



# THE INTERNATIONAL JOURNAL OF ORGANIZATIONAL INNOVATION

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ABOUT *THE INTERNATIONAL JOURNAL OF ORGANIZATIONAL INNOVATION*

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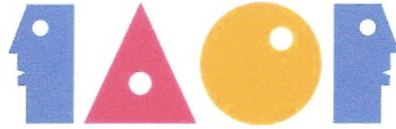
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## MOTHERHOOD AND ENTREPRENEURSHIP: THE MUMPRENEUR PHENOMENON

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### Abstract

Women entrepreneurs play a significant role in contributing to the growth of the global and local economy. Many of the contributions come from a strong emerging trend of so called “Mumpreneurs”, which describes mothers involved in entrepreneurial activities. In this chapter, the authors study the new phenomenon of integrating motherhood and entrepreneurship; about their underlying desire to create a better environment for their family and overall community. The uniqueness of being a Mumpreneur is about balancing work and life, sense of achievement and satisfaction with oneself, increasing income, gaining respect to equalize gender imbalance, and becoming independent. There are however challenges facing Mumpreneurs. These include starting ventures with lack of appropriate knowledge, resource constraints, stereotypes, balancing work and life, and limited networking opportunities. To encounter these challenges, the authors select three mini case studies, based on Australian Mumpreneurs to explore their strategies of overcoming such challenges and barriers. Ultimately, recommendations are introduced for newcomer or nascent Mumpreneurs, raising their new ventures in addition to their motherhood duties. Global and domestic economic prosperity will be maximised and sustained only when women have the equal footing with males. This calls for a change in the business environment, more effective programs from social institutions and government, to better support women being amongst others, Mumpreneurs.

Keywords: Entrepreneurs, Mumpreneurs, Family, Women.

## Introduction

The purpose of this paper is to explore women and entrepreneurship, and more explicitly, those women referred to as “Mumpreneurs”. Whilst entrepreneurs are people who habitually create and develop new ventures of value around perceived opportunities (Maritz, 2004), Mumpreneurs add a whole new dimension to entrepreneurship. The new dimension is motherhood, whereby these women business owners balance the role of mother and the role of entrepreneurship. Their motivation is the altruistic desire to create a better environment for their family and overall community.

The Global Entrepreneurship Monitor (GEM) 2007 identifies that women signify more than one-third of all entrepreneurs, and are expected to participate predominantly in roles in informal sectors. Informal sectors include the emergence of Mumpreneurs, whereby instead of returning to the formal workforce, Mumpreneurs create new businesses around their family environment and circumstances. Mumpreneurs also actively participate in the gender, home-based and lifestyle entrepreneurship domains.

This form of new venture business creation however has its own set of unique challenges, including fear of failure, less optimistic and confidence in business than men, and most importantly, securing start-up finance. Despite these challenges, many Mumpreneurs venture into the unknown, and then struggle in managing their growing businesses. Some successful business cases are selected to aid understanding of Australian women who have been taking this emerging role, the Mumpreneurs. Lastly, ten recommendations or tips are included for budding Mumpreneurs to start their new businesses. Budding Mumpreneurs are referred to as nascent Mumpreneurs, being those Mums with a desire to commence an entrepreneurial new venture.

The context discussed in this chapter is predominantly based in Australia. However, many approaches identified may also well be applicable in Asia Pacific. We do however lend on the literature from USA and New Zealand.

### Methodology

This paper on Mumpreneurs results from an exploratory process identifying this new entrepreneurship phenomenon. It commence with a review of Women in entrepreneurship, predominantly focusing on the Global Entrepreneurship Monitor. A review of the limited literature was complimented by a focus group of identified Mumpreneurs, together with thematic apperception testing of five individual Mumpreneurs. Factors were identified and graded regarding specific challenges and dynamics peculiar to this entrepreneurship segment. The thematic guide also highlighted specific recommendations for nascent Mumpreneurs. Case-study methodology was also introduced to substantiate the apperception from the limited field of reference.

