consistency with relaxation techniques will researchers be able to fully understand the factors associated with yoga practices and the lowering of test anxiety. This researcher took a step in that direction, but further study is needed to complete the task.

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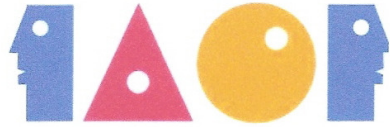
SUSTAINABLE HOUSING DEVELOPMENT: DEFINING THE PROJECT TEAM ROLES AND RESPONSIBILITIES

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Abstract

The housing industry has always been one of the main drivers in any nation's development. As a mature industry, it has undergone countless transformations, upheavals, and changes to meet the demands placed by the various stakeholders in the industry. Recently, the whole industry has been hard pressed by various quarters to look for a better solution towards sustainable development. The housing industry by nature is multi-faceted, consumes natural resources and produces impact on the natural environment. Its importance to the national economies cannot be understated because the industry is the main component in the provision of urban renewal, local regeneration and social development. Thus, the sustainability issues that had impacted on the housing development industry must be considered and taken care of by the project team in any housing development. Creating sustainable housing development is crucially dependent on the knowledge and involvement of all the project team members in the housing development process. This paper attempts to identify the elements of sustainable development and subsequently chart the level of awareness and implementation of sustainable housing development based on the current practices of the project teams. The key project members that were investigated in this research are the Clients, Consultants and Contractors. They were approached to measure the persistence and awareness of the sustainable development issues by means of questionnaires. The findings of this paper identified and benchmarked the elements which are important towards building a sustainable housing development. For future research, a larger survey combining both interviews and questionnaires could be conducted on a larger sized group of respondents made up of house buyers and other key respondents such as central governments, local governments as well as consumer groups to acquire better sampling and subsequently, more comprehensive findings.

Keywords: Sustainability, Sustainable Development, Housing, Construction Industry

Introduction

Sustainable development is basically the act of balancing the fulfillment of human needs alongside the protection of the natural environment to ensure that human needs can be met presently and in the future. Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission On Environment & Development, 1987). Housing development is a key ingredient of progress and governance in any given nation. Creating sustainable housing development requires the knowledge and involvement of all parties in the industry. To achieve the ambitious aim of sustainable housing development, it is important to educate and allow project teams in the housing development industry to grow within the sustainable development realms. At the very least, the fundamental principles of sustainable development must be progressively introduced into the working procedures and processes of these project teams.

In Malaysia, the drive towards generating sustainable development policies had been spearheaded by the government. Major industries in the country had shown enthusiastic response towards the government's calls in sustainable development policy implementation. The housing development industry is seemingly rather receptive towards the policy. Nevertheless, there are some indications that the housing development industry has still a long way to go towards embracing the sustainable development policy proposed by the government. Central to the problem are the existing legislations relating to habitation which are more focused on the physical development of housing, at the expense of social and cultural matters related to housing. Over the years, the emphasis in the housing policies and strategies is centered on the provision of affordable housing rather than sustainable inhabitation. A study of these issues reveals that there is little room for sustainability intervention in the present set up of the Malaysian housing

development structure. To date, all the information points out to the need for the relevant parties to promote a wider notion of sustainability in housing development. This is to improve the environmental performance of the developed residential units as well as creating a greater impact of sustainability upon the lives of the community. This research investigates the level of awareness and knowledge among the project teams in the construction industry towards the sustainability concept and issues within the housing development context; and how they perceived the integration of this agenda within their working environment. The project team members targeted as the respondents in this research are client organizations, construction consultants (engineers, architects and quantity surveyors) and contractors.

Research Objectives

This study aims to:

i)   Identify the important elements of sustainable development to be considered into housing;

ii)   Determine the level of awareness and understanding of sustainable development;

iii)   Discover the level of implementation of sustainable housing development that has been carried out based on the current practice.

Sustainable Development

Sustainable development can be perceived as an idea for mankind to simultaneously acquire balance and achievement between economic, social as well as environmental objectives and priorities. In support of this, several United Nations texts refer to the 'interdependent and mutually reinforcing pillars' of sustainable development as a means for economic development, social development and environmental protection (UNCED, 1993). Sustainability involves the

continuous process of maintaining a dynamic balance between the needs and demands of people for equity, prosperity and quality of life whilst maintaining healthy ecologies.
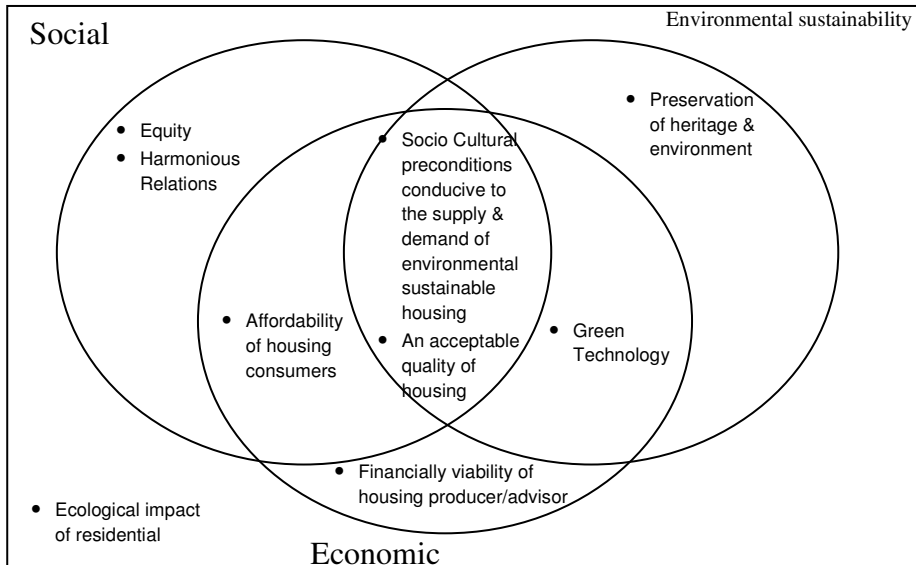
Figure 1: Sustainable Development Framework
(Adopted from Chiu, 2003)

The concept of sustainable development corresponds to a key element domain that has its own distinct driving forces and objectives. The economy is geared mainly towards improving human welfare, primarily through increases in the consumption of goods and services. The environmental domain focuses on protection of the integrity and resilience of ecological systems. Fostering positive human development in promoting a fair and just society is a part of the social aspect of sustainable development (Rozana, 2007). The social aspects of planning, layout and design of housing, creates community spirit and identity thus, people are able to self actualize and experience a good quality of life.

Sustainability objectives will be achieved only if they are implemented in all stages of the building process. Sustainability principles should be incorporated into the design and then carried forward to the construction stage in order to realize the concept. However the goal to achieving sustainable development is the greatest challenge mankind has ever faced, requiring a

concentrated joint effort among consumers, the housing industry and government. Therefore, the needs for a paradigm shift towards sustainability in housing are crucial amongst developers, professionals, builders, planners and owners.

In Malaysia there is increasing public awareness and interest in how buildings affect the environment, workforce productivity and public health. As a result, both the public and private sector are beginning to demand buildings that optimize energy use; promote resource efficiency; and improve indoor environmental quality. Developers, owners, operators, insurers and the public at large are beginning to value and market the benefits of sustainable buildings.

Sustainable Development: A New Perspective for Housing Development

The concerns about urban growth and development around issues of pollution, congestion, fuel use and building forms have been debated in different ways across the globe. Similarly planning system and legislative frameworks have been reworked around environmental and sustainability concerns. Housing by nature is multi-faceted; it consumes natural resources and produces impact on the natural environment. The position of houses, building materials, occupancy demands, energy and water consumption, independently as well as collectively have major environmental implications.

Housing may be seen as one of the prevailing factors that impact the general economy and at the same time, an important component of social development that cultivates cultural attribute, manifestation of aesthetic values and the way of life. A holistic perspective is needed to chart the future of housing development, and the paradigm of sustainable development for housing offers such possibility (Chiu, 2003). Housing is categorized as a basic human need, in which the quality, cost and availability are crucial to an individual's quality of life. With nearly 2

million homes and significant projected growths through building and stock transfer, housing associations have a major role to play in helping to achieve a sustainable future.

The general system approach to sustainability can be applied more specifically to an urban development by viewing each urban housing development as a unique system (Barton, Davis, & Guise, 1995). Nevertheless, implementing the basic principles of sustainable development in the residential sector can be many pronged; where different approaches can be used to ultimately achieve the desired outcome (Llewellyn-Davies, 1997). The lack of a defined or rather standard systems approach will no doubt cause confusion and decreased interest in the vested parties since housing development practices currently implemented have been in place for so many years (Barton, et al., 1995)

Operating the fundamentals of sustainability and applying it to real-world human settlements situations are much more difficult than one might expect. It is only more recently that sustainability has been applied to the consideration of the quality of development in human settlements (Choguill, 2007). Among the actions are to develop homes constructed out of recyclable or renewable materials, designed for a longer use and have minimal impact on the environment (Mobbs, 1998)

It can be argued that environmentally friendly houses allow for more affordable living in the long run as they minimize energy costs. However, it is perceived that neither the private market nor public housing providers have shown much interest in environmentally sustainable housing, because housing is driven by the marginal cost of construction and the question of affordability. The concept of sustainability in housing development should be limited within the need to fulfill basic human needs, absorptive capacity of waste absorption limits, minimizing the

use of non renewable resources and promote use of renewable resources. With this inclusion, the general approach of sustainability can be tailored to address human settlement issues.

The main goal of sustainable housing is to develop affordable housing that are (1) durable and long lasting; (2) cost effective to build and practical to maintain; (3) use natural resources and materials efficiently based on their life-cycle environmental impacts; (4) conserve water, reduces runoff and treats waste-on site; (5) maximize energy conservation and efficiency; (6) reduce building footprints, simplify building shapes and maximize space efficiency; (7) optimize building orientation to integrate natural daylight and ventilation; (8) healthy by eliminating toxic and harmful materials in facilities and surrounding environment; (9) support transportation alternatives; (10) reduce, reuse and recycle materials in all phases of construction and deconstruction; (11) apply maintenance and operational practices that reduce or eliminate harmful effects on people and environment, and (12) design for future flexibility, expansion and capable of safe and efficient building demolition (Housing-Corporation, 2002). The guidelines set may be able to aid housing developers to set performance specifications to better design and evaluate projects. This will act as a base to develop a framework for sustainability.

Elements That Promote Sustainable Development

Economic Aspects

Economic sustainability refers to a system of production that satisfies present consumption levels without compromising future needs; given the environmental constraints and costs (Basiago, 1998; Khan, 1995). The modern concept underlying economic sustainability seeks to maximize the flow of income that could be generated while at least maintaining the stock of assets which yields these beneficial outputs. The development of technology, building

materials and housing designs to mitigate environmental impact of housing activities, and their

implication for financial viability of housing projects, are important.

Social sustainability
Quality of life
Socio-cultural amenities
Diversified accommodation
Overcome social segregation

Institutional sustainability
Stability
Innovative & Partnership
Enabling Governance
Transparency & Accountability
Appropriate Development Control

HOUSING SUSTAINABILITY FRAMEWORK

Environmental sustainability
Air Quality
Land & Biodiversity
Water Conservation
Waste Management
Alternative Sanitation
Resources Recovery
Energy & Material Efficiency
Renewable Energy

Economic sustainability
Access to land & security to tenure
Affordability & Alternative finance
Job Creation
Cost saving

Figure 2: Sustainability Conceptual Framework for a better Quality Living
("South African Consulate General, Housing: Urban Development Framework," 2007)

Environmental costs theoretically need to be accounted for as production costs, if long

term sustainability and equity are to be sought as mandated by the advocacy of sustainable

development (Munro, 1995). The environment cost also refers to the financial viability of private

housing projects, or the socio-political gains against financial costs for subsidized housing

projects and the ability of housing consumers to afford an acceptable quality of housing. It is

inferred that in order for housing to be economically sustainable, the benefits to housing

providers and producers must at least be equal to the costs of housing production given the

housing demand levels.

Social Aspects

Social capital is the resource which people draw upon in pursuit of their aspirations and is developed through networks and connectivity, membership of more formalized groups and relationships of trust, reciprocity, and exchanges (Munasinghe, 1992). There is also an important element of sustainability that incorporates equity and poverty alleviation. Thus, the social dimension of development includes protective strategies that reduce vulnerability, improve equity and ensure that basic needs are met. Future social development will require socio-political institutions that can adapt to meet the challenges of globalization.

Social sustainability in some ways, equates with ecological sustainability, and hence is analogous to ecological limits, as there are social constraints limiting development, which are set by social norms (Chiu, 2003; Mitlin & Satterthwaite, 1996; Monroe, 1995; Munro, 1995). Thus to achieve ecological sustainability which is at the heart of sustainable development, the social structure, social values and norms must be changed so that they are conducive to the sustainability of the environment.

The consciousness and the willingness to live in an environmentally sustainable way will affect housing producers and related government organizations in many ways, for example, the choice of housing sites, the land use planning principles and intensity, the use of environmentally friendly design, building materials and construction methods, the attention to the livability of the property and the impact of the design on the physical quality of life of residents.

Construction and the Environment

The notions of a safe threshold and carrying capacity are important to avoid catastrophic ecosystem collapse. Ecological sustainability of a development activity can be inferred as the

activity that acknowledges biophysical limits and the need to maintain essential ecological processes and life-support systems upon which all life depends (Zovanyi, 1998).

The materialistic culture has caused many housing consumers to continuously seek for bigger homes, ignoring the toll of residential activities on the natural environment. Housing consumers could adopt values which are protective towards the environment such as reductions in energy consumption, optimal use of green design and measures in-built to the property and most importantly, giving preference as well as the willingness to spend more to acquire housing which is built on environmentally friendly principles using green building materials.

Stage		Impacts
Conception & Planning Stage	Reflection ➙	- Impact of the choice of the site - Affects of the development on local ecological system - Opportunity to optimize existing infrastructure
Design Stage	Reflection ➙	- Emphasis on energy saving designs, minimum resource utilization, efficient waste management. - Use of environmentally-friendly building materials and construction systems.
Construction Stage	Reflection ➙	- Extent of using environmentally friendly materials - Minimization of local environment disruptions (dust, noise, & traffic) - Minimization of environmental hazard (construction waste disposal & hazardous materials)
Building Stage	Reflection ➙	- The impact of residential activities on the local and global environment. - Environmental quality of the living environment
Refurbishment Stage	Reflection ➙	- Good maintenance may minimize the need to undertake large-scale replacement of building components
Demolition Stage	Reflection ➙	- The emphases are placed on resource conservation - Impact of the demolition process on the environment.

Figure 3: Impacts Arising From Each Construction Phase (Self –Developed)

An ecological dimension has to be added to the production and consumption processes of housing in order to apply the concepts and principles of environmental sustainability to housing

(Bhatti, Brooke, & Gibson, 1994; Chiu, 2003; Rydin, 1992). The impact of the six stages of construction on the ecological system can be examined in order to steer housing development towards sustainability.

Research Methodology

This study adopted quantitative research techniques for data collection and analysis. To devise a framework congruent to the research objectives, a literature review on the elements and indicators of sustainable development was conducted. Based on the review of published literature and previous research, three key dimensions were identified as being critical foci for this research. The dimensions of environmental, economic and social sustainability which contribute significantly to the successful development of a viable housing sustainability framework form the backbone of the questionnaire which was subsequently designed to gauge and chart the level of awareness as well as the degree of implementation of sustainable development. The three main dimensions were expounded into interrelated variables as a means to better comprehend and analyze the feedback gathered from the targeted respondents. The target questionnaire respondents were focused on key players within the construction industry currently operating and located within the state of Penang, Malaysia. Ten housing projects constituting 50 respondents were identified as the target group to acquire views and perceptions towards the sustainable development issues as well as to determine the significance and level of implementation of sustainable housing development. These respondents represent the three main entities of the construction industry, namely the clients, consultants and contractors. The choice of these three respondent groups enables this research to obtain views and perceptions from the vested parties that actively partake in all phases of housing development and construction, thus

facilitating the opportunity to analyze different viewpoints from the entire gamut of the construction industry.

The questionnaires adapted Likert's scale of five ordinal measures of agreement. Ordinal scale 1 to 5 was used in ascending order to show the degree of agreement. The rationale for adopting this method of data collection through questionnaire dispersion to the target respondents is espoused on the veritable notion that a survey could cover a wide sample of population and housing projects, overcome the generalization problems posed by the experimental and case design and subsequently provide the opportunity to analyze the quantitative data through statistical techniques (Luthans, 1992). In addition, comparisons with other studies adopting similar methodological approach could also be made.

The collected data from the questionnaires was analyzed via the Frequency analysis using the Statistical Packages for Social Science (SPSS) software, version 15.0 to generate frequencies and percentages which were then visualized in the form of bar charts.
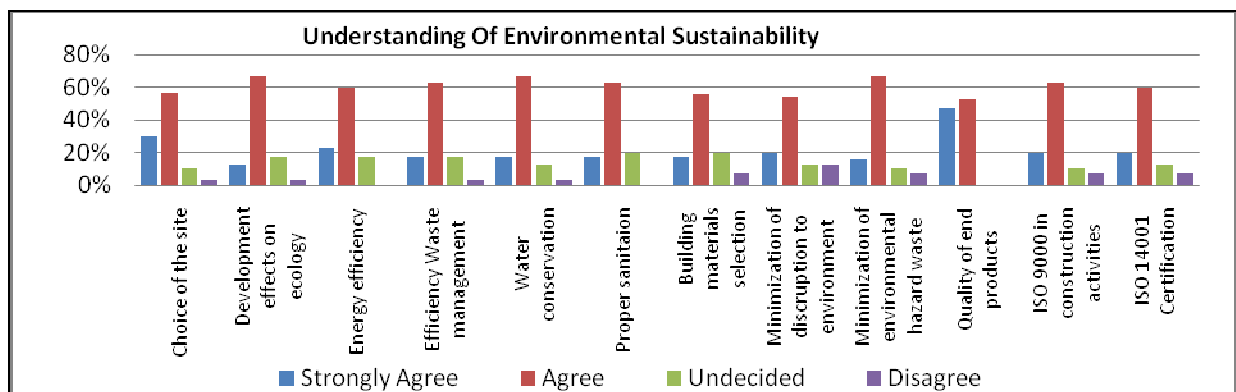
Figure 4: Understanding of Environmental Sustainability by the construction industry's key players
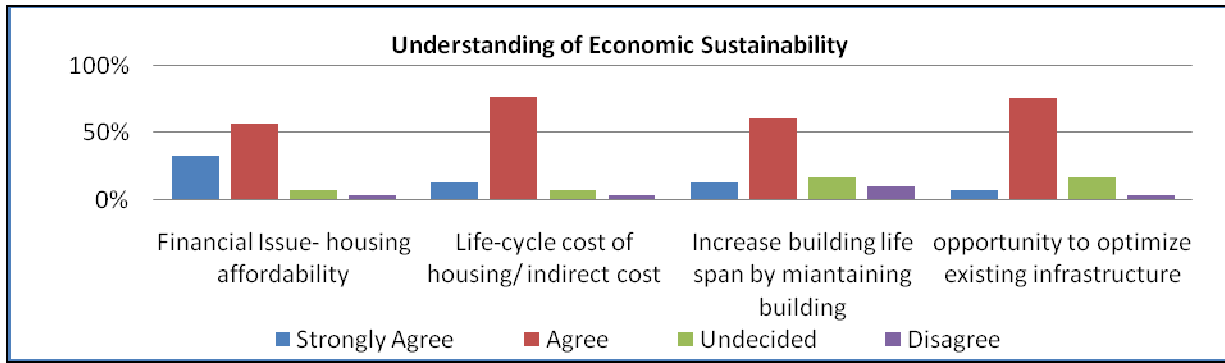
Figure 5: Understanding of Economic Sustainability by the construction industry's key players
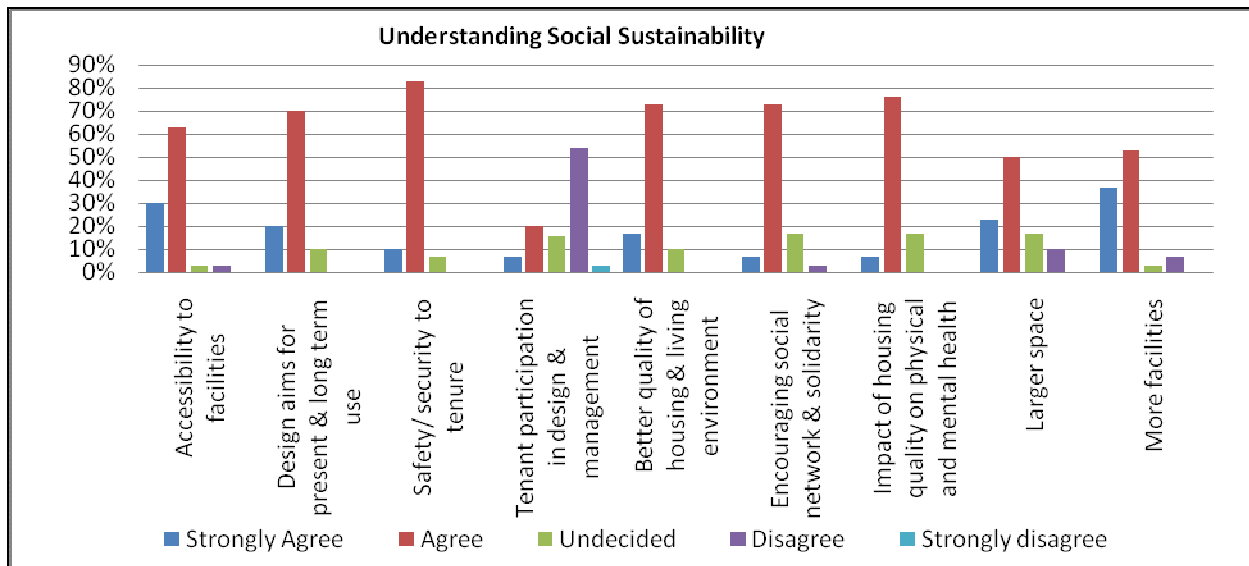
Figure 6: Understanding of Social Sustainability by the construction industry's key players
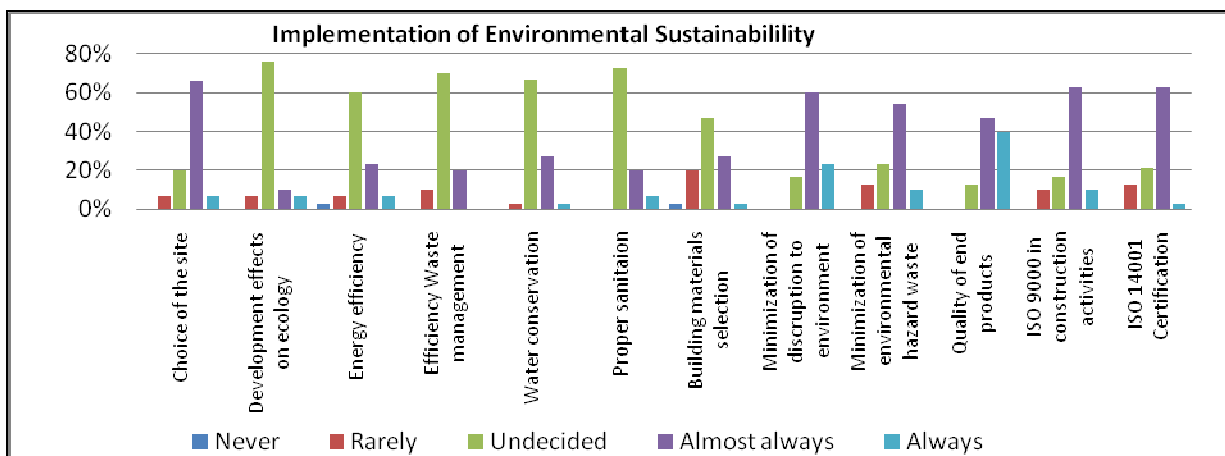
Figure 7: Level of Implementation of Environmental sustainability
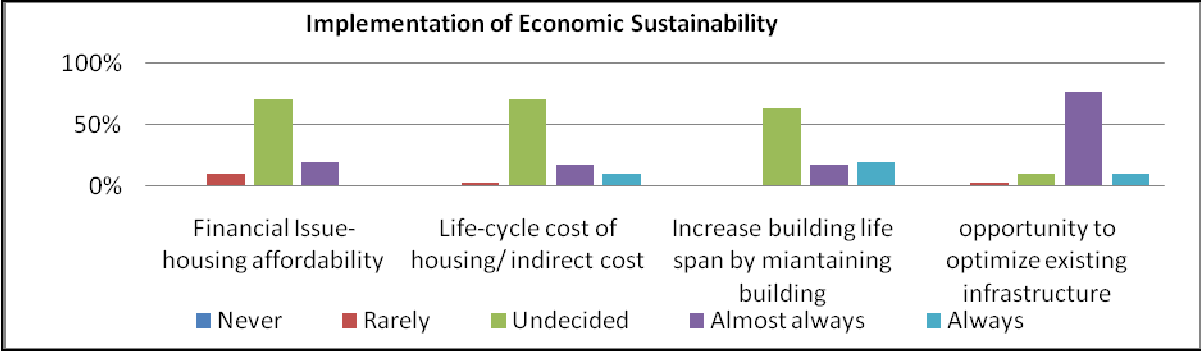
Figure 8: Level of Implementation of Economic sustainability
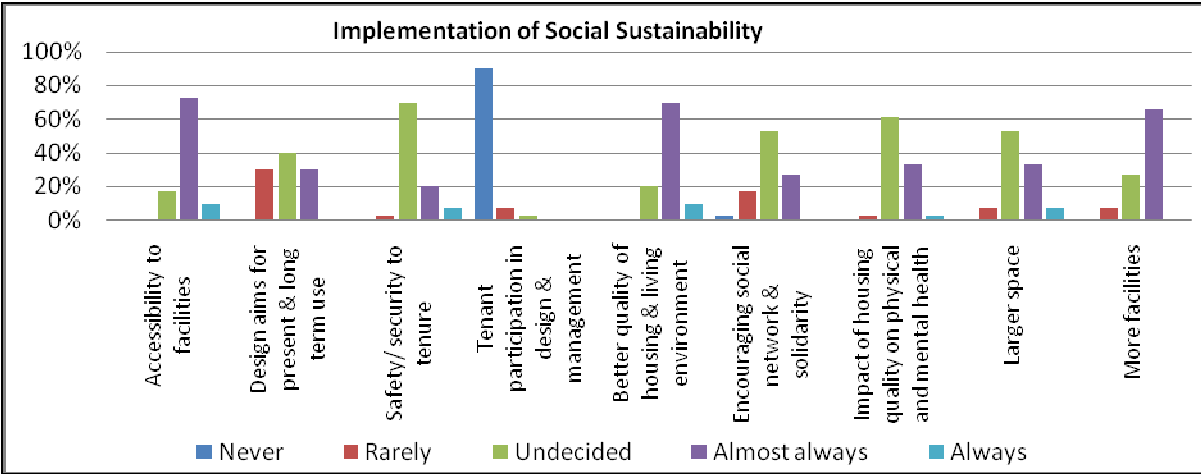
Figure 9: Level of Implementation of Social Sustainability

Data Analysis

The survey results indicate that most of the project team members do understand and are aware of the concepts of sustainable housing development. They also subsequently perceived sustainable housing development as important for the future growth of the industry. In addition, the respondents felt that project managers, consultants and contractors should play more active roles than the clients in creating and implementing sustainable housing developments.

The increasing numbers of sustainable housing development projects being built in Malaysia is an indication of the acceptance of sustainability concepts among housing developers and construction professionals. However when it comes to the implementation stage, it seems

that the project team members were unsure whether or not they had considered all the main elements in sustainable housing developments. This is due to the fact that successfully completed sustainable housing estates are few and far between. Hence, the project team members were unable to benchmark their product offerings against the successful housing schemes.

The respondents agreed that factors that contribute to environmental sustainability such as the choice of site, energy efficiency, efficient waste management and water conservation, are important determinants for sustainable housing development. However, when it comes to implementation, few stated that they had implemented or taken into account environmental sustainability. Most of the project team members were undecided or unaware on the effects of intense development on the local ecological system, energy efficiency, water conservation, proper sanitation and selection of environmental friendly building material. This does not bode well for a more aggressive approach towards providing more sustainably built housing estates.

The economic sustainability emphasizes on financial issues of housing affordability, life cycle cost, building life span by incorporating building maintenance aspects as well as the opportunity to optimize existing infrastructure. Nevertheless, most project team members seem to have a preference for the housing property to have larger space and more facilities. On the contrary, sustainability in the housing context does not necessarily mean an increase in the magnitude of either space or facilities. This scenario reflects that they might not fully understand the total concept of this particular element within the context of sustainable housing development.

As for social sustainability, it was revealed that the team members do understand and are aware that the public amenities such as public transport, shops, schools, work and recreational facilities are very much part of sustainable housing estates. Elements of ease of accessibility,

security of tenure and impacts of housing quality on physical and mental health of occupants are all perceived as important. However when it comes to implementation, elements such as design aims for present and long-term use, better quality of housing and living environment, encouragement of social networks and social solidarity in neighborhood, impact of housing quality on physical and mental health of occupants, were left undecided. This can be inferred to the existence of an unsure level in terms of social sustainability implementation. From the analysis, it can be deduced that tenant participation is unlikely in practice, which then implies the team members of having a light consideration of tenant participation in housing design and management.

Conclusions

It can be concluded that the idea of building housing estates with sustainable housing development design concepts is still relatively new in Malaysia. At present, the housing developers find it difficult to fully implement these concepts because of the unavailability of benchmarked projects. There is no doubt that the demand for sustainable housing is perceived as "always there" but the implementation is very poor because there is a lack of awareness among the housing developers, consultants and contractors. The outcome of the survey does reflect the true scenario of the housing industry; where the understanding of the sustainable concept is present but the levels of implementation of sustainable issues are still inadequate.

Relevant suggestions to increase level of understanding the sustainable housing development concept such as encouraging all parties in industry to attend seminars and conduct brainstorming session can be proposed to get a better understanding of the subject matter. Existing laws and acts on sustainability could be reviewed and subsequently proper enforcement should be carried out to ensure success of implementation. The Government could play a more

active role by supporting and giving incentives in the form of tax rebates and faster development plan approvals to those developers who carry out sustainability practices. The level of understanding and awareness of sustainable housing development among the construction project team members need to be incorporated into the sustainable housing development issues in order to produce more desirable sustainable housings.

The outcome of this study suggests that there are few areas that could be explored for future research and development. The method of survey conducted in this research was specific and prepared for certain targeted respondents. For future research, a survey combining both personal interviews and questionnaires could be extended to a larger sized target respondent consisting of house buyers as well as other key stakeholders to acquire better sampling findings that will give solid footing to a recommended the immediate and future course of action.

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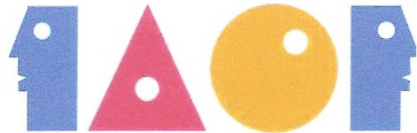
A REFINED AND INTEGRATED KANO MODEL AND THE IMPLEMENTATION OF QUALITY FUNCTION DEPLOYMENT - RESEARCH ON THE LIBRARY OF A VOCATIONAL AND TECHNICAL SCHOOL IN SOUTHERN TAIWAN

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Abstract

A recent education thought is the idea *pursuing improvement and improving quality*. The main purposes of universities and colleges libraries are to facilitate education, research and service to improve the general research and development ability. Thus, the ways that libraries offer more efficient service have significant influences on rising reputation and maintaining sustainable development.

The evaluation on the achievements of libraries is major on reader service aiming at improving service quality. By the combined methods of integrated Kano model and Quality Function Deployment (QFD), the research focuses on the service quality of a library of a vocational and technical school in Southern Taiwan. The results show that finances, plenty of staff and professional ability and technology are the key quality technologies carried out beforehand to improve service quality of the library of the vocational and technical school. Besides, the difference index shows that the greatest differences between importance and satisfaction are in the following perspectives: good application environment (for example: atmosphere, cleanliness and quiet), easy to be operated and offer query function on personal records of lending and convenience for obtaining books from shelves. The improvements of service quality should underline these three aspects from the perspective of differences between importance and satisfaction.

Keywords**:** Refined Kano Model, Service Quality of A Library, Quality Function Deployment

Introduction

Research Gaps

The main statistical data (Ministry of Education, 2009) of the Ministry of Education in Taiwan show that the number of students of vocational schools is decreasing every year. Influenced by international financial crisis, the dropout tendency of university is extended to vocational schools. There are 1500 students who do not register during the first three days of a new semester (Su, 2009). The decreasing number of students makes the completion among universities and colleges more fiercely. Thus, ways of maintaining education quality and improving completion ability becomes one of the most important research issues of universities. The recent education thought is the idea Pursuing improvement and improving quality, which is also the common purpose of each university. The education reform is becoming one of the most important programs of Taiwan government, one consensus reached between people and government. Among reform measures, the improvement and assurance of education quality is one of the popular concerns of the mass and the key point of education reform. Thus, the research on one education quality improvement strategy based on thoughtful consideration and operation should be the key points of efforts made by educators. Therefore, the literature background and motif of this essay is to figure out the demands of students on library and the methods for improvement.

The major function of university libraries, to support education, research and offer service to promote the general research and development ability of universities, have great impact on the rising of academic reputation and the sustainable development. Besides, the research of Liu (2007), universities should pay attention on the abundance of collection, one aspect of One-dimensional attribute. Now, libraries are facing the challenges of internal and

external shocks in the E-generation. As the guidance for customers becoming the new tendency of the service industry, more attention should be paid in rising service quality, collection of data and the improvement of quality of staff. Thus, reader service is the main content of evaluation on achievements of libraries (Huang, 2002). With the influence of underlining service quality and customer satisfaction trend, libraries should take following things into consideration: how to create competitive advantages and to establish business philosophy based on readers to improve service quality.

Based on questionnaires, the essay makes research on the needs of service objects of libraries. By ways of refined integrated Kano model and QFD, the analysis on the general service quality is made so that improvement priority on service can be leveled with further establishment of service quality evaluation mode and lays foundation for rising service quality of school libraries. The research questions are as follow:

(1) What are the demands on library service quality of students of this vocational and technical school?

(2) What are the characteristics of the refined Kano model of service project of the library?

(3) What is the priority of the improvement of service quality of the library?

(4) What are the key technologies of the service quality of the library?

Literature Review

Concepts of Service Quality

Gronroos (1984) stated Service quality come to exist after the comparison between customers' beforehand expectations and afterwards perceptions. Customers always have some degree of expectations as well as perception before and after receiving service. There is a

perceptual gap between the comparisons of two data, named total perceived quality. If expectations meet perception, the value of total perceived quality is high and vice versa. Lewis and Booms (1983) said Service quality depends on the satisfaction degree of customers' expectation to the service.

Parasuraman, Zeithaml and Berry (1985) consider service as a dynamic process, holding that service quality is the difference between customers' expectations and the perception on service. When the latter one is bigger or equal to the former one, the service is good and vice versa.

Overall, service quality is the customers' perception on the service provided in relation to the quality that was expected. During this dynamic process, when expectation is met, the service is good and vice versa.

Dimensions of Service Quality

According to Juran et al. (1974), the influences of service quality on customers are classified into five dimensions: 1. insight quality: this refers to invisible quality. The quality of service totally relies on the inner operation of the service staff due to its invisibility, for example, the maintenance of various kinds of equipment. (2) Hardware quality: this refers to the visible quality. The quality can be perceived immediately on the service due to its visibility. Hardware quality has close relationship with the products of manufacturing industry. For example, customer can see and feel the quality and effects of various kinds of equipments. (3) Software quality: this refers to the perceivable software quality. Though, both of software quality and hardware quality can be perceived, the former one refers toe concrete products; while the latter one refers to operation, for example, whether the service staff can rightly meet customers' demands. (4) Service time quality: this refers to the rapidity of service, for example, the queuing

time in shopping, waiting time for waiters, waiting time of patients for doctors, response time on customers' complains and the waiting time for repairmen. All these reflect the quality of service time quality. (5) Psychological quality: this refers to the politeness and geniality of service providers on customers so that the comfortable environment can be established for customers, for example, the etiquette and professional dedication.

As for library service, Shi and Levy (2005) hold that service should include concrete equipment, attitudes and abilities of staff. Xie Baonuan (1998) holds that there are four influencing factors including entity environment, collection, service staff and communication. Qu Taikui (2003) holds that it should include service, simple use of searing system, book reservation, searching equipment, technologic equipment, environment, service and publication. Chen Yuhong (2002) holds that it should include service, environment, personnel and management, collection, administration and utilization education.

The study is based on opinions of Martensen and Gronholdt (2003), Shi and Levy (2005), Xie Baonuan (1998), Qu Taikui (2003) and Chen Yuhong (2002). Service quality, including 3 dimensions equipment, environment and service, are sub-categorized into 34 categories on the basis of researches of scholars such as: Chen Meiwen (2004), Huang Lichun (2002), Chen Yuhong (2002), Huang Mianmian (2006), Yuan Zheyu (2003) and so on when analyze service quality.

Kano's Two-dimensional Quality Model

General quality holds that the sufficiency of the quality elements means satisfaction and inadequacy means dissatisfaction. However, the two-dimensional quality holds that not all quality elements are like this. The sufficiency of quality elements does not ensure satisfaction.

Sometimes, it may cause dissatisfaction and indifferent. The following parts introduce theories related to two-dimensional quality model:

Noriaki Kano's two-dimensional quality model

Based on Herzberg's (1987) study, Fumio Takahashi and Noriaki Kano introduced M-H theory (Motivator-Hygiene theory) into quality field and renamed it as the M-H Characteristics of Quality. However, the name is not well accepted and he had to rename it as Attractive quality and Must-be quality. Noriaki, Nobuhiko Seraku, Fumio Takahashi and Shinichi Tsuji (1984) formally proposed two-dimensional quality models and empirical studies. It is firstly used in the development of manufacturing industry and the quality is categorized into five dimensions:

(1)Attractive quality element: Satisfaction is reached when the element is sufficient; while, the inadequacy of the element may also be accepted without quality element of dissatisfaction.

(2) One-dimensional quality element: satisfaction is reached when the element is sufficient; while, the inadequacy of the element cause dissatisfaction.

(3) must-be quality element: The element is taken for granted without better satisfaction; while the inadequacy of the element causes the dissatisfaction.

(4) Indifferent quality element: The sufficiency and inadequacy of the element lead to neither satisfaction nor dissatisfaction.

(5) Reverse quality element: The sufficiency of the element causes dissatisfaction; while the inadequacy of the element gives birth to satisfaction.

Figure 1 demonstrates Kano's two-dimensional quality model. The vertical axis illustrates state of customers' satisfaction, and the transverse axis illustrates the sufficiency of quality elements. The straight line through the origin is the one-dimensional quality. This means that the sufficiency of the element gives birth to satisfaction and vice versa. The reverse quality

is also one straight line through the origin with the opposite direction to that of the one-dimensional quality. The attractive quality and the must-be quality are represented by arcs with one above the transverse axis and one below it. This means that the possession of the attractive quality or not do not cause dissatisfaction. The possession of must-be quality closely relates to dissatisfaction category. The indifferent quality is the straight line corresponds to the transverse axis, which means that neither of the sufficiency nor inadequacy of the element causes satisfaction or dissatisfaction.

Refined Kano Model

Yang (2005) redefined the model as refined Kano model. This model can guide companies to make right plan. The procedures of category of this model are initially based on Kano's two-dimensional quality category model followed by attractive quality, one-dimensional quality, must-be quality and indifferent quality subject to mean value of importance degree. Then the four qualities are sub-categorized into eight quality models with the detail definition as shown in Figure 1. (1) *Attractive quality:* this is dividing into high attractive quality and low attractive quality. If the mean value of one certain attractive quality is higher than the total mean value, this means that the element possesses high attractive quality and vice versa. High attractive quality is the best weapon for companies to attract customers. Low attractive quality has little attraction to customers and should be discarded from the cost perspective. (2) *One-dimensional quality:* one dimensional quality is divided into high value-added quality and low value-added quality. If the mean value of certain one-dimensional quality is higher than the total mean value, this means that the element possesses high value-added quality and vice versa. High value-added quality has more contribution on customers and helps to increase
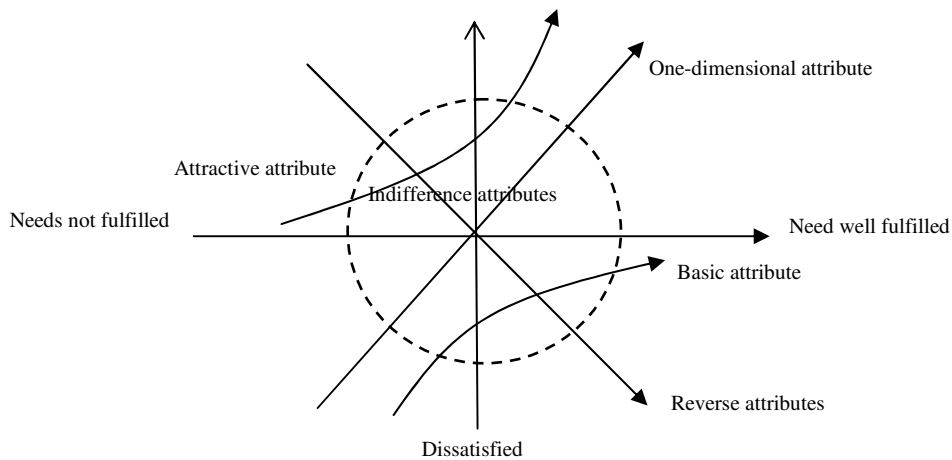
Figure1. Kano's two-dimensional quality model
Source: Yang Ching-Chow（1993）

revenue. Thus, companies should make efforts on offering this kind of quality to customers. Low

value-added quality has little contribution on customer. But companies cannot neglect this

quality. Rather, companies should avoid of lacking in service quality leading to dissatisfaction.

(3) *Must-be quality:* this is divided into key quality attributes and needed quality attributes. If the

mean value of certain must-be quality is higher than the total mean value, this means that the

attribute is the key quality attribute and vice versa. Key quality attributes are necessary quality.

Companies should fully offer this kind of service to customers and meet customers' demands.

Needed quality attributes are the basic quality that companies should reach to avoid customers'

dissatisfaction quality.

(4) *Indifferent quality element:* this is divided into potential quality and non-disturbance quality.

If the mean value of certain indifferent quality is higher than the total mean value, it is the

potential quality. If the mean value of certain indifferent quality is lower than the total mean

value, it is the tolerable quality. The potential qualities gradually become the attractive qualities to customers. Companies may take these qualities as strategies into consideration for future service providing to attract customers. Non-disturbance quality can be omitted from cost perspective. By curved lines, Figure 2 demonstrates the categorization methods of integrated Kano model of quality attributes.
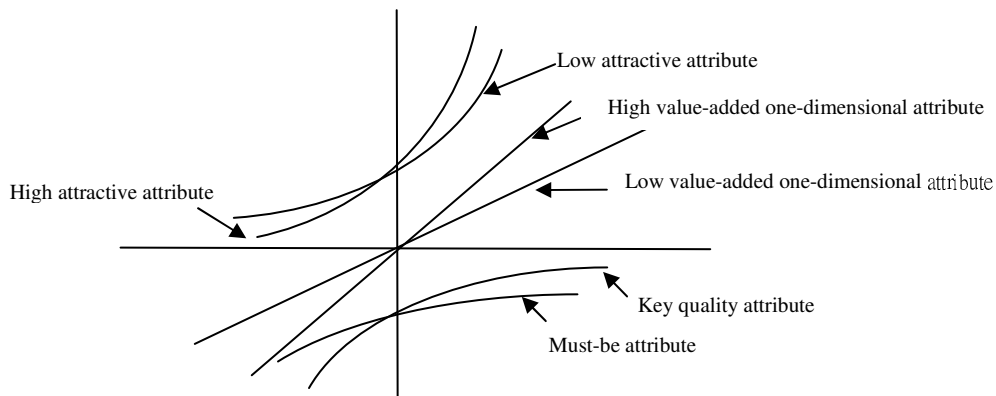
Figure 2 Refined Kano quality model
Source: Yang Ching-Chow (2005)

Kano Model of Quality Attributes

The categorization of quality attributes consists of a set of positive and negative questions along with comparison on positive and negative questions of cross alternatives of customers. The categorization of attributes of the research makes reference on Source: Compiled by the Research two-dimensional categorization diagram of two-dimensional quality model with slight modifications of Noriaki Kano (1984) and Matzler and Hinterhuver (1998). The quality attributes are classified into 5 categories: must-be quality, attractive quality, one-dimensional quality, indifferent quality and reverse quality as shown in Table 1.

Categorization of Two-Dimensional Quality Model

The summarization of above researches shows that library service quality may not all belong to sufficient provide category, that is, high satisfaction level. Due to limit improvement funds, the improvement is more effective if it focuses on prioritization reform attributes and improvement of key technologies. Thus, the research on the cooperation usage of refined Kano model and QFD on library service quality is very important.

Quality Function Deployment

Quality Function Deployment; QFD is started from the quality tactics of the manufacturing industry and most service industries recently used this tactics to improve service quality. The following explanation is the definition, benefit and executive procedure of Quality Function Deployment; QFD.

Concept of QFD

Shigeru Mizuno (1987) defined QFD as "step-by-step deployment of a job function or operation that embodies quality, into their details through systematization of targets and means."

Bossert (1991) holds that QFD provides structure methods to facilitate the establishment f process of a company. This process may help to understand customers' requirements. Lai

		Inadequacy of Attributes				
		Like	Granted	Indifferent	Tolerable	Dislike
Sufficiency of Attributes	Like	Null Quality	Attribute Quality	Attribute Quality	Attribute Quality	One-dimensional Quality
	Granted	Reverse Quality	Indifferent Quality	Indifferent Quality	Indifferent Quality	Must-be Quality
	Indifferent	Reverse Quality	Indifferent Quality	Indifferent Quality	Indifferent Quality	Must-be Quality
	Tolerable	Reverse Quality	Indifferent Quality	Indifferent Quality	Indifferent Quality	Must-be Quality
	Dislike	Reverse Quality	Reverse Quality	Reverse Quality	Reverse Quality	Null Quality

Shunzhen (2001) holds that QFD is used to meet customers' requirement. By way of Step-by-

step guide, it develops customers' expectation qualities and translates them into operational quality program to understand prior qualities.

Overall, this research holds that QFD is systematized methods which reflect customers' requirements and translate them into production plans and service strategies.