### Entrepreneurship and Mumpreneurs

Entrepreneurship occupies a significant role in reshaping economies and societies. It entails the new production process and the introduction of new products or services to new market segments that shapes new organizational structures (Craig and Lindsay, 2002). Generally, entrepreneurship can be defined as a practice by which an individual habitually creates and develops new innovative ventures of value in response to perceived business opportunities (Maritz, 2004). This practice creates employment opportunities, more income and family welfare.

Women have the skills, knowledge and capabilities to be as entrepreneurial as men. According to GEM 2007, there have been an increasing number of women entrepreneurs



throughout the world, who participate in early stage entrepreneurial activity and establish themselves as business owners (Allen, Elam, Langowitz, Dean, 2007). The rate significantly and quietly increased from 5 percent to 38 percent in 30 years (Nelton, 1998). An early stage of entrepreneurial activity determines business that has not been operated more than 3.5 years. On the other hand, established entrepreneurs who have been operational more than 3.5 years, in which time they have a higher chance of failure (Allen et al., 2007). Further evidence is supported by Non-profit Women's Business Research that the rate of women who start their new venture is double the rate as of men in America. Besides, there are 10.6million women-owned businesses which create \$2 trillion of income yearly. An online website for US Women's networking group such as *Ladies Who Launch* also provides workshop for the members. It is found that almost 50 percent are mothers out of 25,000 members (Bower, 2005).

In Australia, the total percentage of female business owners is surprisingly very close to men (18.43 to 23.69 respectively). Furthermore, the prevalence rates of entrepreneurial activity is equivalent to 9.87 percent as of female and 14.02 percent as of male at the early stage of entrepreneurial activity. The percentage of established female business owners is at 8.56 whereas men at only 9.67 (Allen, Langowitz, Minniti, 2006). Even though the female contribution to economic growth is increasingly important and is a key factor that should not be overlooked, little attention and support has been paid to women entrepreneurs. A study by GEM 2007 reports those women involved in entrepreneurial activity gain higher profits than men. This result suggests that women have a greater sense of leadership that connects to better corporate governance and management practices, which impacts firm profitability (Allen et al., 2007).

Mumpreneurs is a new emerging trend that takes on the concept of entrepreneurship into family businesses. It is a part of female entrepreneurship that describes women who start their

own new ventures besides taking a role of being a mother. Family entrepreneurial business is more complex than non-family business. This is due to combination of the two interacting systems: the family and the business (Davis, 1983; Landsberg, 1983). Birley (1989: 37) explains it: “Until very recently, the major role of women was seen in most Western economies by both men and women to be that of wife and mother. Indeed, even should they take employment this was almost always in addition to their role as homemaker.” Harris, Morrison, Ho & Lewis (2008) identified the link between motherhood and the entrepreneurial experience through an exploration of how the Mumpreneur orients the activities of her enterprise to her family, her child(ren) and her personal aspirations. Their title however indicates that Mumpreneurs are in the business of babies, which is not necessarily correct. Mumpreneurs do not limit their business activities within the baby products and services domain, despite research indicating such a preference.

The term “Mumpreneur” was conceptualised by Patricia Cobe and Ellen H. Parlapiano over a decade ago. Their original established online website called Mompreneursonline.com is a women’s-only networking group which draw over 7 million visitors each month. The site includes online community, blogs, lively conversations on message boards, a marketplace of unique products and services by Mumpreneurs, articles, books and business advice from experts for start-up entrepreneurial mums to work from home. Today’s technological innovations and internet capabilities further allow home-based businesses a possibility for every mother to market their products (Bower, 2005).

Scholars consent that foreseen business opportunity, social capital and self-concept are perhaps significant manipulators on entrepreneurial activity (Allen et al., 2007). However, the motives behind the business start-up among males and females are different (Cromie, 1987).