Effects of QFD

On the basis of Liu Yuanchao(1995) and Lai Shunzhen (2001), the effects of QFD including: (1)It reduces time and energy on design period and design changing period; (2) It reduces time and energy during design period and design changing period; (3) It reduces amendment time and waste on cost; (4) It establishes sequences and information deployment method; (5) It reduce the development cycle; (6) It reduces the Start-Up-Cost substantially; (7) It reduces alternation in design; (8) It decreases the possibilities of fastidious and demanding but inept in design; (9) It establishes team-work environment; (10) It helps reach common decision; (11) It keeps written data.

Execution of QFD

Execution of QFD is the construction procedure of House of Quality (FOQ). Subject or different objects and purposes, there are different procedures. The procedures include three layers: service plans, component plans and operation plans. The basic frame of FOQ includes: (1) customers' requirements; (2) analysis of engineering; (3) analysis of competition; (4) evaluation of technologies; (5) Interrelationship matrix (Brown, 1991), as shown in Figure 3.

Yoji Akao（1994）apply QFD into service industry, as shown in Figure 4. The procedures are as followings: (1) Demanded quality deployment chart is drawn based on questionnaire and topics in focus. Evaluation of quality importance is made according to occurrence frequency; (2) Quality deployment chart is made according to demanded characteristics

deployment chart; (3) Quality matrix is made on the use of both demanded quality deployment

chart and quality deployment chart; (4) Based on importance value of requirement quality
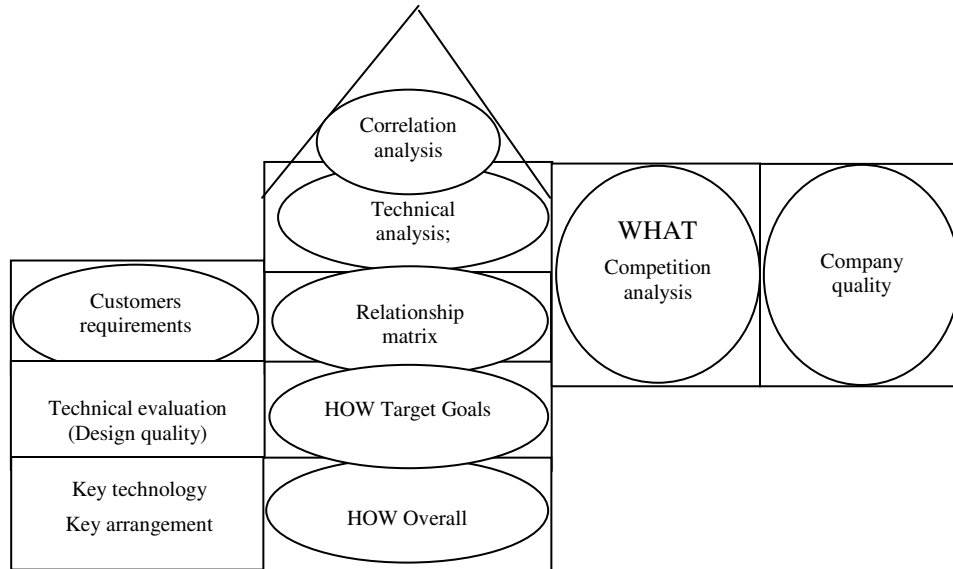
Figure 3 Frame of house of quality (Source: Brown, 1991)

characteristics and correlation between requirements and needs, importance value of each

characteristics is rated; (5) Based on service mechanism, process deployment chart is made; (6) On

the reference of process deployment charts and quality deployment chart, quality process

deployment matrix (B) is made; (7) Calculation importance value of various processes from

importance of quality characteristic values and correlations between characteristics and processes;

(8) Decide motifs of process during process procedure, draw matrix (C) together with process

deployment chart and calculate importance value of motifs; (9) Based on processes of matrix (B)

and (C) and the significant value of motifs, by way of Plato picture or QA charts, QC application

charts of different tradeoffs are made together with the implement of comprehensive quality

assurance activities.
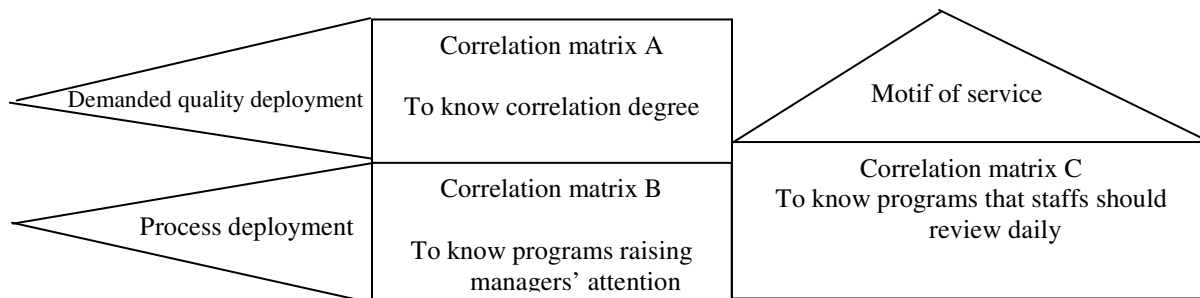
Figure 4 Quality Deployment Chart

Source: Yoji Akao (1994), translated by Chen Yaomao, Quality Function Deployment

Methodology

Research Frame

Based on the research purpose and literature review, the research frame is shown by Figure 5 aiming to understand customers' satisfaction degree on library service quality, to establish requirement quality of library service quality of the vocational and technical schools and get the priority of improvement of library service quality and conduction key technologies.
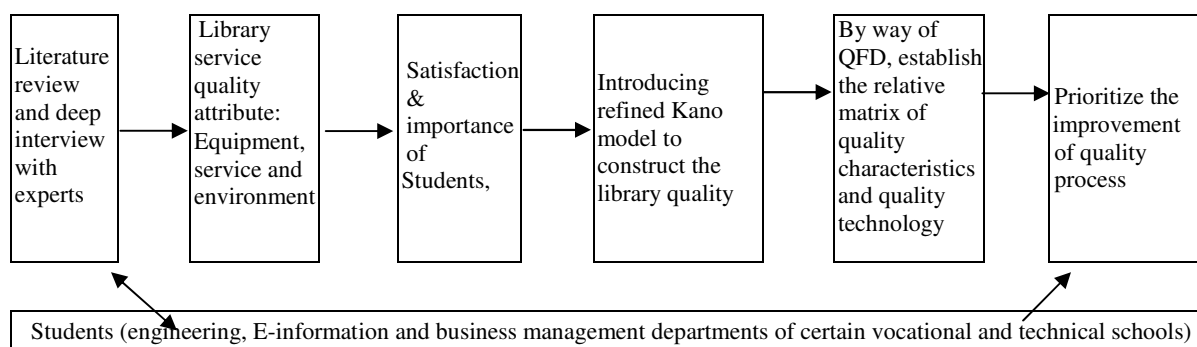
Figure 5. Research frame (Source: Compiled by the Research)

Research Procedures

This research adopts integrated refined Kano model and QFD, with attribute categorization and adjustment of weighting, in order to facilitate the establishment of sequence of quality

enhancement and the selection of key technologies. The research steps, demonstrated by Figure 6, are as followings: the 1st step is the establishment of measure standards for service quality. The questionnaire are designed on the basis of literature review and then dispatched to collect students' opinions on library service quality. The 2nd step is to evaluate importance and satisfaction value. The analysis is based on results of questionnaires. The 3rd step is to categorize according to refined Kano model. The categorization of results of questionnaires is based on Kano's two-dimensional categorization. Then, comparison of importance value of programs and general mean value is made for the purpose of categorization based on Kano's two-dimensional categorization. The 4th step is to adjust comparison value. According to refined Kano model to categorize quality attributes and pick out high attractive qualities, high added-value qualities, low added-value qualities, key quality attributes, must-be quality attributes and so on. These attributes are re-prioritized and sequenced as 6, 5, 4, 3, 2 and 1. The 5th step is to calculate adjusted priority. The 6th step is to re-sequence the elements. The 7th step is to establish the priority of quality enhancement With results shown. by House of Quality, priority of quality enhancement and the key technologies of improvement of conduction of processes.
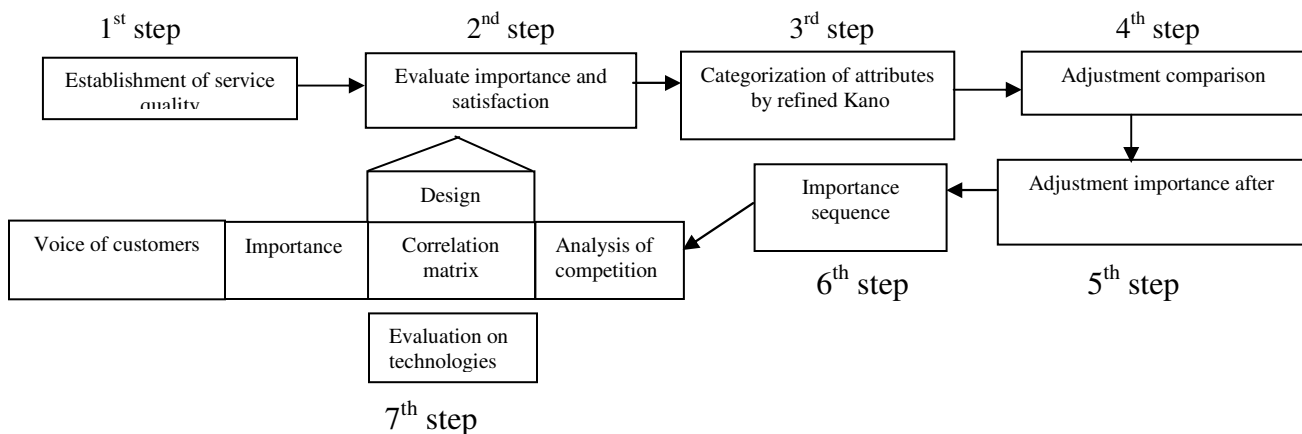
Figure 6.

Research Procedures
(Source: Compiled by the Research)

Design and Objects of Questionnaires

Study objects of the essay are random-selected students of one vocational and technical school in Southern Taiwan. Totally, there are 1,000 students involved in the research. The method adopted is questionnaire and the tool for collecting data is Questionnaires of Vocational and Technical School Students on School Library Service Quality.

The design and the modification of Questionnaires of Vocational and Technical School Students on School Library Service Quality makes reference to Shi and Levy(2005), Xie Boanuan(1998), Yu Taikui (2003), related studies and the interview opinions of experts. There are 4 kinds of questionnaires including importance value, satisfaction value, already done and undone respectively. Library service quality is divided into different dimensions such as equipment, service, and environment and so on with 34 sub-categories.

Basic data include gender, grades, and length of schooling, groups and different willingness of entering higher schools. The score system is divided into 5 degree as dislike, tolerance, indifference, granted and like subject to the fulfillment of library quality attributes or not. Scores of 1, 2, 3, 4 and 5 are rated according to personal perception. Another questionnaire is based on the questions the same with the former questionnaire. The interviewees' attitudes on the importance and satisfaction of accommodation qualities are divided into two categories with 5 alternatives respectively, named: extremely unimportant, unimportant, so-so, important and extremely important as well as extremely dissatisfaction, dissatisfaction, so-so, satisfaction and extremely satisfaction. Scores of 1, 2, 3, 4 and 5 are given according to interviewees' personal perceptions.

Quality Function Deployment, QFD

The research makes reference on researches of Lai Shunzhen (2001), Guo Junting (2003) and Zhang Xuhua (2006). The research of QFD must use the following methods elaborated below.

Location of demanded quality

The quality attributes rely on literature review omitted elaboration here. During the produce of quality deployment charts, the research makes use of refined Kano model to save man power, raise accuracy and precisely obtain psychosocial location of quality demands of customers (students) so that the establishment of quality standards and layout characteristic service. After classification of quality elements, according to refined Kano model definition, low-attractive quality may be discarded from cost perspective. Those belong to non-disturbance quality, whether to be offered or not, cannot raise quality. Thus, low-attractive quality and non-disturbance quality should not be taken into consideration.

Establishment of engineering quality elements

The establishment of engineering quality dimensions makes reference on studies on measure of service quality of Parasuraman et al. (1985;1988) and Juran(1986) together with the deep interview with school's administration staff. Firstly, general environment, hardware equipment, administration and operation procedures, service and the network structures are established. Then, the general environment dimensional deployment is subdivided into the appropriateness of library location, safety of library design, disabled equipment environment, landscaping and cleanliness. Hardware equipment dimensional deployment can be sub-categorized as providing of computer equipment, study rooms, research rooms, leisure equipment and copiers. Administration and operation dimensional deployment is divided into library regulations, appropriateness of management, simplicity of lending and borrowing procedures, sufficient staff and funds, simplicity

and rapidity of data searching methods, contingency response ability and in-service training education. Staff service dimensional deployment can be sub-categorized into professional ability and skills, genialness of service attitudes, service response ability, cooperation of service, and communication skills. Network dimensional deployment can be sub-categorized into clarity, accuracy, on-line answer and on-line borrowing and lending projects.

Weighting priority of service quality elements

(1) Difference index: The new evaluation value is got from the subtraction 3 respectively from original importance and satisfaction values. After the transfer, the quality enhancement index is got from multiplying importance and satisfaction values and new sequence is reached based on re-evaluation. The subtraction of importance rate and satisfaction rate is difference index. The smaller is the index, the earlier is enhancement of quality. When difference index is the same, the smaller is the index of enhancement of quality, the more priority should be given. (2) Original priority weighting (Z_i，i is No.i quality attribute): Based on difference index, the smaller the index is, the more prior the enhancement should be given and sequence is established according to this rule; (3) Priority weighting (X_i，i is No.i quality attribute): Priority weighting is got from re-arrangement of the sequence of original priority weighting; (4) Standardized weighting: the sum of the division of priority weighting and original priority weighting is standardized weighting. ($Y_i = X_i / \sum_{i=1}^{n} X_i$，i is No.i quality attribute，n is the number of entities of quality attributes.)

Relation between quality elements and quality technologies

Discussion is made with relative personnel and schools administrative staff on the correlation between quality elements and quality technologies. In the relation matrix, 5 represents the highest relation, 3 means moderate relation and 1 means low relation.

Quality technologies weighting

(1) Quality technologies absolute value (Wi): technology absolute value of each technology is the sum of results of multiplying standardized weighting of each element and quality weighting refined Kano model, that is Wi=$\sum_{i=1}^{n} Yi*Ti*Si$. Ti is No. i's quality attributes weighting. Si is the relation between No.i's quality attribute and quality technology. 6 means high attractive quality weighting, 4 represents high added-value weighting, 3 means low added-value element weighting, 2 represents key quality element attribute weighting, demanded quality attribute weighting is represented by 1. The regulation makes reference to researches of Zhang Xuhua (2006). During the research, attractive quality, one-dimensional quality and granted quality weighting is respectively represented by 4, 2 and 1. Refined Kano model holds that high quality attributes are with more values among attractive element and low attractive quality may be discarded from cost perspectives. Thus, the research does not include low attractive quality weightings. (2) Quality technology relative weighting Ui: this refers to the total sum of division of quality technologies absolute value and quality technologies absolute value, that is, Ui= Wi/$\sum_{i=1}^{n} wi$. The sequence based on this weighting value is the priority of technology conduction enhancement.

Analysis of Data and Research Results

Research Objects and Obtain of Sample

The research object is the vocational and technical school in Southern Taiwan, from 12th May to 12th June. The questionnaires are dispatched into students of Engineering Department, E-information Department and Business Management Department. There are 1,000 questionnaires

dispatched and 639 pieces return. The return rate is 63.9％. After data sorting, there are 476

pieces of valid samples and validity rate is 74.49％.

Project Analysis

The research adopts analysis methods on the basis of Qiu Haozheng (2003). Firstly, sum

of all the questionnaires is reached. Based on values sequenced from high to low values,

questionnaires with values below 27% are classified into low score category. Questionnaires

with values above 73% are classified into high score category. Then, t-test is carried out on

results of each question of tested bodies of these two categories. After analysis of data, it is

figured out that there are 136 questions possessing discrimination degree. All the questions can

discriminate response degrees of different tested bodies and the continuity of contents.

Validity analysis

The questionnaires of library service quality dimensions used in this research are on the

basis of summarization of literature, such as Shi and Levy (2005) and other relative experts.

Questions are based on contents proposed by Huang Mianmian (2006) and other scholars together with

experts' interviewing opinions. As the contents of literature review have been tested by academic filed

and possess content validity, thus, questionnaires on library service of the essay are designed based on

synthesis of Kano's two-dimensional model and scale opinions with contents validity in discussing

characteristics of students' demands on dormitory service. Thus, the questionnaires possess certain

content validity.

Reliability analysis

From Table 2, it can be found out that when library service quality with fulfilled

attributes and non-fulfilled attributes, importance value and satisfaction value, from 3

dimensions of equipment, service and environment, possess high reliability(values of Cronbach

α>0.7）. Thus, contents of the scale table are high in consistency and possess inner reliability

consistent index.

The results show that when attributes is fulfilled and not fulfilled, among 136 importance and

satisfaction question entities, all the scale coefficient α>0.7.Therefore, all the questions in the

research possess discrimination degree and can discriminate different responses of tested bodies.

Table 2

Excerpt Table of Scale Reliability on Library Service Quality Programs

Sub-scale tables	Number of questions	Cronbach α value			
		Attributes fulfilled	Attributes not fulfilled	Importance value	Satisfaction value
Equipment	7	0.8067	0.8338	0.7831	0.8089
Service	24	0.8587	0.9227	0.8403	0.8212
Environment	3	0.7145	0.8337	0.7238	0.7005
Total scale tables	34	0.8997	0.9441	0.8864	0.8796

Source: Compiled by the Research

Kano's Two-dimensional Quality Total Analysis

The library service quality attributes are categorized based on Kano's two-dimensional

model. Select quality attributes with relative more repetitions under conditions of fulfilled

attributes and non-fulfilled attributes. On the basis of categorization of attributes in Table 1,

Figure 7 is got with each quality attribute.

The research finds out that among 34 library service quality attributes, one-dimensional

qualities include 5 entities such as convenience of book arrangement. These library service

qualities are worth the attention of school broad. Thus, schools should give priority to these

quality attributes for enhancement. Those belong to must-be quality attributes include 20 entities.

These are must-be qualities of school library service. They should not be neglected due to the

possession leading to no higher satisfaction. Those belong to indifferent qualities include 9

entities such as visual collection. These can be discarded from the cost perspectives. *Refined*

Kano Model Analysis

According to Table 3's refined Kano model analysis, it is found out that there are 5 entities possess high value-added, that is, 7, 15, 17, 18 and 23. They have great contribution to universities and raise the achievements of school library service quality. Thus, schools should try their best to offer these services. There are 11 entities belonging to key quality attributes, they are 2, 3, 5, 8, 10, 13, 16, 19 and 32-34. Schools should offer these services to meet students' demands from students' perspectives. There are 8 entities belonging to Must-be quality
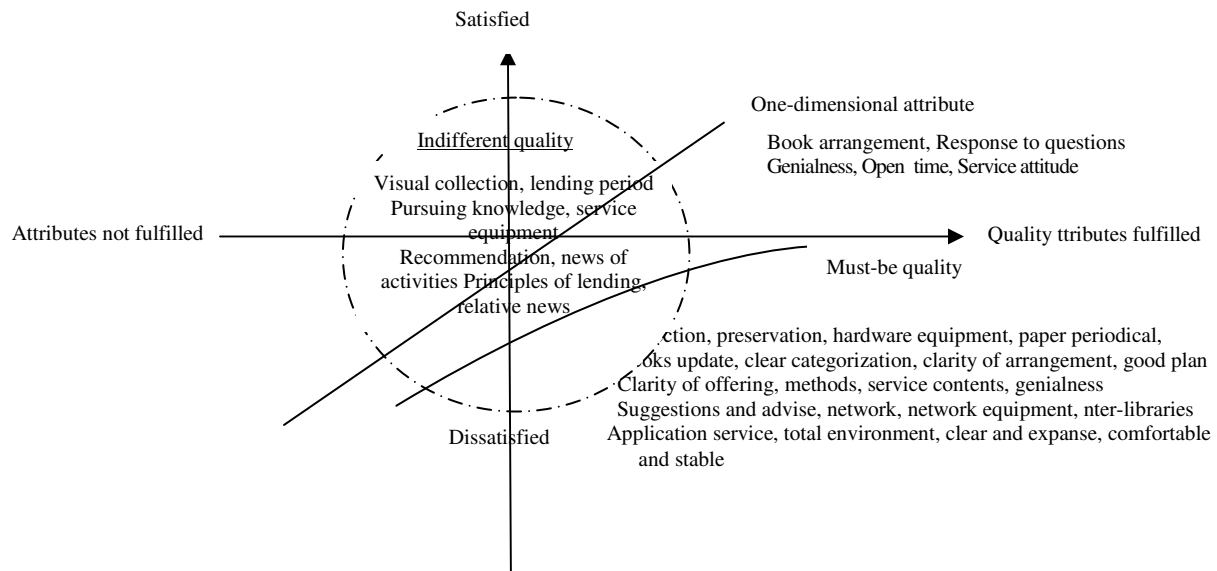
Figure 7. Refined Kano model analysis (Source: Compiled by the research)

attributes, they are 4, 9, 11, 12, 14, 20, 24 and 31. Schools should offer these attributes to some degree to prevent students' dissatisfaction quality. There are 2 entities belonging to potential qualities, they are 25 and 28. They are becoming attractive attributes. Schools should offer these attributes in the future as strategy weapons to attract students. There are 7 entities belonging to

on-disturbance qualities, they are 6, 21, 22, 26, 27, 29 and 30. Schools have no need to offer

these quality attributes from cost perspective.

Quality Function Deployment, QFD Analysis

Importance, Satisfaction and difference index analysis

On the importance sequence of library service quality, open time and convenience of

library resources are in the first place, followed by genialness and book update. On the

satisfaction sequence, book update is in the first place, followed by genialness and the quick

response to questions. Detail information offers in Tables 4.

Relative analysis of attributes and quality technologies

Combined the first three elements in high value-added sequence, importance demanded

quality sequence and different index needed improved, focusing on these elements' quality

function deployment, the technology quality attributes needed established are introduced into

HOQ matrix. After the multiple of standardized scale and the relation between quality attributes

and quality technology, with the scale of refined Kano model qualities, first three quality

technologies needed prior improved are picked out. They are funds and sufficient of staff in

administration and function procedure dimension and the professional ability and technology in

staff service dimension according to the sequence shown in Table 5.

Conclusions and Recommendations

Analysis of Conclusions

Location of demanded quality

Refined Kano model can decide library service quality attributes with great contribution and

more precise information on the basis of which school administrative can improve library

service quality subject to students' needs. For example, pick out high value-added quality with

great contributions such as convenience of arrangement, quick response, functions of website and genial to readers, open time, convenience of resources, genialness.