There are push and pull factors underlying the motivation to become an entrepreneur. Pull factors are positive, which refers to opportunity entrepreneurs, as driven by a business opportunity. Women in Australia are often found to be motivated through perceived opportunity. Push factors are negative, which refers to necessity entrepreneurs, as driven by unemployment, dissatisfaction with the workforce or inflexible labour markets and needs to earn money for living (Alstete, 2003; Orhan and Scott, 2001; Allen et al., 2007; Maritz, 2004).

Mumpreneurs can be driven by both pull and push factors. The primary desire is to create a better environment for their *family* and overall greater *community*.

According to Cromie (1987), women not satisfied with their previous jobs found self-employment as a way to solve the conflict of personal and work demands. Women see business ownership as the only way to make money for living while being committed to family and domestic responsibilities (Fielden, Davidson, Dawe, Makin, 2003). The motive that raises innovativeness is the frustration and dissatisfaction with the products and services available and/or not available in the domestic market. This is particular the case for baby or kid-inspired products or services, for instance, Mac & Cool— an instant cool bowl for kids or night-child care centres to avoid parent's sleepless nights (Bower, 2005; Kuchment, 2006). An unconditional love of motherhood leads mothers to innovatively develop more suitable products for their babies—being the mother of invention. Having seen an unexploited business opportunity, the initial products for their own babies then become commercialized to other mothers. This is one of the reasons why most of the women's ventures in Australia fall in consumer products in retail and wholesale industries. Nevertheless, only a small number of businesses could be claimed as totally new to every customer at the early stage of entrepreneurial activity (Allen et al., 2007).

Again it is highlighted that Mumpreneurs operate across a wide spectrum of markets and domains, not only limited to baby products and services.

Brush (1992) explains that the key motivation for female entrepreneurs is the concern in helping others. Women often integrate the business and family relationships together to the community. Mumpreneurs are motivated because they want to make a difference and contribute to the community and society. Hence, they are more client-oriented than men (Orhan and Scott, 2001). Since they get together to develop their communities and help each other in terms of preparation for their babies, resources, education and training, women are perceived to be more socially oriented than men. Generally, Mumpreneurs are also more likely to recruit other mums into partnerships and networks. . This creates jobs for other mothers and yet again helping one another to achieve greater revenues and profits. In developing countries, business practices of Mumpreneurs even decrease the effect of discrimination against women in labour market. (Weiler and Bernasek, 2001; Moore, 2003).

The uniqueness of being Mumpreneurs is that they are about balancing work and life; sense of achievement and satisfactory with oneself; increasing income; gaining respect to equalize gender, and becoming independent. The most outstanding factor about being Mumpreneurs is that *it is not all about wealth creation*. The goals for women to enter business ownership are not about financial gains, but to follow their intrinsic needs (Rosa, Carter and Hamilton, 1996). This aspect is totally different than male entrepreneurs. Each mother by nature stays intimate with her babies through pregnancy until birth. This role emphasises an important fact of being Mumpreneurs and their desire to spend more quality time on their babies and family, hence a very clear objective is set to balancing family and work, whereas the traditional workforce does not allow them to have such significant flexibility and independence. Many

women perceive entrepreneurship as an approach to earn for and better look after their families, resolving two duties in one goal.

Secondly, it is not just about being a mother. Women who previously had a career their whole life and after all just stay at home all day caring for their babies can become bored, lonely and unhappy. The new venture puts more meaning into their lives, creates self-fulfilment, autonomy, and self-esteem. Hence, Mumpreneurs enjoy more stimulation than motherhood alone can provide. Women deferring childbirth in preference to careers is also the factor behind the surge as they enjoy achieving things. Thirdly, income support from spouses alone may not be adequate in today's economically demanding economy. This creates the desire for wealth. The latest world economical crisis (late 2008) also contributes toward nascent Mumpreneurs wishing to supplement family income. Fourthly, the gender gap is still exists. Mumpreneurs can gain respect, social status and power while being regarded as business people. Lastly, these drive women to gain greater economic and social independence; the most frequently quoted 'pull' manipulators for female entrepreneurs (McClelland and Swail, 2005). This is especially true for young mothers or single mothers against discrimination in labour market (Allen et al., 2007).