Key quality attributes must offer sufficiently, such as: ample and well-preserved of data-base with simple research and usage, sufficient software and hardware equipment for research, rapid update of books, clear mark of projects of each stair, dynamic planning well with clear mark, acquaintance with service and procedures as well as operation of equipment, appropriate response on suggestions and advises, personal lending records on the net with easy operation, good overall environment (such as: atmosphere, cleanliness and quietly), appropriate of location with bright and expanse space and comfortable and stable of desks and chairs. Quality attributes must reach certain must-be levels, such as: collections, fresh and timeliness of magazines and visual equipment, ample collection of paper periodicals and magazines, clear mark of service in each stair, clear operation information on equipment with operation manual with pictures, offer information actively by use of different methods (such as: e-mail, website of library), genial teaching on usage of library resources and equipment, on-line booking, renew, notice for arrival and expiration of books, inter-library service (such as: borrowing books and copies from other libraries) and implement service quality research. Potential qualities such as: service equipment (such as: copiers and scanning machine) and accuracy of lending and borrowing records. These attributes is becoming attractive attributes and administration office may take these into consideration for further strategy weapons to attract customers. Non-disturbance attributes such as: ample of visual collections (such as: DVD, VCD and video tapes), reasonable on lending numbers and periods, location for knowledge as well as relax and leisure place, receive readers' recommendation, handle art activity news,

Table 3. Refined Kano model analysis

Dimensions	Mean value of importance	Mean value of satisfaction	Kano attributes	Refined Kano attributes
30. Collection	3.960	3.853	Indifferent attribute	Non-disturbance quality attribute
31. Service / Project	4.065	3.889	Must-be attribute	Demanded quality attribute
Environment 32. Collection environment	4.273 / 4.271	3.900 / 3.906	Must-be attribute	Demanded quality / Key quality attribute
33. Preservation work / Elevation expanse	4.244 / 4.244	4.079 / 4.079	Must-be attribute	Key quality attribute
34. Hardware Equipment comfortable and stable	4.214 / 4.242	4.038 / 3.994	Must-be attribute	Key quality attribute
Equipment 4. Paper Periodical	4.139 / 4.165	4.048 / 3.968	Must-be attribute	Demanded quality attribute
5 Book update	4.290	4.155	Must-be attribute	Key quality attribute
6. Visual collection	4.065	3.889	Indifferent attribute	Non-disturbance quality attribute
7. Arrangement convenience	4.218	3.880	One—dimensional attribute	High value-added quality attribute
Service 8. Clear categorization	4.225	4.099	Must-be attribute	Key quality attribute
9 Clear mark	4.130	4.002	Must-be attribute	Demanded quality attribute
10. Good planning	4.231	3.979	Must-be attribute	Key quality attribute
11. Clear offerings	4.090	3.914	Must-be attribute	Demanded quality attribute
12 Ways	4.111	3.924	Must-be attribute	Demanded quality attribute
13. Service contents	4.229	4.032	Must-be attribute	Key quality attribute
14. Genial teaching	4.132	3.970	Must-be attribute	Demanded quality attribute
15. Responses	4.176	4.109	One—dimensional attribute	High value-added quality attribute
16. Suggestions and advices	4.225	4.069	Must-be attribute	Key quality attribute
17. Genialness	4.216	4.099	One—dimensional attribute	High value-added quality attribute
18. Open time	4.351	3.994	One—dimensional attribute	High value-added quality attribute
19. Network	4.185	3.863	Must-be attribute	High value-added quality attribute
20. On-line renew	4.113	3.874	Must-be attribute	Key quality attribute
21. Period of lending	4.050	3.866	Indifferent attribute	Demanded quality attribute
22. Pursuing knowledge	4.055	3.933	Indifferent attribute	Non-disturbance quality attribute
23. Service attitude	4.294	4.126	One—dimensional attribute	High value-added quality attribute
24. Inter-library	4.151	3.916	Must-be attribute	Demanded quality attribute
25. Service Equipment	4.174	3.924	Indifferent attribute	Potential quality attribute
26. Readers recommendation	4.004	3.859	Indifferent attribute	Non-disturbance quality attribute
27. Activity news	4.061	3.880	Indifferent attribute	Non-disturbance quality attribute
28. Lending records	4.214	3.980	Indifferent attribute	Potential quality attribute
29. Relative information	4.145	3.965	Indifferent attribute	Non-disturbance quality attribute

Table 4

Analysis Table of Importance, Satisfaction and Different index of Service Quality

Quality attribute dimension	Quality attribute	Service importance			Service satisfaction			Enhancement index	Difference index
		Before convert	After convert	Rate	Before convert	After convert	Rate		
Equipment	Collection	4.11	1.11	24	3.8256	0.8256	33	0.9164	-9
	Preservation well、	4.2437	1.2437	5	3.9706	0.9706	16	1.2071	-11
	Hardware equipment	4.2143	1.2143	13	4.0378	1.0378	8	1.2602	5
	Paper periodical	4.1387	1.1387	19	4.0483	1.0483	7	1.1937	12
	Book update	4.2899	1.2899	3	4.1555	1.1555	1	1.4905	2
	Visual collection	4.0651	1.0651	26	3.8887	0.8887	25	0.9466	1
	Convenience arrangement	4.2185	1.2185	11	3.8803	0.8803	27	1.0726	-16
Service	Clear categorization	4.2248	1.2248	9	4.0987	1.0987	5	1.3457	4
	Clear mark	4.1303	1.1303	21	4.0021	1.0021	11	1.1327	10
	Good planning	4.2311	1.2311	7	3.9790	0.9790	14	1.2052	-7
	Clear offerings	4.0903	1.0903	25	3.9139	0.9139	22	0.9964	3
	Ways	4.1113	1.1113	23	3.9244	0.9244	19	1.0273	4
	Service contents	4.2290	1.2290	8	4.0315	1.0315	9	1.2677	-1
	Genial teaching	4.1324	1.1324	20	3.9685	0.9685	17	1.0967	3
	Responses	4.1765	1.1765	15	4.1092	1.1092	3	1.305	12
	Suggestions and advises	4.2248	1.2248	9	4.0693	1.0693	6	1.3097	3
	Genialness	4.2164	1.2164	12	4.0987	1.0987	4	1.3365	8
	Open tim	4.3508	1.3508	1	3.9937	0.9937	13	1.3423	-12
	Network	4.1849	1.1849	14	3.8634	0.8634	30	1.0230	-16
	On-line renew	4.1134	1.1134	22	3.8739	0.8739	28	0.9730	-6
	Period of lending	4.0504	1.0504	30	3.8655	0.8655	29	0.9091	1
	Pursuing knowledge	4.0546	1.0546	29	3.9328	0.9328	18	0.9837	11
	Service attitude	4.2941	1.2941	2	4.1261	1.1261	2	1.4573	0
	Inter-library	4.1513	1.1513	17	3.9160	0.9160	21	1.0546	-4
	Service Equipment	4.1744	1.1744	16	3.9244	0.9244	20	1.0856	-4
	Readers recommendation	4.0042	1.0042	31	3.8592	0.8592	31	0.8628	0
	Activity news	4.0609	1.0609	28	3.8803	0.8803	26	0.9339	2
	Lending records	4.2143	1.2143	13	3.9958	0.9958	12	1.2092	1
	Relative information	4.1450	1.1450	18	3.9748	0.9748	15	1.1161	3
	Collection	3.9601	0.9601	32	3.8529	0.8529	32	0.8189	0
	Service	4.0651	1.0651	27	3.8887	0.8887	24	0.9466	3
Environment	Overall environment	4.2731	1.2731	4	3.9095	0.9095	23	1.1579	-19
	Clear and expanse	4.2206	1.2206	10	4.0189	1.0189	10	1.2437	0
	Comfortable and stable	4.2416	1.2416	6	3.9937	0.9937	13	1.2338	-7

Source: Compiled by the research

Table 5
HOQ Matrix

Relation of demanded quality attribute — column headers grouped under: Categorized quality attribute; Overall environment; Hardware Equipment; Administration and function procedures; Staff service; Network; Gffere priorindex; Original priority scale; Origin ality scale; Standard zed scale.

Demanded quality attribute	Categoriz																												Gffere index	Origin	Standard
Collection	Q2										5		5	3		1				3		1	1	1	9		1	59
Preservation well	Q1										5			3	1	1	1			3		1		11		2	62
Hardware equipment	Q1		3	3		5	5	3	5	5			5							3			3	2		14
Paper periodical	Q2										5		1	5	1		1	1		3			1	2	5	05
Book update	Q1										1	5		1	3	3		3	5		5	1	5	2	34
Convenience arrangement	V1										5	5		1	1	1							16		4	68
Clear categorization	Q1										3	3	3	1	3	5		3	3		3	3	1		17
Clear mark	Q2										1	5		3		3		3	3		3	3	0	4	08
Good planning	Q1	5	3	1	3		3	3	3	3	3		3		5	3		3		3	3	7		1	59
Clear offerings	Q2		1								3	3	1	3	1	1	3	3	3	3	3	3	6	1	31
Ways	Q2					1					1	3	3	1		1		3	3	3	3	0		19
Service contents	Q1										5	5	3	1	5	5	5	5	1	3	3	3	3	3	1 1 6	45
Genial teaching	Q2										5	1		5	5	5	5	5	5	5		3	7	0	28
Responses	V1										5	1		5	5	5	5	5		5		2	6	03
Suggestions and advises	Q1										5	1		5	5	3	5	5	5	5		5	9		23
Genialnes	V1														5	1	1	5		1		3		11
Open time	V1										5		5	3								12		3	65
Network	Q1					5						1	5		3	5	5	1	3	3		5	5	16		5	71
On-line renew	Q2										5	5		3	3	3		1	1		3	1	5	6	9	54
Service attitudes	V1										5	3	3		5	5	5	5	5	5	5	1	5	1	3	4	39
Inter-library	Q2					5					5			5	5	3	5	1	1	1	1	3	3	4 0 7	48
Service equipment	P1					5			5				3		1	1	1		1	1		4	8	51
Lending records	P1								5	5			3	3	1	1	3	3		1	5	4	3	37
Service	Q2										3	1	1	3	1	1	1	1	1	1	1	8		25
Overall environment	Q1	5	5	3	5	5	5	3	3	5	3			3								19	6	74
Clear and expanse	Q1	5			5	3																2	5	42
Comfortable and stable	Q1		3	1		1	3	3	3				1					1				7	0	57
Quality technology absolute scale		177	1.56	0.76	153	97	2.59	129	123	158	120	4.15	184	4.54	5.38	262	38	416	.43	189	.05	99	80	.68	.44	860
Quality technology relative scale		028	.024	012	025	016	041	022	021	025	020	070	031	077	091	44	57	71	075	32	052	68	31	045	058	015
Sequence of importance of conduction		16	18	25	17	23	12	20	1	19	2	5	14	2	1	11	8	4	3	19	6	15	10	7	24

Relation of demanded quality, high relation=5, mediocre relation=3, low relation=1

Categorization: V1 high value-added quality, Q1 key quality attributes, Q2 demanded quality attributes, P1

potential quality attributes (Source: Compiled by the research)

relative information on update library data and introducing meeting of library usage. These entities may be discarded from cost perspectives.

On library service demanded quality perspective, the followings are comparatively most important 2 entities on the basis of research objects: rapidity of book update together with ample and well preserved data base without trouble in searching and usage in structure dimension, open time and convenience for library resources together with genialness in service dimension, good overall environment (such as: atmosphere, cleanliness an quietly) together with comfortable and stable of desks and chairs in environment dimension. Among all these things, the most important entities are open time and convenience for library resources, genialness and rapidity of book update.

<center>*Satisfaction on demanded quality*</center>

The mean satisfaction value of research objects on library service quality of a certain vocational and technical schools in Southern Taiwan is 3.968, which means there is still space for improvement. Among quality attributes, comparatively satisfactions are rapidity of book update, genialness, and quick response to questions. Comparatively dissatisfaction entities are: book collection, fresh and timeliness of magazines and visual equipment, introducing meeting on usage of library resources and acceptation of readers' recommendation. As introducing meeting on usage of library resources and acceptation of readers' recommendation belonging to non-disturbance quality, while book collection, fresh and timeliness of magazines and visual equipment belonging to must-be quality needs, When improvement is on the comparatively dissatisfaction entities, book collection, fresh and timeliness of magazines and visual equipment should reach certain degree to solve the dissatisfaction on service quality and it facilitates to enrich the efforts if improvement standards rely on satisfaction.

Different index perspectives

As the first three entities shown by different index are: good overall environment (such as: atmosphere, cleanliness and quietly), on-line personal lending and borrowing records with simple and clear operation and convenience for arrangement. There are great gaps between importance and satisfaction in the values of these three entities. If gaps between importance and satisfaction are taken into consideration in deciding the prior enhancement qualities, these three entities should be in priority place.

Sequence on quality technology conduction

The research uses integrated and refined Kano model and QFD analysis to figure out the priority in conduction key quality technologies when improving library service quality of this vocational and technical school. The priority is given to entities of funds, sufficient of staff and professional ability and skills.

Contribution of the Research

After empirical studies, categorizations of refined Kano's two-dimensional quality model in library service quality are known. Satisfaction and dissatisfaction on each service quality is clarified. Procedure importance sequence is figured out after understanding priority of conduction on service quality so that reduce the time and energy in improvement planning and save waste of resources.

Suggestions For Further Studies

(1) Focusing on importance of engineering technologies offered by research results, further research analysis with administration and planning implement steps should be carried out for the convenience of implement of administration.

(2) Satisfaction research after improvement: focusing on the improved service quality, satisfaction research may be carried out in order to know the effectiveness of improvement measures in enhancement of library service quality with the purpose of fully usage schools' resources.

(3) Sample selection: due to limited man power and material, the tested bodies are restricted to students of a certain vocational and technical schools in Southern Taiwan. For better understanding on the whole situation of library service quality of vocational and technical schools in Taiwan, taking geographical difference into consideration, it is highly recommended to adopt stratified sampling method which classifies the area into 4 sub-categories: Northern part, Middle part, Southern part and Eastern part of Taiwan. Results based on the samples from 4 areas are more convincing and practical.

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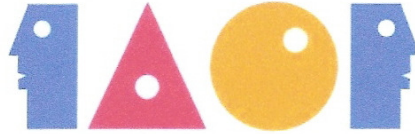
IDENTIFYING THE INDICATORS OF SUSTAINABILITY IN THE CONSTRUCTION INDUSTRY

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Abstract

The aspiration to achieve sustainability in all human activities with regards to the usage of limited natural resources had been put to the forefront of development discussions among the world leaders, industrialists and the general public for years. It is long being held that, despite its contribution to society's development and modern life, the construction industry is the main contributor of natural resources depletion and is responsible for high levels of environmental pollution. It is also considered to possess attributes that cause climate changes and other environmental threats. The construction industry, to its credit, does recognize the importance of understanding and implementing sustainable development strategies to responsibly use scarce natural resources in the construction and development activities. Despite the keenness of the industry to instill sustainable development concepts in all stages of construction processes, there seems to be a dearth of a suitable framework that can be used as a guide by the construction project teams in their planning, implementation and control of construction activities.

Therefore, there is a need to look into the fundamentals of sustainability to achieve sustainable construction. There is a wide belief that individuals, construction firms and societies need to find models, metrics and tools to articulate the extent and the ways in which current activities are deemed to be unsustainable. Developing a standard measure contributes towards achieving sustainability in all forms. In addition, it also provides decision and policy makers with all data and information of interest to draw plans to achieve the principles of sustainable development. This paper attempts to develop a framework to assess construction sustainability in Malaysia. These indicators will include the integration of all fundamentals that contribute towards sustainable development, namely, environmental, economic and social factors.

Key Words: Sustainability, Construction Industry, Indicators, Assessment.

The Importance of Sustainability

There is a growing realization among leading scientists, the public and politicians that we are using the planet's resources in ways which exceed its long-term capacity of use and this practice in turn undermines the vital life support system of the planet. In the last decade, the difference in living conditions between rich and poor people, both between and within countries, has also widened, exacerbating environmental damage (TCPA, 2003). This scenario points out that sustainability is merely not a "hear-say" scenario, but has its effects on both the local and global populace. Sustainability is considered as a global issue and it requires a global solution (Ugwu & Haupt, 2007). There is an increasing pressure on the need to achieve sustainability and the relevant authorities must formulate effective ways to achieve sustainability and to be implemented as a cornerstone for future policies (Kühtz, 2007). This is what that makes sustainability an important issue as being debated in large scale interests all over the world.

After reviewing previous studies on the subject of sustainability, it was noted that most scholars used the definition that emerged from the Brutland Commission "Our Common Future" with regards to sustainability. The report defined sustainable development as, *"… the development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* (WCED, 1987). This concept focuses equally on the economic, environmental and social values (G. K. C. Ding, 2008); making it the benchmark definition that has been adopted by various publications to base ideas, claims and support sustainability related findings.

The integration among the three sustainable fundamentals makes sustainability a holistic concept. In other words, this gives the implication that efforts in creating sustainability will have to coincide with satisfying the needs of shareholders. Sustainability can be considered as a

condition that cannot be achieved overnight. Sustainability may be perceived as a long term exercise carried out by various parties to achieve a sustainable condition within the parameters of economic, social and environmental cornerstones.

The fundamental target of the construction industry is to achieve sustainability as well as playing the role as an economic driver for the society. The principles of sustainable construction projects attempts to adhere to the definition of sustainable development by protecting the environment and enabling all people to improve their life through the pursuit of economic and social objectives.

The construction industry should take into account the concept of sustainability to promote a more positive development of society and at the same time keep at bay the negative impacts that construction may have towards the environment. The needs of future generations have always been a key aspect of the sustainability concept. As for sustainable development, there exists three key principles (Alameda County, 2002):

- Build for the long term – construct buildings that are durable and long lasting.

- Build for our children – make their environment safe.

- Build for the planet – make the materials from sustainable resources.

A rationally sustained construction industry is reflected by the progress of sustainable development fundamentals; which are social and economic factors alongside with the environmental factor. Therefore, there is a need for developing countries such as Malaysia to have the ability to assess the sustainability of their projects (Ugwu & Haupt, 2007) by using a combination of environmental, social and economic factors. The matter at hand is how to sustain the construction industry as an economic driver for the society as well as having a friendly working correlation with the environment. The sensible action to take in this scenario is to

develop a panacea in the form of a tool or technique that could enable the construction industry to function in both ways: as an economic driver; and being environmentally friendly.

The danger of implementing a sustainable development strategy and policy arises when the policy does not practice a uniform or parallel emphasis of sustainability fundamentals, for instance, to emphasize on the technological advancement while neglecting the environmental issues. To avoid this, indicators specifically designed for the Malaysian scenario should be formulated and implemented to ensure a more structured and balanced approach towards achieving sustainability in the construction industry. Previous studies pointed out the benefits of formulating the right indicators and assessment framework in order to improve construction sustainability. The previous studies done were considered as a contribution towards sustainability science in translating the global objectives of sustainability into project level decision-making to achieve a sustainable construction environment (Ugwu & Haupt, 2007).

Sustainability plays a powerful role in the social level, that is to say, having the ability to provide access to good education, creating goodwill, improving community consultation and promoting interest in various fields. Firstly, one should consider the significant issues influencing the area such as poor health, crime, and social exceptions, before any action to make an area more sustainable can be taken (Boyko, Cooper, Davey, & Wootton, 2006). Therefore, it is pertinent to consider the best criteria during the assessment, which will in turn reflect the success rate of achieving social sustainability. To deal effectively with sustainability issues, one should consider the need for extra knowledge, identification of knowledge database and be resourceful to put into practice new skills to support this process. By improving the current situation, it will subsequently help to develop capabilities of management and leadership to support the promises of sustainable development (Gloet, 2006).

From the economic sustainability perspective; the issues of sustainability deals with a wide range of factors within the local and global level (Gloet, 2006), which is, making sustainability a common issue to different business of different industries (A. Azapagic, 2003). Different industries may have different approaches towards attaining sustainability objectives. The different approaches may pose different practices in work (Gloet, 2006).

Thus in infusing sustainable development concepts within the construction industry, there is a need to be aware of the design and construct for sustainability, bearing in mind the different sustainability approaches that the end user may have. Sustainable development must account for the integration of social needs, economic and environmental impacts of the sustainability to chose the strategy (Kühtz, 2007).

From the construction industry point of view, measurement is essential in order to have good management and performance improvement (Torbett, Salter, Gann, & Hobday, 2001). Furthermore, a measurement tool can also be used to ensure that sustainability objectives are being met (A. Azapagic, 2003). This statement is also applicable in the implementation of sustainable development policies and initiatives by the construction firms. Most of the sustainability assessment methods developed by previous researchers only lay emphasis on environmental elements. Long term effects can be seen as one of the main perpetrators of environmental problems and the fiercely competitive construction firms may find it difficult to mend their ways.

Sustainability Assessment

A number of sustainability assessment framework has been used to evaluate firms performance (Singh, Murty, Gupta, & Dikshit, 2009), and the integration of the three bottom line concept assessment is necessary to demonstrate that a project can be classified as sustainable

development (George, 1999). To ensure optimization and effectiveness of sustainability implementation, the progress and shortcomings require to be measured and monitored (Singh, et al., 2009). Measuring and monitoring will be through the assessment of sustainability based on the combination of indicators for the fundamentals of sustainable development. Ding (2008) claims that multiple dimensional sustainability models were based on embracing economic, social and environmental values.

The construction industry sustainability index can be developed as a model to address the important criteria in relation to sustainable construction decisions (Ding, 2005). The index captures the complexities of the ecosystem, yet remains simple enough to be used (Ding, 2005). Lutzkendrof & Lorenz (2006) pointed out, that there is a demand for complicated as well as simple assessment process and presentation of assessment results. The assessment functions in several ways in providing a common set of standards and goals. It will also play a good role in creating the body of knowledge and expertise within the design team of building and construction firms (Cole, 1998). Subsequently, the sustainability assessment then acts as a means for education and empowerment (Mathur, Price, & Austin, 2008).

There is insufficient effort to measure sustainability with integral approach that encompasses environmental, economic and social aspects (Singh, et al., 2009). The challenge of sustainable development for any business is to acquire quality of life presently without compromising the quality of life of future generations (A. Azapagic, 2003). Sustainable construction can be achieved based on the willingness and ability of the construction firms to drive change (Bourdeau, 1999). Formulation of policies that gives change to economic market forces, are required to govern the activities of professionals in the construction industry. (Bon & Hutchinson, 2000).

To sustain the success of the construction firm, information is crucial for creating a consensus for a sustainability assessment (Gomes & Silva, 2005). In addition to that, an effective stakeholder participation is needed to develop custom indicators in developing countries to address sustainability (Ugwu & Haupt, 2007) and Malaysia is considered as one of the developing countries with its own custom features. By developing an indicator system which suits the construction industry, present problems can be identified and the solution can be subsequently proposed.

Indicators represent the method to develop and measure sustainability progress in an easy and understandable way. These indicators are aimed to measure positive movement towards sustainable activities for the systems to be measured (Guy & Kibert, 1998). Selecting indicators of the framework will depend on a number of factors such as availability of data and complexity of the analysis (Azapagic & Perdan, 2000). Critical indications of sustainable construction will focus on issues such as land use, water, energy and material use (A. Azapagic, 2004). Therefore, quantifying the amounts and types of these indicators in construction can provide a possible solution to address the issues of sustainability in construction.

Sustainability indicators are intended to reflect the application in real situations, where the usability considers principles underpinning sustainable development (Ugwu, et al., 2006), as well as playing the role to translate sustainability issues into quantifiable measures of the integration of the three bottom line factors (A. Azapagic, 2004). Indicators are also considered as a tool for policy making by experts and stakeholders (Singh, et al., 2009). The goals of creating indicators are to monitor the progress, understand sustainability and to educate the stakeholders involved in the process. Indicators must have the ability to translate both internally-relevant and externally-important sustainability issues into the representative measures of performance and

subsequently provide a holistic assessment for sustainability and reduce the number of criteria to help decision-makers (A. Azapagic, 2004).