#### Challenges facing Nascent Mumpreneurs

Resembling men, women can run their own businesses across a variety of markets and industries. However, it is not easy to start a business while also being a mother. Since 1930s, the trend emerged toward a "double burden" for women to concurrently and successfully take the responsibility to perform the roles of worker and mother (Allen et al., 2007). A worldwide entrepreneurship survey last year showed that women still face a variety of challenges and problems in developing and running a business (McKay, 2001; Allen et al., 2006). Many barriers still exist for them to establish and grow new ventures. The literature also supports that there are

obstacles faced by female entrepreneurs, which prevent their developments (O’Gorman, 2001). Five core challenges are identified, integrating literature with this qualitative research:

**1. *Getting started with lack of knowledge:*** Many mothers find it difficult to put their heads back into business after having babies. They often had no idea how to write a business plan, source manufacturers, find the market for their products and establish the new venture. Imagine women who have been staying home as housewives, many of whom may have lost business contacts. It is unclear how to seek business and legal advice, develop the knowledge and managerial skills required to establish the businesses locally and internationally. Nelson (1987) finds that women are at disadvantages in education and working experiences as they approach entrepreneurial activity. It is only the passion the mothers have to attempt to produce the products for their babies and the community as a whole. This led the mothers facing the risks of starting a new venture, a challenge calling for appropriate mentoring, assistance, education and training.

**2. *Resources constraints:*** It is found that female entrepreneurs have a distinct lack of financial support. Most Mumpreneurs have started their own business with their own savings or personal assets and employ little or no external funding. This is because they found the problem of securing start-up finance without having credit ratings and a formal business plan. They require obtaining capital as the most serious self-described barrier to growth in Australia (Moore 2003). “Financial aspects of venture start-up and management are without a doubt the biggest obstacles for women” (Brush, 1992: 14).

Moreover, many mothers often have the responsibilities of do-it-all domestic labours and limited assistance. Without enough savings, they cannot establish the business and find extra resources to unload their accountability. Finding suitable employees also seem to be a problem

as expressed by an Australian entrepreneur; “One of the biggest barriers for me was getting good staff who were able to work in a start-up versus a corporate culture...Being a tiny company with global clients – trying to meet their expectations of delivery, quality and service” (McClelland and Swail, 2005: 100)

**3. *Women stereotype:*** Women and men have different perspectives regarding how they see the world. They face different situations and react differently react to a given situation and approaches to the market place. Across the globe, women entrepreneurs express more fear of failure to start up their own businesses more than men. A mother is less optimistic about her own ability and has less self-confidence. The more risk adverse characteristic kept them away from engaging in new ventures; with more than one-third of women communicating a fear of failure. These factors are a significant forecaster of nascent Mumpreneurs. Accordingly, women’s level of confidence to successfully run the business is still less than men (43 percent and 59 percent respectively) (Allen et al., 2007).

**4. *Balancing work and life:*** Work family balance has been a topic of academic interest since the 1980s, and recently considered as a ‘woman’s issue’ in the study of entrepreneurship (Greene, Hart, Gatewood, Brush and Carter, 2003: 10). Many researches embrace discussion of the challenges that Mumpreneurs face in combining business and family responsibilities (see for example Brush 1997). It is not easy to balance a business while raising children. Having your own business could mean higher responsibilities and thus, balancing work and family is even more difficult. Women still face traditional culture and values, emotional attachment to family assets in which stress on their role as being a mother within the family and on the time spent on their babies or kids. There is a risk involved in terms of running their own business while setting aside the amount of appropriate time to their family responsibilities.