Sustainable Construction

The countries that face a declining trend in construction projects as a result of economic recession usually see sustainability as an important issue because it could help them arrest the worrying decline (Bon & Hutchinson, 2000). Construction is important to the economical growth of every country (Raynsford, 1999; Seaden & Manseau, 2001). Sustainable construction is construction that contributes to and upholds sustainable development. With the implementation of sustainable construction, the construction firms are bound to bring about positive changes; i.e. less pollution, waste and even constitutes to the well-being of future generations. The industry contributes to the economic development of Malaysia by developing infrastructures in all phases of development which is turn spurs general and overall economical growth. The construction industry is primarily responsible for putting together all necessary resources and production facilities or structure towards establishing a cohesive inter-dependant network of economic generating units. Lack of awareness for the sustainable development principle is one of the barriers of sustainability (A. Azapagic, 2003).

The construction activities, being multi-faceted in nature, consume huge portions of raw material in order to produce the end products. Many construction companies are still relying on the conventional methods of construction devoid from the lean construction and Industrialised construction concepts. This practice produces formidable amounts of waste. Construction wastes consist of hazardous materials and are often not recyclable, thus giving rise to environmental pollution. Further, the industry irrationally produces undesirable remnants which includes depletion of non-renewable resources, destruction of landscapes and creation of health and safety

problems both relating directly and indirectly to the people involved with the construction industry (Augenbroe & Pearce, 1998).

Although the construction industry is considered important for the progress of any society (Ding, 2005; Patermann, 1999), there is no defense for their disregards towards environmental protection (Ding, 2005). Even if the industry is willing to mend their ways, they must recognize that the application of sustainability concepts to project developments requires great effort from different disciplines (Ding, 2005; G. K. C. Ding, 2008). With every project undertaken, the elements of cost, time and quality will always form the whole development equation throughout the duration of the project. A sustainable development should take into account the various construction activities that need to be performed to complete any project. These activities could involve the overlapping of different construction trades such as general laborers, carpenters, bricklayers, electricians and plumbers with each of these tradesmen with their own respective orientations. Thus, these trades have their own respective impact to the three aforementioned fundamentals of sustainability. Having considered the complexities of the construction industry, it is obvious that a sustainability assessment tool must incorporate all the three fundamentals of sustainability rather than the existing approaches that look only into environmental factors alone.

Economic growth development and the long-term effects on living standards have always been a matter of concern for people and have recently escalated into becoming a global concern (Ding, 2008). Environmental protection has always been an issue associated with the construction industry (Ding, 2005; Yahya and Boussabaine, 2006). Efforts put in by all the parties concerned in the construction industry, has made the negative environmental impacts of construction projects to be wider and better understood by architects, engineers, operators, and owners (TCPA, 2003). The Malaysian context CIB report (1998) raised the issue of protecting

the environment during construction process and introduced steps to reduce environmental impact that results from construction activities.

An initial investigation carried out in this study reveals that the Malaysian construction firms perceive sustainable development as another cost centre that can drive up their operating costs and eventually blunting their competitive edge. Because of this, as discussed in the previous paragraphs, an assessment method integrating environmental, economic and social factors needs to be developed so that the industry could effectively plan and implement sustainable development policies. Hence, it is imperative to develop a framework specifically tailored to the Malaysian scenario because as a developing country with its own unique characteristics, the newly developed framework could be the answer for a multitude of problems in relation to construction sustainability in the country.

As shown in Figure 1, the framework works in two stages; the first being to develop the sustainability concept, and the second with regards to implementation. Aspects of environment, economy and social are reflected with the understanding and formulation of the sustainability concept. Cost mitigation and balance between the environment to both the economy and social elements are crucial to prevent an unbalanced segregation of funds allotted in creating sustainability. This is imperative as construction firms might neglect the need for sustainability if the cost of creating environmental sustainability is high. The second stage of the framework views the implementation of sustainable development with a solid understanding of the concept. With all the three sustainability factors taken into account in the first place, it is highly possible to bring about environmental, economic and social benefits into the equation.

Frameworks are only effective at the macro level decision making issues, whilst at the micro level, it is best to use a holistic approach to facilitate decision making (Ugwu & Haupt,

2007; Ugwu, Kumaraswamy, Wong, & Ng, 2006). The framework only concentrates on a wider national level and is not intended to address micro-level integrated decision-making issues. This specific scope of focus however does not negate the potential benefits of this framework as by introducing the concept of a workable sustainability notion.
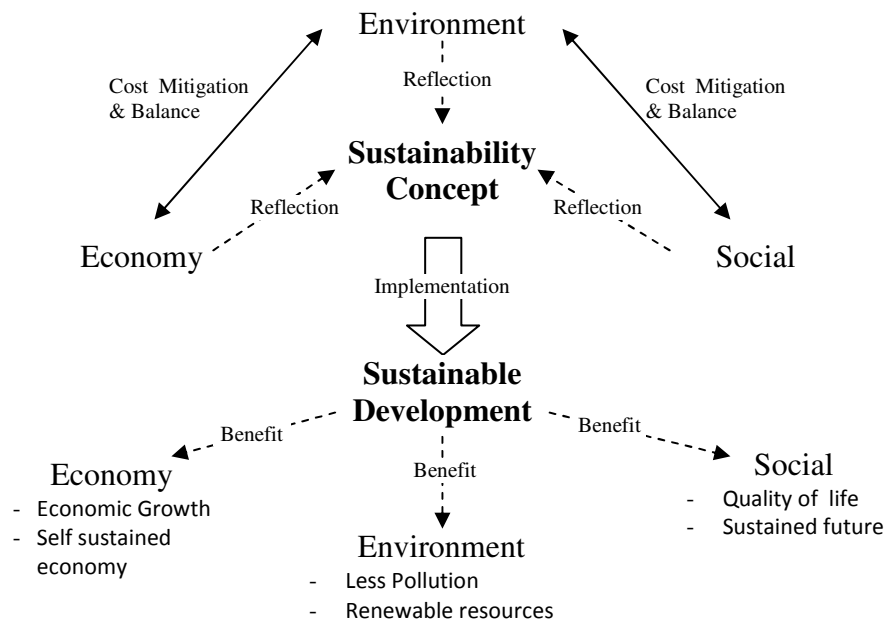
Figure 10: Sustainability implementation framework for the Malaysian construction firm

within the macro level, downstream activities, including micro level decision making, will eventually embrace and adopt the sustainability concept. This framework therefore may be impetuses towards creating working practices within the construction industry that wholly profess to the principles of sustainable development.

The developed Malaysian framework could be the right impetus to give momentum towards efforts in promoting sustainable development in the Malaysian construction industry. It is hoped that construction firms will not be put off by the term "sustainable development", perceiving it to be merely a purveyor of cost additions. Rather, with an assessment tool

integrating all the fundamentals of sustainable development, (environmental, economic and social), the firms will be able to form learned judgments towards construction sustainability.

Conclusion

There is no doubt that more actions need to be done to address some of the irrational usage of natural resources through construction activities at global levels. The depletion of natural resources coupled with the ever increasing world population indicate the seriousness of the current situation and a veritable need to address the matter at hand. Preventive measures need to be taken now so that the future generations will have reasonable amount of natural resources at their disposal whenever they need them.

The study attempts to produce a sustainability model that can be used in the construction firms. Unlike any other existing model for the construction industry, this model incorporates the three fundamentals of sustainability within it. The model was designed to specifically suit and be applicable to the Malaysian construction firms. With further modifications, it is believed it can be adopted by other countries via incorporating their distinct practices and characteristics. The benefit of this study is not only on environmental protection, but also on the internal and external interests of the construction firms, namely, the employees, owners and investors. This combination of benefits reflects social, economical and environmental protection and at the same time maximizes profits while keeping the cost of input to a minimum.

In order to encourage the practice of sustainability in the construction industry, the government could play a more active role by giving sustainability-related incentives and rewards to the deserving construction companies. The incentives are vital to lessen the short-term impacts suffered by the companies as a result of sustainability policy implementation. It is widely accepted that, despite the government's support, the application of sustainable principles will still

result in an increase in cost and subsequently a higher price to be borne by the clients. Therefore, it is in the best interest of all that the government plays an important role in achieving environmental sustainability through the development and enforcement of the rules and laws that must be abided by all relevant parties.

The integration of the three fundamentals of sustainable development into the proposed framework should encompass all the critical aspects of performance and quality in the construction industry. To minimize the cost impact arising from sustainability implementation, environment and economic sustainability issues must be taken into account during the project design phase. In the same token, the satisfaction of the end users cannot be compromised because it is important for the attainment of social sustainability. By considering the concerns of the initiators, practitioners as well as the end users, the advent of a sustainability-led construction industry may not all that far ahead.

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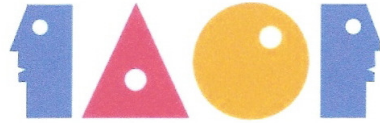
A STUDY OF THE INFLUENCES OF THE BABY BUST ON THE MANAGEMENT ENVIRONMENT OF PRIVATE TECHNICAL/VOCATIONAL COLLEGES - USING A TECHNICAL COLLEGE IN NORTH TAIWAN AS AN EXAMPLE

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Abstract

In view of Taiwan's society, there has been the phenomenon of the decreasing trend in the number of children in Taiwan, which has deeply influenced other aspects such as National Health Insurance, workforce required, alternative job opportunities, further study opportunities, etc. That's why we should find a way to reduce the influences and impingements of the decreasing number of children on the country. In addition, how a country maintains national sustainable development has become a global problem.

Taiwan's birth rate has been decreasing year by year. In 2008, the number of newborns, for the first time, is less than 200,000, forcing primary and secondary schools to reduce number of classes. Because of this fact, private technical and vocational colleges are now facing the difficulties such as how to survive, and sustainable management under such circumstances, and these would be the most important and imperative challenges for college presidents. The purpose of this study is by adopting some methods from the gray theory, to forecast the situation and trend in the future, and also to provide personal ideas and suggestions as references.

Keywords: phenomenon of the decreasing trend in the number of children, grey prediction.

Introduction

According to the research by the University of Kentucky, USA, in the US, men with low income tend to get married late without intention to have children. They prefer to live in cities. Due to the fact that young ladies, those who have got married late, and low-income men, have no desire to raise children, the number of children has been decreasing in the US.

Although the problem similar to the one in the US has also occurred in Taiwan, the causes are different. Over the decade, the birth rate has been decreasing year by year. It has become a trend. We should find out the reasons behind, in order to reduce the influences this problem may cause or may have caused.

The Causes of the Baby Bust in Taiwan

American sociologist N.J. Smelser believes that the over birth rate of a society is influenced by the social and economical factors (Swedberg, 1994). The national income in Taiwan has been increasing. This phenomenon has not only improved the nationals' living standards, but also, on the other hand, made "getting married, starting a career, and having children" become a psychological burden because of the increasing unemployment rate, stronger competition, and reducing salary. The trend of globalization has increased the competition in the Taiwan society. Parents nowadays wish their sons and daughters to become somebody. With this kind of thought, they raise and teach their children with elite education, which costs a lot of money. Considering the costs, many of the families tend to plan to have only one or two children. Some of them even want no children at all.

The Influences of the Baby Bust

The decreasing birth rate would cause the population structure to become unbalanced and the population to decrease gradually. If we allow the baby bust to keep on going arbitrarily, it

may lead to the problems of insufficient labor supply, families' heavier burden of raising children, and more serious social and economical problems. However, there are also advantages in the society under the influence of the baby bust. When there are fewer children in a family, the time parents spend on their children would be less, which means, parents would have more time for their career and goals in their lives would be more diversified.

The Impact of the Baby Bust on Colleges

The number of colleges in Taiwan has been increasing with time, now the number is 5.6 times of that before. Since the government started to promote birth control, the birth rate has been decreasing. Schools in remote districts usually enroll fewer students than schools in cities. Now with lower birth rate, what they are going to face is not only the decreasing number of students enrolled, but also their survival in the upcoming years.

Literature Review

Analysis of the Current Status of Private Technical/Vocational College Management

In this article, the operating environment of only private technical/vocational schools in Taiwan is analyzed. And the "grey prediction" method is adopted to build models for analyses. A technical/vocational college in north Taiwan is used as an example to predict the decreasing trend of number of students due to drop-out or temporary suspension in the future. It is expected that colleges can come up with their own blue ocean strategies in the environment which is under the influence of the baby bust. Fund sources, qualified teacher sources, and student sources & student qualities are analyzed in the following paragraphs:

i.   Fund sources: National universities are government-subsidized. Therefore the number of students wouldn't affect their administrative affairs. As for private technical/vocational colleges, the very first challenge is enrolment rate. For them, number of students has very direct influence

on the resources of fund used for college development. This income covers the money which will be actually spent on "faculty salaries", "buying new equipments", "industry-academy cooperation", "research subsidies", and "development of administrative affairs". Once number of students reduces, either because there are fewer newly enrolled students or because of drop-out or temporary suspension, the result may be as minor as affecting administrative affairs, or as serious as a matter of survival.

ii.   Qualified teacher sources: Currently, it's very difficult to find a job in Taiwan. Therefore, looking for a source of qualified teachers for technical/vocational colleges is not a problem. However, it is undeniable that national universities pay better than private technical/vocational colleges. And their research environments are better as well with more complete equipments. That's something you can not find in technical/vocational colleges. That's why high quality teachers and researchers tend to stay in national universities.

iii.   Student sources & student qualities: Under the education system in Taiwan, students are selected carefully and strictly via all kinds of exams. First-rate students prefer to go to national universities. Second-rate students can enter better private universities, while the rest can only go to universities/colleges of lower ranks. The departments set up in the recently years in Taiwan are not much different from the existing departments. The development of departments is influenced by the degree of enrolment difficulty instead of enterprises' demands for talents. For example, students from department of tourism and leisure management or department of food and catering management can hardly find jobs after graduation. In many of these cases, the qualities of students are just too low to provide them competitiveness.

The Impact of the Baby Bust on University/College Management

Currently, Taiwan is facing the baby bust problem. Higher education is expanding rapidly. The gap between the supply and demand of talents is changing swiftly with industrial structure. High technologies advance with each passing day. The average education level in the job market is getting higher. And the unemployment rate of highly educated intellectuals is increasing. The baby bust has affected elementary schools, high schools, and universities/colleges. Many elementary schools have closed down or been merged because of the insufficiency of students. This phenomenon is particularly common in remote districts. Relatively, similar condition of insufficiency of students has also been observed in universities/colleges. Therefore, some scholars and experts have predicted that some universities/colleges will be facing their ends.

Grey Relational Analysis

The grey theory was proposed by professor Ju-Long Deng in 1979. In March, 1982, an article "Control Problems of Grey System" in an international magazine "System & Control Letters" published by North Holland Publishing Co. made it known internationally. Over the years, through the continuous efforts made by professor Ju-Long Deng and domestic and foreign scholars/experts to develop and apply this theory, it has been adopted in more than 10 domains with many research reports being published (Deng, 1982). Mingzhi Mao and E.C. Chirwa from the University of Bolton, UK predicted the risk of death in car crash in the US and the UK with grey forecasting model. The predictions from the model were very close to the real values (Chirwa, 2004/06/15). In 2007, scholars Diyar Akay and Mehmet Atak from Turkey used Grey prediction to predict the total electricity consumption and the consumption of electricity for industrial use. The prediction was more accurate than the predictions from all the existing researches (Diyar Akay, 2007/09). Scholars Che-Chiang Hsu and Chia-Yon Chen predicted the

demand on electric power in Taiwan with an improved grey model. Obviously, the prediction accuracy was also improved (Chen, 2003).

Ju-Long Deng believes that the grey theory mainly pinpoints the uncertain system model and incomplete information to conduct the system relational analysis and model construction, meanwhile studies the characteristics and behaviors of system through prediction and decision making methods. The problems of uncertainty, multi-input, discrete data, and insufficient data can be efficiently solved through the model. The following methods have been commonly applied in researches:

i.   Grey Generating: With grey generating, from data without orders, the rules and characteristics can be revealed. It reduces the randomness and increases the orderliness of data. The commonly used grey generating methods include:

(1)   Grey Relational Generating Operation: Grey Relational Generating Operation: Processing data according to real condition without distorting them.

(2)   Accumulated Generating Operation: Accumulated Generating Operation: Data are accumulated.

(3)   Inverse Accumulated Generating Operation: Inverse Accumulated Generating Operation: Data are dissipated. It is the inverse of Accumulated Generating Operation

(4)   Interpolation Generating: Interpolation Generating; using data on hand to conduct data imputation with mathematical methods.

ii.   Grey Relational Analysis: Only few data are required for this method, and it can solve problems with complicated interrelationships between multiple factors. It's a method to measure the degree of relationships between discrete series.

iii.   Grey Modeling: Using generating series to create a set of grey pseudo difference equation

and grey differential equation. It can be categorized into the following:

(1)   GM (1, 1): It represents first order differential equations with only one input variable for prediction.

(2)   GM (1, N): It represents first order differential equations with N input variables for multi-variant relational analysis.

(3)   GM (0, N): It is a special case of GM (1, N); it represents zero order differential equations with N input variables for multi-variant relational analysis.

iv.   。 Grey Prediction: It's a prediction method with GM (1,1) model using data on hand. It finds future status and conditions of all elements in a series.

v.   Grey Decision: There is subjectiveness in every strategy used to solve problems. Therefore, different strategies lead to different results. It is necessary to reduce the influence of subjectiveness with some tool. And grey decision is a decision made by combining strategies with a GM model.

vi.   Grey Control: Through behavior data of system to find rules to predict future behaviors. The predictions will be sent back to system after being calculated. It's a method used for system control.

Research Design and Implementation

Grey prediction is used to predict the possible number of students who will drop out in the future before the end of semester. The theory of the grey prediction is based on n data series to build a GM (1, 1) model to calculate the values after the nth data point. The series is as below:

$$X^{(0)} = \left(X^{(0)}(1), X^{(0)}(2), \dots\dots\dots, X^{(0)}(n) \right) (1)$$

After generating a GM (1, 1) model, we can solve:

$$\hat{X}^{(0)}(n + \xi), \xi \in \{1,2\dots\dots\}$$

The process of grey prediction can be written as:

$$\text{IAGO} \circ \hat{\text{GM}} \circ \text{AGO} : X^{(0)} \rightarrow \hat{X}^{(0)}(n + \xi) \quad (2)$$

where ξ is the predicted value or a data point estimation.

The types of grey prediction models:
 i. Sequence grey prediction
 ii. Calamities grey prediction
 iii. Season calamities grey prediction
 iv. Topological grey prediction
 v. System grey prediction

Sequence grey prediction is adopted in this research. Therefore, only this model is further discussed below:

Due to the limitation on use, we must first verify if the series is a series without any trip points.

The original series is $X^{(0)} = \left(X^{(0)}(1), X^{(0)}(2), \ldots\ldots\ldots, X^{(0)}(n) \right)$

When the class ratio $\sigma^{(0)}(k)$ satisfies:

$$\sigma^{(0)}(k) \in [(1 - \sigma, 1), \text{or} (1, 1 + \sigma)] \subset (0.1353, 7.389), \; \forall k \in k = \{2, 3 \ldots\ldots, n\}$$

The series $X^{(0)}$ is defined as a series without trip points.

For a series without trip points, $X^{(0)}$, the following 6 steps are required for the grey prediction of this series:

 i. AGO: Conduct accumulated generating operation on $X^{(0)}$ to obtain $X^{(1)}$.

 ii. MEAN: Calculate the average of $X^{(1)}$ to obtain $Z^{(1)}$.

 iii. Construct the data matrix B and the data vector y_N:

$$B = \begin{array}{cc} -Z^{(1)}(2) & 1 \\ \cdots & \\ -Z^{(1)}(n) & 1 \end{array} , \quad y_N = \begin{array}{c} X^{(0)}(2) \\ \vdots \\ X^{(0)}(n) \end{array} \quad (4)$$

iv.   Calculate the GM (1,1) model parameters:

$$\begin{matrix} a \\ b \end{matrix} = (B^T\,B)^{-1}\,B^T\,y_N \quad (5)$$

v.   Generate the GM (1,1) prediction model whitening equation

$$\hat{X}^{(0)}(K+1) = (X^{(0)}(1) - \frac{b}{a})e^{-ak} + \frac{b}{a} \quad (6)$$

$$\hat{x}^{(0)}(k+1) = \hat{x}^{(1)}(k+1) - \hat{x}^{(1)}(k) \quad (7)$$

vi.   Obtain the predicted value $\hat{x}^{(0)}(n + \xi)$.

$$\hat{X}^{1}(n+\xi) = (X^{(1)}(1) - \frac{b}{a})e^{-a(n+\xi-1)} + \frac{b}{a} \quad (8)$$

$$\hat{X}^{(0)}(n+\xi) = \hat{X}^{(1)}(n+\xi) - \hat{x}^{(1)}(n+\xi-1) \quad (9)$$

Results and Discussion

As previously described, it is very important to retain good students and teach them well for technical/vocational colleges. Therefore, grey prediction is adopted in this research in order to predict possible status of students dropping out in the future with a model constructed with research subjects being the students who had dropped out or been suspended temporarily during 2003~2009 academic year on purpose of early warning. First, the numbers of students who had dropped out or been suspended temporarily during 2003~2006 academic year are used as the data to generate a prediction model, while those in 2007 academic year in used for verification. The model therefore generated is then used to predict possible numbers of students dropping out or being suspended temporarily during 2008~2009 academic year with the data from 2004~2007 academic year. The original data, which are the numbers of students from 5-year junior colleges or 4-year institutions who had dropped out or been suspended temporarily during 2003~2007 academic year, are listed in the table below.

Table 1. Data of the numbers of students from the college being studied who had dropped out or been suspended temporarily.

Descriptive statistics of the numbers of students from a technical college who had dropped out or been suspended temporarily during 2003~2007 school year (unit: person)					
Academic Year	**92**	**93**	**94**	**95**	**96**
5-year Junior College – Drop-out	126	126	94	158	153
5-year Junior College – Temporary Suspension	34	36	36	39	32
Subtotal	160	162	130	197	185
4-year institution – Drop-out	8	58	56	135	269
4-year institution – Temporary Suspension	7	23	44	43	70
Subtotal	15	81	100	178	339
Total	**175**	**243**	**230**	**375**	**524**

Data source: summarized by the author

Grey prediction is applied to the numbers of 5-year junior college drop-outs in the table above to verify the precision of the model and to predict the number of drop-outs in 2008 academic year:

Because the precision of the model is as high as 81.388%, this qualifies the model as a prediction model.

Table 2. Prediction Model

```
Model precision:  a = -0.1445644899      b = 82.0042069031
K represents the year of data
----------------------------------------------------------------------------------
          x^0(k)           x0(k)            e(k)%
  k = 1     126.0000
  k = 2     107.8255       126.0000        14.4242
  k = 3     124.5962        94.0000       -32.5492
  k = 4     143.9755       158.0000         8.8763

---------------------------------------------------------------------------------
  k = 5     166.3689              Average residual = 18.6166 %
**************************************************************
```

The precision calculated from this model is 81.388%

The formula derived from the model can be used to calculate the number of 5-year college drop-outs. The calculated numbers are listed in Table 3. below.

Table 3. The Number of Students

Model precision: a = -0.2002958964   b = 73.1419506532
K represents the year of data
----

	x^0(k)	x0(k)	e(k)%
k = 2	126.0000		
k = 3	108.9238	94.0000	-15.8764
k = 4	133.0792	158.0000	15.7726
k = 5	162.5914	153.0000	-6.2689

----

k = 6   198.6484   Average residual = 12.6393 %
****
The precision for this model is 87.36%.

After calculation, the predicted value of the number of 5-year junior college drop-outs is 198.

a and b are parameters waiting to be determined. a is the development coefficient, and b is the control coefficient of grey prediction. If a>0, $X^{(0)}$ is saturated, which means, there will be a decreasing trend of the variable in $X^{(0)}$.

Table 4. The Predicted Number Of 5-Year Junior College Drop-Outs In 2009 Academic Year
Model precision: a = -0.1237377804 b = 128.1938872564 K represents the year of data
----

	x^0(k)	x0(k)	e(k)%
k = 3	94.0000		
k = 4	148.8442	158.0000	5.7948
k = 5	168.4498	153.0000	-10.0979
k = 6	190.6379	198.0000	3.7182

----

k = 7   215.7485   Average residual = 6.5370 %
****

The development coefficient "a" is negative for the 2009 academic year prediction. It is obvious that the number of drop-outs will be increasing. Applying the same model to the data from the 4-year institution students in table 1, the result shows:

Table 5. The prediction model for 4-year institution drop-outs
Model precision: a = -0.5381819203   b = 25.5042315196
K represents the year of data

----

	x^0(k)	x0(k)	e(k)%
k = 1	8.0000		
k = 2	39.4867	58.0000	31.9195
k = 3	67.6364	56.0000	-20.7792
k = 4	115.8536	135.0000	14.1825

----

k = 5	198.4445	Average residual = 22.2937 %

****
The precision of the model for 4-year institution drop-outs is 77.7%

Because there were only junior students, no senior students, in 2003 and 2004 academic year, the numbers of drop-outs are relatively smaller. And the prediction may not be as precise.

Table 6. The Predicted Number Of 4-Year Institution Drop-Outs In 2008 Academic Year
Model precision: a = -0.7054806190   b = 0.0282857795   K represents the year of data

----

	x^0(k)	x0(k)	e(k)%
k = 2	58.0000		
k = 3	59.4806	56.0000	-6.2154
k = 4	120.4375	135.0000	10.7870
k = 5	243.8643	268.0000	9.0059

----

k = 6	493.7812	Average residual = 8.6694 %

****
According to the calculation result, it is afraid that there will be as many as 493 students dropping out in 2008 academic year.

The development coefficient "a" is negative for the 2008 academic year 4-year institution prediction. It is obvious that the number of drop-outs will be

increasing. The number of 4-year institution drop-outs in 2009 academic year can be predicted with the prediction of 2008 academic year.

Table 7. The Predicted Number Of 4-Year Institution Drop-Outs In 2009 Academic Year
Model precision: a = -0.6120282805   b = 63.2397880965   K represents the year of data

----

	x^0(k)	x0(k)	e(k)%
k = 3	56.0000		
k = 4	134.4998	135.0000	0.3705
k = 5	248.0402	268.0000	7.4477
k = 6	457.4279	493.0000	7.2154

----

k = 7   843.5739   Average residual = 5.0112 %

****

According to the calculation result, the number of 4-year institution drop-outs is 843, which is almost doubled.

The development coefficient "a" is negative for the 2009 academic year 4-year institution prediction. It is obvious that the number of drop-outs will be increasing. Students who don't finish a semester include both drop-outs and suspended students. They should all be considered. Therefore, the suspended students are included to generate a new model to find out possible actual status.

The same model is applied to the total numbers of 5-year junior college drop-outs and suspended students, and the result shows:

Table 8. The Prediction Model For 5-Year Junior College Drop-Outs And Suspended Students.
Model precision: a = -0.1189876146   b = 116.2576987385   K represents the year of data

----

	x^0(k)	x0(k)	e(k)%
k = 1	160.0000		
k = 2	143.6740	162.0000	11.3124
k = 3	161.8280	130.0000	-24.4831
k = 4	182.2760	197.0000	7.4741

----

k = 5   205.3076   Average residual = 14.4232 %

****

The model precision is 85.5768%

Table 9. The Predicted Number of 5-Year Junior College Drop-Outs
And Suspended Students in 2008 Academic Year
Model precision: a = -0.1490866063 b = 111.0817196844 K represents the year of data

```
-------------------------------------------------------------------------------
              x^0(k)         x0(k)            e(k)%
    k = 2     162.0000
    k = 3     145.8347       130.0000         -12.1806
    k = 4     169.2811       197.0000          14.0705
    k = 5     196.4970       185.0000          -6.2146
    ---------------------------------------------------------------------------
    k = 6     228.0885                Average residual = 10.8219 %
    **************************************************
```

The result from the model shows that in 2008 academic year, there might be

228 5-year junior college students dropping out or being suspended.

The development coefficient "a" is negative. It is obvious that the number of

drop-outs and suspended students will be increasing. The number of drop-outs and

suspended students in 2009 academic year can be predicted with the prediction of

2008 academic year.

Table 10. The Predicted Number Of 4-Year Institution Drop-Outs In 2009 Academic Year
Model precision: a = -0.0797454555   b = 169.4680965464   K represents the year of data

```
-------------------------------------------------------------------------------
              x^0(k)         x0(k)            e(k)%
    k = 3     130.0000
    k = 4     187.2000       197.0000          4.9746
    k = 5     202.7397       185.0000         -9.5890
    k = 6     219.5694       228.0000          3.6976
    ---------------------------------------------------------------------------
    k = 7     237.7962                Average residual = 6.0871 %
    **************************************************
```

The result from the model shows that in 2009 academic year, there might be

237 students dropping out or being suspended. The development coefficient "a" is

negative. It is obvious that the number of drop-outs and suspended students will be

increasing. The same model is applied with the data from table 1 to predict the

number of 4-year institution drop-outs and suspended students.

Table 11. The Prediction Model For 4-Year Institution Drop-Outs And Suspended Students.
Model precision: a = -0.4343021769 b = 49.2373303069 K represents the year of data

----

	x^0(k)	x0(k)	e(k)%
k = 1	15.0000		
k = 2	69.8192	81.0000	13.8035
k = 3	107.7928	100.0000	-7.7928
k = 4	166.4197	178.0000	6.5058

| k = 5 | 256.9330 | Average residual = 9.3674 % |

****

The model precision is 90.6326%

The predicted number of 4-year institution drop-outs and suspended students

in 2008 academic year is:

Table 12. The Predicted Number Of 4-Year Institution Drop-Outs And Suspended Students
Model precision :a = -0.6039864919 b = 18.5315185982 K represents the year of data

----

	x^0(k)	x0(k)	e(k)%
k = 2	81.0000		
k = 3	92.6287	100.0000	7.3713
k = 4	169.4548	178.0000	4.8007
k = 5	310.0000	339.0000	8.5546

| k = 6 | 567.1132 | Average residual = 6.9088 % |

****

The possible number of 4-year institution drop-outs and suspended students in

2008 academic year is 567. For the prediction of the number of 4-year institution

drop-outs and suspended students in 2008 academic year, the development

coefficient "a" is negative. It is obvious that the number of drop-outs and

suspended students will be increasing. The number of 4-year institution drop-outs

and suspended students in 2009 academic year can be predicted with the prediction

of 2008 academic year.

The result from the model shows that in 2009 academic year, there might be

930 4-year institution students dropping out or being suspended. The development

coefficient "a" is negative. It is obvious that the number of drop-outs and suspended students will be increasing.

Table 13. The Predicted Number Of Drop-Outs And Suspended Students

Model precision :   a = -0.5418164927   b = 83.7426835513 K represents the year of data

----

	x^0(k)	x0(k)	e(k)%
k = 3	100.0000		
k = 4	183.0603	178.0000	-2.8429
k = 5	314.7039	339.0000	7.1670
k = 6	541.0158	567.0000	4.5827

----

k = 7   930.0748   Average residual = 4.8642 %

****

The model precision is 95.1358%

Lastly, the numbers of drop-outs and suspended students from 5-year junior college and those from 4-year institution are summed up to make overall predictions as below:

Table 14. The Prediction Model For 5-Year Junior College And 4-Year Institution Drop-Outs And Suspended Students.

Model precision: a = -0.2555852767 b = 140.8168380866   K represents the year of data

----

	x^0(k)	x0(k)	e(k)%
k = 1	175.0000		
k = 2	211.4115	243.0000	12.9994
k = 3	272.9781	230.0000	-18.6861
k = 4	352.4740	375.0000	6.0069

----

k = 5   455.1205   Average residual = 12.5642 %

****

The model precision is 87.4358%

The model is applied to predict the number of 5-year junior college and 4-year institution drop-outs and suspended students in 2008 academic year.

The result from the model shows that in 2008 academic year, there might be 762 day school students dropping out or being suspended. For the prediction of the number of day school students dropping out or being suspended, the development

Table 15. The Predicted Number Of 5-Year Junior College And 4-Year Institution
Drop-Outs And Suspended Students

Model precision: a = -0.3863825656 b = 102.1949030365 K represents the year of data

----

	x^0(k)	x0(k)	e(k)%
k = 2	243.0000		
k = 3	239.3571	230.0000	-4.0683
k = 4	352.2493	375.0000	6.0668
k = 5	518.3869	524.0000	1.0712

| k = 6 | 762.8828 | Average residual = 3.7355 % |

****

coefficient "a" is negative. It is obvious that the number of drop-outs and suspended students will be increasing.

The prediction of the number of day school students dropping out or being suspended in 2009 academic year can be obtained:

Table 16. The Predicted Number Of Day School Students Fail To Complete The Semester.

Model precision: a = -0.3553274070 b = 222.6791870122 K represents the year of data

----

	x^0(k)	x0(k)	e(k)%
k = 3	230.0000		
k = 4	365.5037	375.0000	2.5324
k = 5	521.4449	524.0000	0.4876
k = 6	743.9182	762.0000	2.3729

| k = 7 | 1061.3092 | Average residual = 1.7976 % |

****

The result from the model shows that in 2009 academic year, there might be 1061 day school students dropping out or being suspended. For the prediction of the number of day school students dropping out or being suspended, the development coefficient "a" is negative. It is obvious that the number of drop-outs and suspended students will be increasing.

Summarizing the tables above, all the development coefficients are negative. It can be found that the number of students dropping out or being suspended in that college will be increasing. How to prevent the situation from worsening is an important topic for the administration and school affair staffs of that college to put in more effort. This research believes that this number would keep on increasing.

Conclusions and Suggestions

According to the predictions by the models above, it can be found that the research subject college will be facing 762 day school students fail to complete the semester in 2008 academic year. By assuming the total number of students is 9000, the ratio is 8.47%. In 2009 academic year, the number may reach 1061, with the ratio being 11.8%. This high ratio of students fail to complete the semester would seriously affect the finance of the college. If plus the fact that there are not enough newly enrolled students, in the future, this college might have management difficulty due to the insufficiency of students. Teachers would lose their jobs and the school would close down. In order to prevent the management difficulty caused by the baby bust, the following management strategies can be considered to adopt to avoid the situation from worsening.

i.   Facing the fact, reducing school size, transforming into a community university.

Up to now, there are 113 community universities in the US. They are mainly sponsored by local governments, industries, and community groups in order to provide higher education in their areas. The features of the community universities in the US include: low tuition, career oriented curriculums, 2-year system, and small classes. In the US, students can choose to go to low-tuition universities which are near their homes according to their circumstances and study preferences after graduating from high schools. After obtaining

an associate degree, they can be transferred to 4-year universities or start their careers. According to the statistics, 44% of the university students in the US are actually in community universities. The number of community university students in 1996 is 369% of that in 1965. The demand for community universities can easily be seen. (Bryant, 2000-12-06)

To increase income and decrease expenditure is an important means when in difficulties. If the number of students enrolled is affected by the environment, then "student retention" is a possible solution for universities/colleges. Although this method can not help to increase income of universities/colleges, at least it helps to avoid the situation of being short of tuition. The focus of private universities/colleges should be on "increasing income and decreasing expenditure" in the aspect of management, not just the aspect of finance. Universities/colleges which have gone through enrollment difficulties can stop enroll students for departments not in popular demand. Thus their resources can be used for the departments more students are willing to enter. This way, universities'/colleges' management ability can still be retained, meaning they still retain the minimum space to survive. Then they can start to concentrate on more delicate and refined ways to run universities/colleges. Also they can reduce the ratio of students enrolled via the Joint College Entrance Exam. Instead, they can attract more on-the-job students to with advanced study. By copying the successful ways to run schools in the US and developing new directions, universities/colleges may have a chance to go back to the top when the populations are changed in the future.

ii.　　　Cooperating with enterprises to establish enterprise universities

Enterprises need proper talents, while schools need students. There are teachers with doctor's degrees and perfect training places in schools. If schools can meet enterprises' demands attentively and establish "enterprise universities" which combine enterprises' demands and schools' demands, both of them will benefit.

iii.   Establishing local public official training centers with the assistance from the government.

Every year the government contributes quite some money to help training public officials to institutions such as city/county Public Service Training Centers. If the training similar to the one from Public Service Training Centers can be handled by local universities/colleges, the investment in hardware can be saved and universities/colleges would have more funds. It not only meets the government's demands for training, but also saves universities/colleges from their management difficulties. Evaluations can be conducted to ensure the quality of universities'/colleges' teachers and places, and to rule out inadequate universities/colleges.

The education in Taiwan can not merely depend on the elite students from elite schools. In the early years, the development of Taiwan depended on students who had graduated from universities, 5-year junior colleges, and vocational high schools. A very important task for the government is to cultivate technical/vocational college students with world outlook and technology competitiveness. Secondly, The management of technical/vocational colleges should think deeply about how to help principals to run schools like CEOs running an enterprise, with continuous innovation and development enthusiastically, without being limited by the thoughts of being the disadvantaged technical/vocational colleges. Then features and characteristics of their own will be

formed, becoming a blue ocean strategy which is different from the traditional education

methods.

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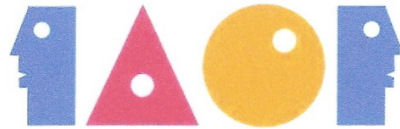
Foreign Direct Investment Origin and Regional Productivity in China: A Comparison between China, U.S. and Japan

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Abstract

While foreign direct investment (FDI) is widely recognized as one of major driving forces on promoting the regional economic growth in China, its impact on regional productivity is unclear and is less systematically investigated. Moreover, the widened inequality between coastal and non-coast regions implies that the absorptive ability differs substantially across regions and therefore the productivity effect of FDI may depend on the technological gap between the host region and the investing country.

This article investigates the effect of FDI on regional productivity in China and further examines the potential differences in productivity effect of FDI between two China's main sourcing countries with relative higher technology gaps: Japan and US. Based on the province panel dataset from 1996 to 2005, the main findings are summarized as follows. First, FDI is overall found to have a significant and positive impact on regional economies' productivity. Second, the total factor productivity (TFP) effect of US FDI is about 12% higher than Japan FDI. Third, Japanese FDI exhibits the highest impact on productivity followed by US and other country for non-coast regions. Fourth, in terms of total factor productivity (TFP) effect, the overall US FDI seems to be more important than Japan's FDI since the TFP enhancing effect of US FDI is prevailing in both coast and non-coast regions, while the positive TFP effect of Japan FDI is only found for non-coast regions. From the policy perspective, if FDI contributes to a region's technical development, of particular relevance is how to attract the appropriate FDI in terms of the technological gap.

Keywords: Foreign Direct Investment (FDI), Productivity, China

Introduction

Foreign Direct Investment (FDI) has significantly contributed to China's economic development and growth for the past few decades. It not only expands the volumes of production and exports but also improves the efficiency of production through technology transfer. FDI is a potentially pivotal external source of technological change in China. However, the importance of its contribution to China's total factor productivity (TFP) growth is less well systematically investigated. Hong Kong and Taiwan have been the main investors, while Korea, Japan and United States also have recently started to invest heavily in China. Among these main FDI investing countries, Japan and US are considered as the two countries foremost in the technology frontier in the world. FDI in China from different countries tends to have different characteristics. In general, FDI from Taiwan, Hong Kong and Korea tends to be characterized as investment into lower knowledge-intensive and /or resource-intensive technology, whereas FDI from Japan and US incline to embed with relative high knowledge –intensive technology.

Most of the literature regarding FDI and economic growth focus on the presence rather than the origin of investment. Specific technology and capital transmitted via FDI generally enlarge production capacities and product varieties of host countries. However, FDI from different countries usually are accompanied with differences in technology level and objectives. The spillover effect embodied in FDI from different origins might contribute to a substantial difference in the degree of enhancing a region's productivity. Also, technology spillovers of FDI from parent firms to their foreign affiliates could mitigate technology gaps between the two, but its effectiveness also depend on the hosting region's absorptive ability. Although the empirical results of FDI and regional productivity growth tends to support the significant and positive impact of FDI, some also suggest the absorptive ability of recipient region (country) matters.

This paper addresses the question of whether FDI of different origins contribute differently to the productivities of regions with different absorptive abilities. Since the FDI from Japan and USA differ in their technology and objectives and the different economic development status between China's coastal and non-coastal region, this paper is an attempt to investigate how FDI of different origins contribute to the productivity of the region with different absorptive ability. It aims to empirically examine the role of inward FDI from Japan and USA on promoting China's regional productivity over the period 1996-2005. We first employ the methodology developed by Levinsohn and Petrin (2003) to calculate TFP in order to control for the endogenous problem and unobserved heterogeneity on estimating the production function. Next, this study proceeds with estimates on determinants of regional productivity, especially focusing on FDI from Japan and USA. The main findings are summarized as follows. First, there exists strong evidence of different impacts of FDI from Japan and US on China's provincial TFP, respectively. Second, FDI from US exhibits a higher impact on productivity than that of Japan. Third, Japanese FDI exhibits a higher impact on productivity than the US for non-coast regions. Fourth, the productivity effect of US FDI is significantly positive in coastal regions, while the impact of FDI from Japan is insignificant. The results may be helpful to direct FDI policy to further enhance the regional development in China, especially the Western China. This paper intends to shed light on what kind of FDI strategy the Chinese government should implement to narrow the imbalance between coastal regions and the non-coast region.

In the next section, the concept of productivity spillovers from FDI is introduced. Characteristics of spillovers are also discussed, focusing on the relationship to the origins of investors from Japan and US. Section 3 describes the data utilized in this study and

details the calculation of TFP and empirical specifications. The empirical results are discussed in Section 4. The final section presents concluding remarks.

FDI and Regional Productivity

How FDI Affects Regional Productivity

FDI can affect regional productivity through many channels. Local firms in a region can improve their productivity by learning the advanced technology and management knowledge from the entry of FDI. The FDI spillovers can result from the training of local workers who acquire specific knowledge and skills from the Multi National Corporations (MNCs) and then change their employment to local firms. FDI can also create positive forward linkage and backward linkage effects by providing similar services to local purchasers and technology information to help the relevant local networks. Besides, the regional productivity can be enhanced by the competition brought by the FDI presence.

The empirical results regarding the effect of FDI on productivity for the developing and developed countries are mixed. Only limited findings support the existence of positive spillovers in developing countries. An important factor of FDI spillover is the relative technology gaps between the host and home country of foreign MNCs. Takii (2005) finds evidence that the spillovers are smaller in Indonesian manufacturing, for which technology gaps are wider. By testing the data for Indonesian manufacturing, Takii (2007) suggests that the level of labor productivity and capital intensity in foreign MNCs depend on the stage of economic development. He also implies the wider technological gaps between foreign and local firms decrease the magnitude of productivity spillovers. On the other hand, similarity in technology and product can foster higher competition, which might force local firms to enhance competitiveness.

The argument that FDI and international trade serve as major driving forces contributing positively to China's faster growth during the late-1980s to mid-1990s was well recognized in enormous empirical studies. (E.g. Chen *et al.*, 1995; Harrold, 1995; Pomfret, 1997; Shan, 2002; Liu *et al.* 2002). However, the empirical results regarding the effect of FDI on productivity for China is relatively limited. Chuang and Lin (1999) found FDI has a positive impact on productivity of local firms in China and concluded a significant spillover effect. Zhu and Lu (1998) found that FDI spillovers have a greater impact and are more effective in promoting labor productivity than TFP. Chuang and Hsu (2001) used plant-level data to examine spillovers in China and confirmed the existence of positive and larger impact of FDI on Chinese industries, especially in the low-technology gaps sectors than in the high technology gaps sectors. Liu and Wang (2003) studied the determinants of TFP for across sectional sample of Chinese industrial sectors, specially focusing on the impact of FDI. Their results indicate that foreign presence is one of the most important factors enhancing TFP in Chinese industries, supporting the argument that FDI is an effective way of introducing advanced technology to host country. Wang and Zhao (2008) suggest that market-oriented western FDI generates more spillovers at the inter-industry levels than export-oriented overseas Chinese FDI in Chinese manufacturing. To identify the differences in the impact of FDI sourced from Taiwan, Japan and USA on China's labor productivity and TFP across regions, Huang (2004) found that FDI sourced from Taiwan, Hong Kong, and Macau (THM) contribute to the spillover effects in China's regions with a higher technology gap.

FDI from Japan and US

From 1996 to 2005, the share of Japanese and U.S. investment in the cumulative value of realized FDI account for 17.28% and 13.85%, respectively, of total (Hong Kong excluded) FDI

inflows into China. Table 1 shows FDI from Japan and US concentrate more on the coast area

relative to non-coast area. Their share to total FDI is around 30% compared to 20% in the

Table 1 FDI Toward China from Japan and US

|	1996-1997	1998-1999	2000-2001	2002-2003	2004-2005
All					
Japan	654,260	580,846	660,497	837,986	1,130,026
US	581,414	734,916	790,217	895,504	755,554
Total	3,544,837	3,613,217	3,331,879	5,197,989	6,671,876
J+U(%)	34.86	36.42	43.54	33.35	28.26
Coast areas					
Japan	625,313	543,267	624,637	758,392	1,071,160
US	530,697	666,178	710,189	77,752	631,876
Total	3,048,468	3,116,378	2,862,598	4,469,511	5,556,428
J+U(%)	37.92	38.81	46.63	34.36	30.65
Non-coast areas					
Japan	28,947	37,579	35,860	79,594	58,866
US	50,717	68,738	80,028	117,975	123,678
Total	496,369	496,839	469,281	728,478	1,115,448
J+U(%)	16.05	21.40	24.69	27.12	16.37

Total denotes the total FDI towards China with Hong-Kong excluded.

non-coast area. During 1996 to 2005, averaged 94% FDI from Japan concentrates in the coast

regions compared to only 88% FDI from the US. FDI from Japan has been increased in the coast

area while FDI from US has increased first and decrease after 2004. In the non-coast area FDI

from US has continued to increase and FDI from Japan has decreased after 2004 despite its

previous increasing trend. For the FDI from US, the non-coast regions percentage has steadily

increased from 8.72% in 1996-1997 to 16.37% in 2004-2005. It implies an interesting

distributive trend between Japan and US. Compared with the stable trend of FDI from Japan

toward coast regions, it seems that there is an increasing trend of investment toward inland

regions for US firms.

Figure 1 compares the trends of FDI flows from Japan, and US. FDI from US had

reached to the peak in 2001 and declined since then, while FDI from Japan had remained steady

during 1996-2005. Table 2 describes the regional distribution of FDI from Japan and US.

Shanghai, Goungdong and Liaoning are the top three regions receiving more than 51.2% of FDI

from Japan during 1996 to 2005. Shanghai, Goungdong and Shangdong are the top three regions

receiving more than42.4% of FDI from US during the 1996-2005 period of time.