Eveline (1999: 5) states “The traditional disengaged father still predominates in Australia, as in most randomly sampled studies elsewhere” This is because men “face important economic, policy and cultural constraints to their involvement” (Flood 2003: viii). Only mothers are encouraged to provide intensive care and nurturing for their children (Pocock, 2005). This stereotype requires some Mumpreneurs to do it all on domestic and emotional labour. Hence, Mumpreneurs may face the “feelings of ambivalence, parental stress and work/ family conflict” (Eveline 1999:4). It is a cultural contradiction to motherhood. Resistance from family shows the greatest obstacles for female entrepreneurs in developing countries (Babaeva and Chirikova, 1997). Pocock (2005) regards this clash as the “work/ life collision”. The literature also indicates that such family obligations restrict the strategic decision making of Mumpreneurs.

**5. *Fewer networking opportunities:*** Having a role model, access to information and social networking are important for entrepreneurs regardless of gender. However, there is an argument supported by GEM 2007 that there is less opportunity for women than that of men (Allen et al., 2007). Birley (1989) finds that often women do not have the opportunity to basically socialize in the commercial networks in their previous employment. They only gain their first managerial experience in their home-based businesses. Women have a lack of connection with smaller business networks to start and promote the growth of the business; lack of high-level network contacts that men can draw on to advance the businesses including the work around legal deficiencies (Carter and Rosa, 1998). Additionally, it is due to societal factors that women have less time for both informal and formal networking (Ibarra, 1993). Thus, with existing qualifications, they often became entrepreneurs through hobby-related small-scale privatization of shops and restaurants.

#### Mini Case Studies of Australian Mumpreneurs



Although being Mumpreneurs contribute many benefits to women, a few Mumpreneurs have failed to continue their new ventures. Others have lost the balance between work and family, often resulting in domestic disputes. These are predominantly due to the challenges and barriers as previously described. However, Australian women are a lot more active in starting up new business compared to some other high income countries, for instance Italy, Japan, Germany and France. On average, 25-34 year old women are involved in entrepreneurial activity in early stage, and then grow into established entrepreneurs at age 35-44. When entrepreneurial activity is motivated by opportunity, less fear of failure was expressed in Australia (Allen et al., 2007). More cases found that Australian Mumpreneurs have successfully been managing businesses well. Many Mumpreneurs who started their own businesses with inspiration after motherhood are now becoming instant millionaires. The selected case studies entail how they approach, the challenges and the methods they use to operate the businesses and reflect to family life. They are extraordinary women with successful businesses, and thus studying and learning from real-life Mumpreneurs present valuable lessons.

#### *“SINGLE - MUM”-PRENEURS: UNTOXCITY SOAP WITH BODY SHOP AUSTRALIA*

Many young mothers can struggle to start a business when they have a lack of experience. However, many nascent Mumpreneurs have received assistance from the Body Shop Australia. The Body Shop and the Australian Federal Department of Education, Science and Training (DEST) developed their project in Victoria, New South Wales and Brisbane in early 2006 called “Babes in Business (BiB): An enterprise education project for young mothers and young women”, which offers 11 days of business training, creative workshops, mentoring, teamwork and other long-term support for women entrepreneurship (Studdert, 2007). Their objective is “to build the innovation and enterprise skills of young mothers and women to assist

in developing alternative income streams and re-engagement in local communities” (Cunniffe, 2006). This encourages mothers to start their small home-based business to balance work and family. The program provides assistance in developing personal and business-related skills for mothers to seek for perceived business opportunities. Many Mumpreneurs do not know that all their skills of motherhood in fact can be transferred into business. Raising a child includes commitment, day-to-day/ short and long term plan, communication, scheduling and organisation, creativity and so forth; all of which can be used to run a business (Cunniffe, 2006). For instance, the daily activities require a mother to be very organized to schedule time to prepare meals, pick up their kids or pay attention to small details to even remember where the kids left their socks at home.

In the course of its great benefits to young women, positive social change and community as a whole, it recently attracted American Express who offers up to \$5000 loans-without-interest and the Red Cross to be committed as the sponsors (Studdert, 2007). The program also covers costs of business registration for start-ups. BiB catered around 15 participants aged between 18 and 25 via wide range of supportive partner community agencies such YWCA (Cunniffe, 2006).