China has replaced ASEAN-4 (Indonesia, Malaysia, Philippines and Thailand) in

becoming the largest destination of Japanese FDI in Asia (Xing & Wang, 2006).

Figure 1 FDI Share of Japan and US
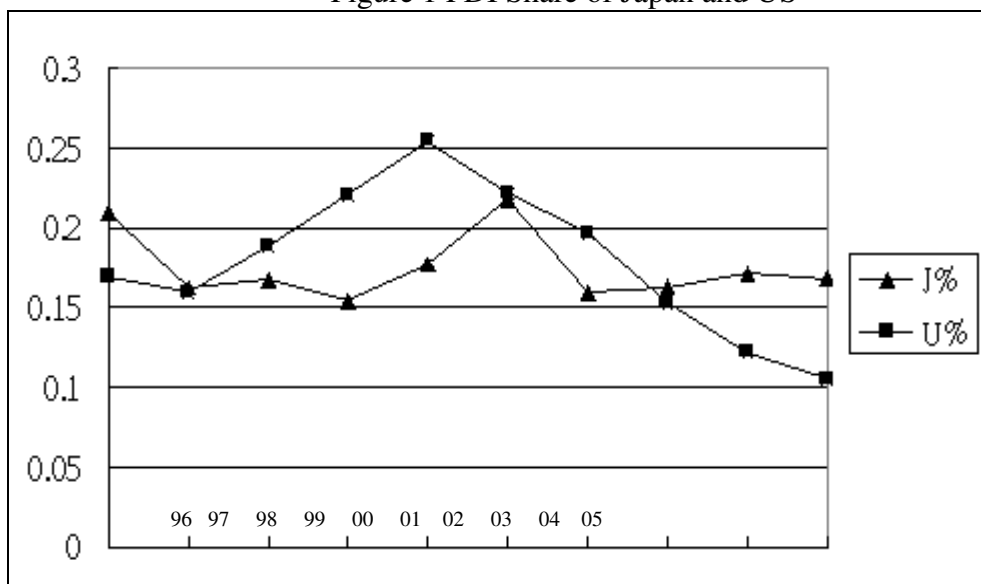
FDI from Japan is particularly clustered in the delta areas where inland waterways

abound. It may be explained by the fact Japanese investment tends to concentrate on the

electrical and electronic manufacturing industries; these are characterized by bulky and heavy

products that do not tend to be transported by air. Japanese FDI towards China concentrates in

manufacturing, lead by the electrical industry, transportation equipment and machinery. Japanese

FDI has fluctuated very much in the manufacturing sectors, especially in the electrical machinery

Table 2 Regional Distribution of FDI 1996-2005

	Japan	US	Total
Beijing	366,386.5	217,657.4	1,611,927
	(9.54)	(5.90)	(5.67)
Tianjin	332,723	349,136	1,814,313
	(8.66)	(9.46)	(6.38)
Heibei	135,694	114,279	817,965
	(3.53))	(3.10)	(2.88)
Liaonng	617,062	363,557	2,246,893
	(16.06)	(9.85)	(7.91)
Shanghai	725,286	604,068	3,381,722
	(18.88)	(16.36)	(11.90)
Zhejing	274,676	271,777	1,883,101
	(7.15)	(7.36)	(6.63)
Fujian	88,835	355,469	2,946,424
	(2.31)	(9.63)	(10.37)
Shandong	362,319	381,331	3,639,116
	(9.43)	(10.33)	(12.80)
Guangdong	626,400	578,004	5,928,949
	(16.30)	(15.66)	(20.86)
Guangxi	14,347	24,482	582,052
	(0.37)	(0.66)	(2.05)
Hainan	79,040	56,709	671,912
	(2.06)	(1.54)	(2.36)
Shanxi	2,513	27,106	234,020
	(0.07)	(0.73)	(0.82)
Anhui	22,450	24,353	259,328
	(0.58)	(0.66)	(0.91)
Henan	15,446	60,691	318,209
	(0.40)	(1.64)	(1.12)
Hubei	83,051	80,856	841,133
	(2.16)	(2.19)	(2.96)
Hunan	22,934	73,910	537,836
	(0.60)	(2.00)	(1.89)
Chongching	37,970	22,726	192,803
	(0.99)	(0.62)	(0.68)
Yunnan	3,231	8,199	86,128
	(0.08)	(0.22)	(0.30)
Shaanxi	27,370	40,521	242,284
	(0.71)	(1.10)	(0.85)
Quianghai	1,206	25,446	96,470
	(0.03)	(0.69)	(0.34)
Ningxia	3,021	9,951	67,078
	(0.08)	(0.27)	(0.24)
Xinjiang	575	1,395	22,058
	(0.01)	(0.04)	(0.08)

Note: The amounts are in millions of dollars.
    The percentage share is in parenthesis.
    Total denotes the total FDI except FDI from Hong Kong.

and transportation equipment industries, while it has been rather stable in the non-manufacturing sector. According to Toyo Keizei (2005), most Japanese subsidiaries are located in three regions: Shanghai, Jiangsu and Guangdong with 32.6%, 15.2% and 13.3% respectively. With regards to FDI ownership, there are currently about three quarters of FDI from Japan are in the form of traditional joint venture and one quarter are wholly foreign-owned.

One unique characteristic of Japanese affiliated manufacturers is the extensive involvement in "reverse imports," exporting their product back to Japan. According to a survey conducted by JETRO (2003), 62% of Japanese affiliated manufacturers operating in China stated that they exported at least 70% of their products. It implies that serving Japanese Market is one of the major objectives for Japanese MNCs investing in China. Japanese investment in China's manufacturing has been export-oriented, and using China as a production base serving Japanese domestic market as well as global market has been the primary objective. It can be confirmed that many products under Japanese MNCs' brands in Japanese domestic market as well as global market are made in China. In general, FDI from Japan is mainly export-oriented and it effectively integrated Chinese firms into fragments of global production chains.

The US s replaced Japan in becoming the major source of non-Hong Kong FDI inflows into China after 1999. The total FDI towards China had increased from 3.54 billion US dollars in 1996-97 to 6.67 billion US dollars in 2004-2005. However, the amount of FDI from US remains relatively modest. Overall US affiliates based in China account only about 2% of total US affiliate sales and they contribute relative little to aggregate Chinese investment.

FDI inflow from the US concentrates in capital- and technology-intensive industries such as electrical equipment, chemicals, electronics and transportation equipment. In 2004, only 70% of US affiliates based in China were wholly owned. Unlike FDI from Japan, US FDI in China

appears to focus primarily on the domestic market rather than exports. The US FDI functions as a means of accessing the Chinese market to extend oligopoly power into local market rather than using it as an export platform (Gill & Tay, 2004).

Although with similarity in the technology advantage, there exist some differences between FDI from U.S. and Japan. Aoki (1998) and Friedman and Fung (1996) identify the difference between the typical hierarchical coordination in American firms and the typical horizontal coordination in Japanese firms. Fung, Iizaka, and Parker (2002) found labor quality is an important determinant for both U.S. and Japanese direct investment in China. They argued that the difference between American hierarchical coordination and Japanese horizontal communication explains partly the estimated impact of labor quality on FDI is larger for Japan than the United States. Besides, the practice of just-in-time production and job rotation by Japanese firms at home and abroad also leads to a greater emphasis on workers' education. In general, the US FDI is more domestic market-oriented and pays less attention on innovations in Chinese affiliates, implying that its technology level is lower than Japanese FDI, which is more export-oriented. This smaller technology gap enables local firms to learn and absorb technological knowledge from US FDI more easily. Therefore, US FDI is probably to have a higher productivity enhancing effect for the developing country, China.

<center>Empirical Specifications and Data</center>

To examine how foreign direct investment determining total factor productivity, we start with the calculation of total factor productivity (TFP). Conventional calculation on TFP adopts the concept in Solow (1957) that technological change is the residual when the share of capital and labor inputs are taken off form the output in the production function. This index is also widely employed in existing studies on China's TFP, such as Liu and Wang (2003). However,

this measure does not consider endogeneity and unobserved heterogeneity on determining inputs, resulting in serious bias on estimating TFP (Olley & Pakes, 1996; Levinsohn & Petrin, 2003; Vahter & Masso, 2007).

This paper adopts Levinsohn and Petrin's (2003) method to calculate TFP. A natural logarithm form of value-added Cobb-Douglas production function is adopted as below.

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \omega_{it} + \eta_{it} \qquad (1)$$

Where y is the value added of province i in year t, terms l, k, and m denote labor, physical capital stock, and material,[1] respectively. ω is unobserved heterogeneity that can affect the usage of labor and capital and it is treated as TFP. η is a white noise error term.

According to Levinsohn and Petrin's (2003) assumption, the unobserved heterogeneity ω can be poxized by m and it affect fixed capital inputs, implying that the demand of intermediate goods is a function of k and ω. That is,

$$m_{it} = f(k_{it}, \omega_{it}), \ \frac{\partial m}{\partial \omega} > 0 \qquad (2)$$

We can rewrite the demand function of intermediate goods as $\omega_{it} = f(k_{it}, m_{it})$. That is, the unobserved heterogeneity ω is converted into a function of observable inputs k and m. Therefore, equation (1) can be rewritten as

$$y_{it} = \beta_0 + \beta_l l_{it} + \phi_{it}(k_{it}, m_{it}) + \eta_{it} \qquad (3)$$

Where $\qquad \phi_{it}(k_{it}, m_{it}) = \beta_k k_{it} + \beta_m m_{it} + \omega_{it}(k_{it}, m_{it})$

Following Levinsohn and Petrin's (2003) methodology, this study adopts the summation of zero to third power of k and m to approximate $\phi_{it}(k_{it}, m_{it})$ and rewrite equation (3) as

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[1] Constrained on the availability of information for provincial intermediate goods, this study includes only electricity utilization as the proxy of intermediate goods.

$$y_{it} = \delta_0 + \beta_l l_{it} + \sum_{g=0}^{3} \sum_{h=0}^{3-g} \delta_{gh} k_{it}^g m_{it}^h + \eta_{it} \qquad (4)$$

We cannot identify β_0 drawn from the intercept term of $\phi_{it}(k_{it}, m_{it})$, while we can obtain $\hat{\beta}_l$ by estimating equation (4). Therefore, $\hat{\phi}_{it}$ can be estimated by the following:

$$\hat{\phi}_{it} = \hat{y}_{it} - \hat{\beta}_l l_{it} = \hat{\beta}_0 + \sum_{g=0}^{3} \sum_{h=0}^{3-g} \delta_{gh} k_{it}^g m_{it}^h \qquad (5)$$

Given the candidate values of β_k^* and β_m^*, we obtain:

$$\hat{\omega}_{it} = \hat{\phi}_{it} - \beta_k^* k_{it} - \beta_m^* = \hat{y}_{it} - \hat{\beta}_l l_{it} - \beta_k^* k_{it} - \beta_m^* m_{it} \qquad (6)$$

Then, we can obtain the TFP from equation (7):[2]

$$TFP = \hat{\omega}_{it} = \exp(\hat{y}_{it} - \hat{\beta}_l l_{it} - \beta_k^* k_{it} - \beta_m^* m_{it}) \qquad (7)$$

To focus on the determinants of technological progress in terms of TFP, especially focusing on FDI from various sourcing countries, the empirical models are developed as below:

$$\ln TFP_{it} = \alpha_0 + \alpha_1 \ln RD_{it} + \alpha_2 TI_{it} + \alpha_3 HTEXP + \alpha_4 \ln FDI_{it} + \varepsilon_{it} \qquad (8)$$

The dependent variable *TFP* denotes the total factor productivity that is calculated from equation (7). As for the explanatory variables, *RD* and *TI* represent the internal and external technological sources, respectively. The R&D investment is devoted directly to producing new products or new processes and it has been widely recognized to serve as the major source of technological change in theoretical and empirical literature. Concerning the influence of technology import, while it usually comes with certain restrictions and could eventually end up with technological reliance for developing countries, it offers immediate access to desirable technologies and promotes growth and technological progress significantly in the short run. This positive impact of technological imports on China's regional growth and productivity has been witnessed in Liu

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[2] The detailed derivation on the semi-parametric estimates of TFP, please see Levinsohn and Petrin (2003).

and Wang (2003) and Kuo and Yang (2008). We therefore expect a significant positive coefficient associated with this variable.

The variable *HTEXP* denotes the value of high-tech product exports. Although China's large economic growth can be supported sufficiently relying only on its domestic market, China which manufactures and exports many labor-intensive as well as high-tech products serves as the factory for the world currently. Through the learning-by-exporting effect, firms can learn and absorb advanced foreign knowledge and then raise their technological capability. Therefore, the variable *HTEXP* is also expected to enhance productivity.

Finally, the most important variable this paper concern is the effect of foreign presence on TFP. *FDI* represents the amount of inward foreign direct investment. Most inflow comes from countries in which their GNP is higher than China, implying the technologies accompanying *FDI* are more advanced than China. Therefore, *FDI* can promote China's *TFP* directly and indirectly arising from knowledge spillovers. Young and Lan (1997) argued that the extent of technology transfer is fairly limited, but at the level expected given China's developing status and technological capacities, while the potential for utilizing FDI as an instrument of technological development in a Chinese context is greater than theory would suggest. Alternatively, many studies discussed in the previous section have found a significantly positive impact of FDI on productivity; we therefore expect a positive productivity effect of FDI.

FDI inward from various sourcing countries may exhibit different impact on host regions' productivity due to the differences in FDI type and technological gap. Hong Kong, Taiwan, and Macau are the largest FDI Investors towards China and they are evidenced to have a strong impact on China's productivity (Huang, 2004). However, how the FDI come from technological frontiers, such as Japan and United States, contribute to China's productivity is less investigated

regardless of their increasing investment in China recently. To examine the potential differences in the productivity effect of FDI between Japan and US, this study includes Japanese FDI (lnJP) and US FDI (lnUS) in equation (8), respectively.

The data used in this study contain 24 provinces in China over the period 1996-2005, yielding 240 observations. Due to the availability on collecting different FDI sourcing countries in each province, 7 provinces are deleted from the 31 population provinces, including Inner Mongolia, Jilin, Heilongjing, Jiangsu, Sichuang, Guizhou, and Tibet. The period we studied coincided with the development stage of high-tech industries in China, implying that various technological sources should be more relevant to productivity. According to the geographical feature of whether a province is adjacent to the ocean, this study further classifies 11 provinces into the coast region, including: Liaoning, Shandong, Hebei, Beijing, Tianjin, Shanghai, Zhejiang, Fujian, Guangdong, Guangxi, and Hainan. On the other hand, the remaining 13 provinces are classified into non-coast regions. Table 3 describes the measures of variables and data sources.

Empirical Results

Impacts of FDI on TFP

We look first to the regressions obtained from equation (8) and the estimates are shown in Table 4. The χ^2 values are the Hausman test on the random-effect versus the fixed-effect model and we use a criterion of 5% statistical level to choose which model is more appropriate. Because the χ^2 values are lower than the 5% statistical level (p<.05), only the results of the random-effect model are shown in Table 4. In addition, we separate the Japan, US, and other FDI (mainly FDI from Korea and Taiwan) and run the analysis as model TFP (ii)

Table 3 Variable Definitions, Summary Statistics, and Data Sources

Variable	Definition	Mean (S.D)
TFP	Total factor productivity: calculated by equation 7 (RMB million)	957.570(718.325)
LABOR	Labor population who are older than 15 years old (million)	19.946(14.180)
CAP	Capital stock: calculated using the perpetual inventory method (RMB billion)	743.408(738.465)
MATERIAL	Electricity Consumption (billion kilowatt)	55.689(46.312)
RD	R&D expenditure (RMB million)	4288.395(6059.180)
TI	Technology imports (RMB million)	2642.161(3257.473)
HTEXP	Exports of High-tech products (RMB million)	25714.221(10042.910)
FDI	FDI inflow (RMB billion)	156.074(226.792)
JP	FDI inflow from Japan (RMB million)	2714.348(2388.757)
US	FDI inflow from US (RMB million)	2528.53(1820.082)

Note: The means and standard errors of the variables are calculated by the pooling data for the 1996-2005 period.

For the internal sources estimates, the coefficient on lnRD is significantly positive at the

1% statistical level (p<.01), indicating that R&D capital does have a positive impact on

enhancing TFP in China. This provides evidence that devoting more R&D effort enables higher

productivity growth in China. The estimated magnitude of R&D elasticity is 0.202, implying the

Table 4 The Impacts of FDI on Regional Productivity in China

	TFP (i) RE	*TFP* (ii) RE
Constant	5.238***	5.094***
	(0.336)	(0.399)
lnRD	0.197***	0.202***
	(0.025)	(0.027)
lnTI	0.136***	0.127***
	(0.031)	(0.035)
lnHEEXP	0.006	0.001
	(0.014)	(0.015)
lnFDI	0.122***	
	(0.026)	
lnJP		0.133***
		(0.040)
lnUS		0.148***
		(0.034)
lnOFDI		0.147***
		(0.041)
χ^2	0.632	0.971
R^2	0.842	0.836

Note: Figures in parentheses are standard deviations. * and *** represent significance at 10% and 1% statistical levels, respectively.

TFP elasticity of R&D is 0.202. That is, keeping other variables constant, one additional percent input on R&D can raise 0.2% growth in TFP. It is an encouraging result, because Chinese firms have been engaged more intensively in R&D since the mid-1990s, and so the impact of R&D expenditure on TFP growth is significant during the study period from 1996 to 2005.

Although R&D exhibits a significant positive impact on productivity growth, is it the only way to promote technological progress? How much do external technological sources affect technological progress in China? It is apparent that the coefficient of lnTI is 0.127 and significant at the .01 statistical level, lending supportive evidence that external technological sources of technology import is also positively associated with higher *TFP*. As discussed earlier, developing countries can expand their technological capability by relying upon internal as well as external technological sources. This argument coincides with the technological development of the Chinese economy during 1996-2005, which also recorded a larger amount of technology import. Though technology imports offer immediate access to desirable technologies, its TFP effect is lower than that of R&D, implying that in-house R&D is the predominately important factor for China to develop indigenous technologies and to keep sustainable economic growth.

The estimated coefficient for high-tech exports is positive in both estimates, but it is statistically significant only in the estimates (ii). This result seems to indicating the existence of learning-by-exporting effect on enhancing provinces' total factor productivity.

Turning to the main issue, we ask: Does the foreign presence really promote technological progress for the host regions and does the TFP effect of FDI differ between Japan's FDI and US' FDI? The estimates in model (i) show that the FDI variable is associated a significantly positive coefficient. This result is consistent with most previous finding that the advanced technologies and knowledge embodied in FDI can promote China's productivity. The

estimated coefficient is 0.122, implying that 1% increase in FDI will raise TFP by 0.122%. This magnitude of FDI elasticity is a little lower than that (0.16) in Liu and Wang's (2003) industry level study.

From the policy perspective, there are two important implications drawn from the above analysis. First, the sum of external effects (technology and FDI) seems to be higher than R&D, implying that both internal and external technological sources have positive impact on technological change, while the external sources appear to have a greater impact on raising regional TFP in the period from 1996-2005. Second, given the higher impacts of R&D than technology import, China should emphasize R&D rather than import technologies, in order to establish indigenous technological capability.

Does the sourcing country of FDI matter on the TFP effect of FDI? Does the technological gap prevent Chinese firms to learn the advanced knowledge? We separate the amount of FDI into Japan, US, and other FDI (mainly FDI from Korea and Taiwan) and re-estimate equation 8. The estimates are shown in model (ii). It is interesting to see that the coefficient for all FDI variables is all significantly positive, suggesting that wherever the FDI inflows come from (mostly from countries which the degree of economic development is higher than China), the knowledge embodied in the FDI inflow has a positive technological spillover and then enhance host regions' productivity.

Concerning the potential differences in TFP effect of FDI between Japan and US, it can be compared by the estimated coefficient on FDI variable. We find that the estimated coefficient on lnUS is similar with that of lnOFDI (mainly FDI from Korea and Taiwan), and it is a little higher than that of lnJP. The TFP effect of US is about 11.28% higher than that of Japan. As discussed in section 2, Japanese FDI towards China concentrates in manufacturing, particular for

electrical industry, transportation equipment and machinery. On the other hand, US FDI is primarily domestic market oriented and functions as a means of accessing the Chinese Market rather than using it as an export platform. It may imply that the technological capability embodied in Japanese FDI should be higher than US FDI. Lin *et al*. (2008) argued that the technological gap exerts a negative impact on the host regions' TFP in China, implying that the smaller the technological gap, FDI has a larger impact on promoting productivity. Due to the smaller technological gap, the knowledge embodied in US FDI is easier for Chinese firms to absorb and imitate and thus it contribute a higher effect on regional economies' TFP. Similarly, the smaller technological gap between China and other countries (mainly Korea and Taiwan) may help to partly explain the higher estimated coefficient of lnOFDI on TFP.

Further Investigation

The inter-province income inequality that is correlated with geographic location in China continues to be one of the top issues ever since the beginning of economic reforms. In order to help the western half of China catch up with the coastal region, the government created a State Council and carried out the "China Western Development" policy in 2000. The main components of the strategy include the development of infrastructure, enticement of foreign investment, increased efforts on ecological protection, promotion of education, and retention of talent flowing to richer provinces. Although China's western regions have witnessed a rapid annual economic growth over the past six years, the dynamics of productivity are the alternative key factor concerning whether inland regions can really catch up in the long run.

According to the above analyses, both FDI from Japan and the US have significant impact on TFP in China. However, their investment types and geographical distribution are quite different. We therefore examine whether the productivity effects of Japan and the US FDI in

coast and non-coast regions exhibit different patterns. Table 5 displays a series of estimates on the effect of FDI on TFP for the 11 coast and 13 non-coastal provinces.

Two methodologies are employed to examine the potential differences in the TFP effect of various sourcing countries. First, we implement the estimates by using all samples and including the intercept terms between FDI and coast and non-coast dummies. Second, we separate samples into coast and non-coast and then implement the estimates on obtaining results shown in Table 5.

Alternatively, the TFP effect of US FDI appears to be statistically significant in both coast and non-coast regions. Since the main purpose of US FDI is to expand the Chinese market rather than using it as an export platform and the average technology level of Chinese coastal regions is higher than the non-coast regions, its gap to the US FDI is smaller. With a better absorptive ability, the estimated TFP effect of coast-area regions is about 50% higher than that of the non-coast regions for the FDI from US.

Second, concerning the productivity effect of FDI invested by other countries (mainly Korea and Taiwan), it is also found to have a stronger impact on TFP in non-coastal regions. Since the relative technology gap between non-coast regions with Korea (Taiwan) is smaller compared to that of US, the enhanced TFP from other countries' FDI toward China is larger.

When we separate samples into coast and non-coast regions, only the estimate of lnUS is significant in the coast regions and all the estimates of lnJP, lnUS and lnOFDI are positive and significant in the non-coast regions. Japanese FDI exhibits the highest impact on productivity followed by US and other country for non-coast regions. It implies the non-coast regions benefit its TFP from the inflow of FDI wherever it comes from. Under the growing moving-inside trend, FDI toward China may alter their incentive from export-oriented to more market-oriented type.

Table 5 TFP Effect of Japan and US FDI on Coast and Non-Coast Regions' Productivity in China

	(iii) All Provinces RE	(iv) Coast RE	(v) Noncoast RE
Constant	5.327***	5.720***	4.866***
	(0.400)	(0.609)	(0.523)
lnRD	0.203***	0.174***	0.232***
	(0.027)	(0.043)	(0.033)
lnTI	0.123***	0.120**	0.129***
	(0.034)	(0.059)	(0.041)
lnHEEXP	0.004	0.013	-0.008
	(0.015)	(0.022)	(0.020)
lnJP		0.009	0.150***
		(0.079)	(0.047)
lnUS		0.170***	0.129***
		(0.057)	(0.041)
lnOFDI		0.056	0.145***
		(0.074)	(0.049)
lnJP*Coast	0.028		
	(0.058)		
lnJP*Noncoast	0.137***		
	(0.040)		
lnUS*Coast	0.176***		
	(0.043)		
lnUS*Noncoast	0.117***		
	(0.035)		
lnOFDI*Coast	0.077		
	(0.053)		
lnOFDI*Noncoast	0.130***		
	(0.041)		
χ^2	1.074	0.189	0.475
R^2	0.843	0.834	0.854
# of observations	240	110	130

Note: Figures in parentheses are standard deviations. * and *** represent significance at 10% and 1% statistical levels, respectively.

Conclusions

FDI has been significantly contributing to China's economic growth for the past decades for the post-reform period since the late 1970s. However, how important the contribution of FDI to China's TFP remains an important and interesting issue that is less well investigated. Moreover, the limited studies on exploring the effect of FDI on productivity result in mixed results.

This paper addresses the question of whether FDI of different origins contributes differently to the productivities of regions. It aims to empirically examine the role of inward FDI from Japan and USA on China's regional productivity over the period from 1996-2005. We first employ the new methodology developed by Levinsohn and Petrin (2003) to calculate TFP. This new approach allows us to control for the endogenous problem and unobserved heterogeneity on estimating the production function. Adopting the estimated TFP as the dependent variable, this study next examined the determinants of TFP, especially focusing on FDI of Japan and US.

Based on a panel dataset for 24 provinces in China over the period 1996-2005, our empirical findings are summarized as following. First, FDI is overall found to have a significant and positive impact on regional economies' productivity. This result is consistent with most previous studies. Second, the TFP effect of US FDI is about 12% higher than Japan's FDI. It can be attributed to the differences in types and geographical distribution of FDI between Japan and US. Third, Japanese FDI exhibits the highest impact on productivity followed by US and other countries for non-coastal regions. Fourth, in terms of TFP effect, the overall US FDI seems to be more important than Japanese FDI since the TFP enhancing effect of US FDI is prevailing in both coastal and non-coastal regions, while the positive TFP effect of Japan's FDI is only found for non-coastal regions.

One important policy implication drawn from this study is that attracting inflows of foreign capital with appropriate technology in terms of the technological gap continues to be an important strategy for promoting productivity and economic growth for the inland regions.

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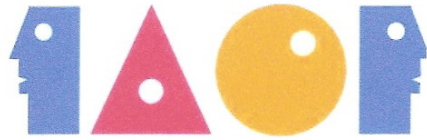
A STUDY OF THE RELATIONSHIPS BETWEEN CORPORATE CORE COMPETENCE, MANAGEMENT INNOVATION AND CORPORATE CULTURE

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Abstract

This study investigated the relationships between three variables: management innovation, corporation core competence, and corporate culture, along with their dimensions The study found that the information innovation dimension has no significant positive correlation with the four dimensions of corporation core competence, or with those of corporate culture. The relationship between the dynamic process of realization and information innovation can be enhanced by a supportive culture, and that the relationship between the effective integration of resources and information innovation can be enhanced by an innovative culture. Finally, the study determined that there is no statistically significant relationship between management innovation and corporation core competence.

Keywords: Management, Innovation, Corporation, Competence, Culture

Competition among modern corporations involves not only products and prices, but also corporation core competence. It is based on who can consistently take the lead. Therefore, it is necessary for a corporation to constantly improve its core competence to enhance its position in future business competition. Management innovation adds value to an organization, strengthening its chance of survival. The business environment is increasingly characterized by keen domestic and global competition, rapid technological change, and constrained resources. The ability to innovate in overcoming the challenges is a primary determinant of corporate success.

Corporate culture consists of the leading common values and behavior in a corporation which are formed in long term management activities, and recognized and abided by all employees. Enforcing the construction of corporate culture may improve competitiveness of a corporation. Corporate culture couples with corporate economic development and gradually becomes part of a corporation's comprehensive power. Corporate culture is important in enabling businesses to adapt to new situations and challenges. It promotes management innovation when a new business model is expected. Therefore, it is important to know more about the relationships among corporation core competence, management innovation and corporate culture.

Literature Review

Management Innovations

Management innovations are new processes introduced by management which enables organizations to reach their goals, and includes object management, environmental research and judgment, coordination, integration and schedule control. Van Ark, Inklaar, and McGuckin

(2003a) stated that *management innovation is a service product or service process that is based on some technology or systematic method, and it includes replicable elements that can be identified and systematically reproduced in other cases or environments.* Management innovations can, for instance, be new solutions in the customer interface, new distribution methods, and novel application of technology in the service process, new forms of operation with the supply chain or new ways to organize and manage services (Van de Ven, 2003; Van Ark, Inklaar, & McGuckin, 2003b). Sie, Chu and Chen (2007) organized management innovation into the following three categories: organizational innovation, informational innovation, and technological innovation.

Organizational Innovation

Organizational innovation refers to new ways of organizing work in areas such as work-force management, employee empowerment, new people partnership, or positive action. Organizational innovation makes an organization a collective resource for innovation, knowledge management, value chain management, customer partnerships, distribution, finance, and manufacturing (Tushman & Nadler, 1996). Innovation in all these areas can improve the competitiveness of a business.

Information Innovation

Information innovation is neither singular nor linear, but systemic. It arises from complex interactions between many individuals, organizations and their operational information. Clark and Guy (1998) stated that corporations are successful in realizing the full return from their information innovations when they are able to match their information developments with complementary expertise in other areas of their businesses.

Technological Innovation

Janssen (2000) stated that in order to withstand relentless global price competition of products, it is necessary for a corporation to innovate constantly. Technological innovation includes anything technological that helps a corporation adapt to rapidly changing business situations in the face of competition. Technological innovation is crucial for a corporation to survive in a global economy.

Corporation Core Competence

Core competence is an activity that is performed more successfully by a corporation than by its competitors and that is in demand by the market. Specifically, the competence of a corporation is a combination of resources that are superior in competition under the whole strategy of the corporation. (Collis & Mongomery, 1995) In other words, it refers to the ability of all sections in a corporation to share and use its resources. Long and Vickers-Koch (1996) stated that core competence is a type of secretive/confidential skills, knowledge and techniques which have superiority over specific points of the value chain. Hamel (1994) also reasoned that the corporation core competence should be defined as a kind of capacity to combine many individual techniques - but not fiscal properties - into one. Following are four different concepts that further explain the basis for corporation core competence.

Shift of Resources and Capability

Shenkar and Li (1999) stated that emphasis should be put not on resources alone but also on capability when discussing the corporation core competence. The two factors together describe corporation core competence.

Combination of Distinctiveness and Persistence

Corporation core competence should have unique resources. Without distinctiveness, there will be little to create competitive advantage over others. However, being distinctive alone can not sustain a competitive advantage. (Tang, 1999) Temporary distinctiveness can not ensure the long-term survival of a corporation. Therefore, the combination of distinctiveness and persistence is an important factor for developing corporation core competence.

Effective Integration of Resources

Zack (1999a) stated that corporation core competence is conditioned by resources and these resources should not be individual, but effectively integrated among all parts of the corporation. Therefore, without reasonable and effective configuration and settlement of resources, a corporation can not fully exert its competitive edge or continue developing.

Dynamic Process of Realization

Competence is not a static process but a dynamic one (Zack, 1999b). Due to the challenges of constant changes in the business environment, corporation core competence must be constantly renovated, developed and cultivated for the corporation to survive.

Corporate Culture

Corporate culture is a representation of the values of a company, and influences the movements and behavior of the staff within a company. The culture of an organization collects and organizes internal beliefs and values possessed or shared among staff. Corporate culture can set up a common value system.

Wallach (1983) classified corporate culture into three types; namely bureaucratic culture, innovative culture and supportive culture. Hampton, Summer and Weber (1987) introduced another type of corporate culture which they labeled effective corporate culture. Generally speaking, corporations with bureaucratic culture are comparatively stable, mature and cautious in

operation. Innovative culture by necessity involves a move away from old, sometimes comfortable and seemingly effective ways of doing business. For corporations willing to take the risk and for leaders committed to building innovative culture, the first requirement is to understand the innovative process, and the second is commitment to its policies. Organizations with a supportive culture provide their staff with opportunities to learn from each other and activate a warm family-like environment. Corporations with effective cultures pay special attention to controlling the balance of cost and efficiency. This kind of corporation is effective, but there exists competition between individuals and departments. It operates according to the principles of balancing risk and profits, and it often takes a greater risk in the operation and accepts radical reform.

Relations among Corporation Core Competence, Management Innovation

and Corporate Culture

A corporation should constantly reestablish its core competence on the basis of management innovation. Both the existing areas of an organization's competence and new concepts introduced into it can be enriched and the uniqueness of a business can also be expanded, but only when the entire staff of the corporation is willing to expand with innovations in service. If the establishment of a competitive lead of an organization is based on its core competence as indicated by its staff, then the obtaining of the core competence should have close relationships with the corporate culture of the organization. (Bohlander, Snell & Sherman, 2001) Quinn (1992) noted that the accumulation of capacity to develop new technology adds great value to core competence, and is also an additional approach to learning the modes of organizational innovation and corporate culture.

After a review of 43 articles about innovation written in the past thirty years, Van der Panne, Van Beers and Kleinknecht (2003) found that the success of management innovation was determined primarily by two factors: corporation core competence and corporate culture. They made reference to five essential points related with management innovation: (a) corporate culture has influence on management innovation, and the collective properties of the management innovation achievement shall be recognized. (b) At the beginning of management innovation, a corporation is operated on the basis of corporate culture and corporation core competence. (c) The management innovation team with a mixed background of multiple subjects can balance both corporate culture and management innovation; thereby setting up superiority in corporation core competence can be expected. (d) Clear and definite management innovation strategy and service management style will be helpful to management innovation. (e) Adaptability of management innovation is the core competence of a corporation. If corporate culture can take advantage of the correlation between management innovation and corporation core competence, corporations shall grasp the most favorable timing of coming into management innovation.

Methodology

Research Framework and Hypotheses

As discussed above, it seems that there are mutual relations among management innovation, corporation core competence and corporate culture. For further understanding of these relationships, this study was focused on testing the following dimensions of management innovation: organizational innovation, information innovation and technological innovation. The dimensions to be tested for corporation core competence were: shift of resources and capability, combination of distinctiveness and persistence, effective integration of resources, and dynamic process of realization. The dimensions for corporate culture were: bureaucratic culture,

innovative culture, supportive culture and effective culture. This study further investigated the role which corporate culture plays in the relationship between management innovation and corporation core competence. There are four hypotheses in the study as shown below.

H1: A positive correlation exists between Management innovation and Corporation Core Competence.

H2: A positive correlation exists between Corporate Culture and Management innovation.

H3: A positive correlation exists between Corporate Culture and Corporation Core Competence

H4: Corporate Culture has an adjustment impact on the relationship between Management innovation and Corporation Core Competence. H4 was split into the following three sub-hypotheses, H4.a, H4.b, and H4.c.

H4.a: Corporate Culture enhances the positive correlation of Organizational Innovation with the four dimensions of Corporation Core Competence, respectively.

H4.b: Corporate Culture enhances the positive correlation of Information Innovation with the four dimensions of Corporation Core Competence, respectively.

H4.c: Corporate Culture enhances the positive correlation of Technological Innovation with the four dimensions of Corporation Core Competence, respectively.

Research Sample and Scales

Taiwanese investment in mainland China has continued to grow steadily especially since China's entry into the World Trade Organization (WTO). National Bureau of Statistics of China (2008) showed that 2 of the top 10 foreign-invested service industries exporters of China in 2007 were HANNSTAR BOARD and BAOLI, which were invested by Taiwanese businessmen. Taiwan-invested service industries going west to the Mainland on a large scale has introduced large amounts of funds, technical personnel and talents into China.

In this research, samples were chosen by way of convenience sampling. Subjects were enterprise owners and division managers of Taiwanese-invested businesses in the Taiwanese

Business Association of the National Cross-strait Science and Technology Development Park in Si-Chuan Province of China. These owners/managers, who were used as samples, were responsible for filling out questionnaires in respect to the three variables in the study. The study designed the questions for the three scales of the questionnaire through the interviews of experts and scholars. There were eight questions for the Scale for Management innovation, eight for the Scale for Corporation Core Competence, and six for the Scale for Corporate Culture. Of 800 questionnaires were sent out, and 260 valid ones were returned. The questions were primarily based on 6-point Likert scales.

The study applied the component analysis to extract common factors and the varimax to carry out the orthogonal rotation. The eigenvalue of higher than 1 and the factor loading of higher than 0.6 were set as the criteria to remove unsuitable questions in the questionnaire. (Kaiser, 1958) According to these criteria, the study deleted one question out of 8 ones for the Scale for Management innovation. The rest ones were suitable for further analysis. The study also carried out the reliability analysis and the validity analysis. Madu, Kuei and Jacob (1996) addressed that if the item-total correlation (predictive validity) of a question in a questionnaire should be higher than 0.5, it means that the question can indicate the contents or subjects we'd like to test. The study found that the questions of the questionnaire met the above criteria of the item-total correlation. As Nunnally (1978) stated, the Cronbach's α higher at least than 0.7 is the minimum requirement for showing the consistence of test results. Cuieford (1965) said that Cronbach's α higher than 0.7 shows high reliability, that between 0.7 and 0.35 shows fair reliability and that less than 0.35 shows the consistency is low consistence and should be rejected. For example, for the Scale for Management innovation, the Cronbach's α of separate dimensions are 0.95 (technological innovation), 0.95 (organizational innovation), and 0.90

(information innovation); and the cumulative percentage of variance was 90. For the Scale for Corporate culture, the cumulative percentage of variance was 69 and the Cronbach's α was 0.93. For the Scale for Corporation core competence, the cumulative percentage of variance was 71 and the Cronbach's α was 0.96. It can be seen that the three scales in the study met the requirements of reliability.

Results and Discussion

From the results of Pearson's correlation analysis, the correlation coefficients between the Organizational Innovation Dimension of Management innovation and the four dimensions (Shift of Resources and Capability, Combination of Distinction and Persistence, Effective Integration of Resources, and Dynamic Process of Realization) of Corporation Core Competence were 0.030, 0.029, 0.024 and 0.026, respectively. Those between the Technological Innovation Dimension of Management innovation and the four dimensions of Corporation Core Competence were 0.331, 0.331, 0.300 and 0.315, respectively. The Information Innovation Dimension of Management innovation shows no positive correlation with Corporation Core Competence (correlation coefficients: -0.062, -0.056, -0.042 and -0.073, respectively). Therefore, hypothesis H1 is partially tenable.

The correlation coefficients between the three dimensions (Organizational Innovation, Information Innovation and Technological Innovation) of Management innovation and Corporate Culture are 0.050, -0.084 and 0.411, respectively. Therefore, hypothesis H2 is partially tenable. Corporate culture showed a significant positive correlation with the four dimensions (Shift of Resources and Capability, Combination of Distinction and Persistence, Effective Integration of Resources, and Dynamic Process of Realization) of Corporation Core competence (correlation coefficients: 0.695, 0.711, 0.728 and 0.703, respectively). Therefore, hypothesis H3 is tenable.

As for the test of hypothesis H4, there are four partial cases based on bureaucratic culture (sample size: n=69), innovative culture (n=63), supportive culture (n=51), and effective culture (n=77), as compared with the entire sample (sample size: N=260)

The t-values for Organizational Innovation under the four dimensions of Corporation Core Competence (Row: Organizational Innovation; Column: Combination of Distinction and Persistence, Effective Integration of Resources, Shift of Resources and Capability, and Dynamic Process of Realization in order; as shown in Table 1) were correspondingly higher for the entire sample than for those in the partial case assorted by emphasis on Bureaucratic Culture. For example, the t-value of Organizational Innovation under Combination of Distinctness and Persistence was 3.762 for the entire sample and 2.466 for the partial case assorted by emphasis on Bureaucratic Culture (Table 1). The other three partial cases by emphasis on Innovative Culture, Supportive Culture, and Effective Culture showed the same results as for Bureaucratic Culture. Therefore, hypothesis H4.a is untenable.

Results for Information Innovation under Dynamic Process of Realization (Row: Information Innovation; Column: Dynamic Process of Realization) showed the t-value of the entire sample is 0.773, that is, lower than that (0.911) of the partial case assorted by emphasis on Supportive Culture. The t-values of Information Innovation under the remaining three dimensions (Combination of Distinction and Persistence, Effective Integration of Resources, and Shift of Resources and Capability) of Corporation Core Competence were 1.259, 1.448, and 1.556, respectively for the entire sample, but those for the partial case assorted by emphasis on Supportive Culture were 0.775, 0.910, and 0.993.

Similarly, for Information Innovation under Effective Integration of Resources, the t value of 1.448 for the entire sample was lower than that (1.715) for of the partial case assorted by

emphasis on Innovative Culture. The t-values for the remaining three dimensions (Combination of Distinction and Persistence, Shift of Resources and Capability, and Dynamic Process of Realization in order) of Corporation Core Competence for the partial case assorted by emphasis on Innovative Culture were correspondingly lower than those for the entire sample.

The t-values of Information Innovation under the four dimensions of Corporation Core Competence for the partial cases assorted by emphasis on either Bureaucratic Culture (Table 1) or Effective Culture were respectively lower than those for the entire sample. Therefore, hypothesis H4.b is partially tenable.

Results of Technological Innovation under the four dimensions of Corporation Core Competence showed that the t-values for the entire sample were higher respectively than those for the partial cases assorted by emphasis on Bureaucratic Culture (Table 1), Supportive Culture, Effective Culture, or Innovative Culture. For example, the t-value of Technological Innovation under Combination of Distinctness and Persistence (Row: Technology Innovation; Column: Combination of Distinctness and Persistence) was 10.285 for the entire sample, that for the partial case assorted by emphasis on Bureaucratic Culture was 5.126 (Table 1), that on Supportive Culture was 6.576, that on Effective Culture was 5.230, and that on Innovative Culture was3.705. Therefore, hypothesis H4.c is untenable**.**

As discussed above, Information Innovation has no significant correlation with the four dimensions of Corporation Core Competence. Except for the fact that Supportive Culture could enhance the positive correlation between Information Innovation and Dynamic Process of Realization and that Innovative Culture could enhance the positive correlation between Information Innovation and Effective Integration of Resources, the relationship between Management innovation and Corporation Core Competence could not be enhanced toward

positive correlation by Corporate Culture. This may be because their original correlation is
strong so that Corporate Culture can not show any further impact on them.

Table 1

Multiple Regression Analysis of Management Innovation and Corporation Core Competence:
Entire Sample and Partial Case Based On Bureaucratic Culture

		Entire sample (N=260)				Partial Case by Emphasis on Bureaucratic Culture (n=69)			
		Combination of Distinctness & Persistence	Effective Integration of Resources	Shift of Resources & Capability	Dynamic Process of Realization	Combination of Distinctness & Persistence	Effective Integration of Resources	Shift of Resources & Capability	Dynamic Process of Realization
Org I [a]	C	0.079	0.155	0.140	0.071	0.103	0.138	0.172	0.074
	t	3.762	3.760	3.361	3.428	2.466	1.751	2.113	1.826
	p	0.000***	0.000***	0.001***	0.001***	0.015**	0.082*	0.036**	0.069*
Inf I [a]	C	0.042	0.095	0.103	0.026	0.042	-0.017	0.052	0.000
	t	1.259	1.448	1.556	773	0.644	-0.141	0.409	0.002
	p	0.208	0.148	0.120	0.440	0.520	0.888	0.683	0.998
Tec I [a]	C	0.187	0.366	0.334	0.171	0.187	0.309	0.371	0.156
	t	10.285	10.315	9.310	9.573	5.126	4.475	5.197	4.416
	p	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
R square		0.127	0.127	0.105	0.113	0.131	0.107	0.133	0.103
F value		36.567	36.550	29.518	32.170	9.337	7.422	9.511	7.139
Dubin-Watson		2.203	4.311	4.355	2.170	2.165	4.088	4.231	2.096

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. C = Coefficient. t = t-value. p = p-value.
A: Org I = Organization Innovation. Inf I = Information Innovation. Tec I = Technological Innovation.

Conclusion and Suggestions

Management innovation is a widely discussed topic in business as well as in society as a
whole. Any corporation that aims to survive and remain viable must constantly reevaluate its
management in order to maintain current and competitive business practices. Management
innovation evaluation should be not only an important processing tool for managing new and
effective resources, but also a detailed management tool for both the integration of specific new
resources and the object system. For example, once a new method of service is suggested to an
organization, it should be implemented to run effectively in the organization. This study
produced several specific ideas that establish a link between core competence and the activities
of management innovation.

Improving and Strengthening Management Innovation

With the global economic integration speeding up, a business must keep up to date with changing domestic and foreign economic and technical environments. If a corporation wishes to be secure in a competitive market, it is very difficult to reach the anticipated goal by relying only on small revisions in service methods and modes.

Although Taiwan-invested enterprises have made great progress in recent times in learning and using advanced theories from foreign business experiences, methods and techniques about service management still lag behind. For example, stress is placed upon on the growth of operations, but the long term goals of the corporation are ignored. The followings are key points for improving all levels of management innovation: the corporation should have the strategic idea of considering the overall situation. They must learn to make use of domestic and foreign markets and resources to design the long-term development. They should adopt advanced scientific methods of service management to obtain their strategic goal and guidelines, so as to constantly enhance corporation core competence.

Promoting the Adjustment and Reestablishment of Service Management

Structure for Flexibility and Diversification

The service management structure may also be called the "skeletal system" of a corporation. It can keep service management operating normally. Innovation within a corporation includes adjustments and redesign such as the modernization of the corporation's scope and structure, the flexibility and flatness of service management structure as well as the diversification and individualization of a service management. Management innovation in all

these aspects will improve the managerial efficiency of a corporation, and further promote its core competence.

The Core Position of Staff and Strengthening Management Innovation in HRM

A corporation should reform the traditional staff management system and shift its emphasis onto developing, training and instructing talented individuals from the service strategic angle. The corporation should stick to principle of "customer first" so that it can effectively bring forth the potential of human resources capable of the highest service quality. While accelerating the circulation of human resources, it is more important to enhance both the renewal of their service ideas and the implementation of their service ideas. In addition, the corporation should guide its employees to join or form study groups to promote lifelong service education and training, which is also one of the management innovations of human resource management. Management innovation is at the core of corporation development, while study and learning are a major source for the corporation to permanently motivate and advance the service workforce.

Constructing Corporate Culture and Improving Corporation Core Competence

Showing special concern for the construction of corporate culture requires building and defining service beliefs and values among the corporation staff, which then influence the service spirit and consciousness of each employee. Regarding this service aspect, Japanese "Toyota spirit" and "Panasonic style" are most recognizable. Only after establishing unique and exclusive service values can a corporation integrate the individual beliefs of employees into a unique service cultural trend, which in turn has a profound influence service staff of the corporation. It would also improve the core competence of the corporation.

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