Melisa Bentaberry, a young single mother who has a passion and desire to run a natural soap business, is one of the first graduates from Melbourne course. She had suffered terribly from eczema, was unemployed and has to raise a child with chronic sleeping problems alone, all of which left her at difficulties. Melisa has limited experience but found her passion in nursing, organic and natural healing. From the interview with the Australian Newspaper says Melisa “I needed special soaps and shampoos for my skin. It seems a natural development to begin making them myself. But I also got interested in the healing power certain plants have, in their scents and essential oils and wanted to combine those with the soaps”. In addition, she says “*I was ready to*

*make the commitment to setting up my own business but I had no money, no credit rating, and knew I'd never get a loan*" (Studdert, 2007). This is the dilemma that many Mumpreneurs face prior to start up. The program manager, Paula Cunniffie articulates "Many say they felt very poorly judged as young mums, but find that after the program they get treated with respect as business people" (Studdert, 2007). Many people have the attitude towards stereotype of young single mothers that their lives will be ruined. This supports the argument to one of the motives that being Mumpreneurs is to equalize gender and to gain respect proving that those people are wrong. Also, it was apparent that Melisa would need to increase income being a single mother.

With support from the BiB program, she has now been able to start up her own hand-made soaps business and work from home. A good concept of Melisa to create balance to the bodies to different people's lifestyles using soap has translated into entrepreneurship. The weekend workshops at premises also include childcare support and nursery facilities making it easy for young mothers to attend. The three stages cover 1) Discovering innovation and enterprise, 2) Developing enterprise and 3) Implementing and evaluating enterprise. Generally, it goes through all business essentials to develop required business skills, the entire business plan including supplies, finance and marketing, networking and alliances to put inspiration to action. Regular meeting is done throughout the program by teamwork to review progress, discuss ideas and advice provided by visiting experts including emotional support. Mentoring and personal/business networking also allows participants to build sustainable businesses and stronger community in the long run (Cunniffe, 2006).

#### *KIDSPOT.COM.AU PTY LTD – THE MUMPRENEURS PARTNERSHIP*

The Two Mumpreneurs, Katie May and Dani Gurrie, both mothers of two kids together started an online privately owned business Kidspot Australia, a website that simplifies activities

of parenthood. In 2005, it all began from Katie's idea, the former marketing director of [www.seek.com.au](http://www.seek.com.au); Australia's number one job site. It was when her daughter was reaching five years old and Katie the 39-year-old mother expressed her frustration of unable to find a jumping castle on the Internet for her daughter. She decided to put together her ideas and came up with nearly entire business plan to show her co-worker, Dani the 38-year-old mother who is now in the partnership (O'Brien, 2007). As earlier mentioned, the study supports this evidence that Mumpreneurs often call in other mums into partnership (Allen et al., 2007).

Katie and Dani started off with their own savings and kept their day jobs while doing market evaluation. It initially presented only as a directory of maternity, baby and kid related products and activities. In June 2006, US-born Katie has moved back to the US with her husband a former Australian cricketer Tim May. She manages the home-based business in Texas with monthly visit to the South Melbourne office-with twelve employees. After a few years, the website has become very popular with hundreds of companies listed for organizing kid's parties, a market to buy and sell kid-inspired products, a rich community and private forum/ chat for mums to share experiences. All in all, the information feedbacks to Katie and Dani to customize content what parents need to know and editorial to match the interests. Due to its popularity, it eventually attracted the founding investor of [www.seek.com.au](http://www.seek.com.au), Irvin Rockman to come on board to support the financial aspect (O'Brien, 2007).

By being Mumpreneurs give Katie and Danie the flexibility; the motive to balance work and life. "I'm taking kids to activities which used to be outsourced. I may have to work to midnight, but I'm much more satisfied with my balance in terms of being a mum" says Katie. Danie also enjoys bringing her kids to the Melbourne office where she is in charge and having home-based business two days per week. She emphasises the fact that a support from her

husband, Ashley whom with IT background, is critical, “He is extraordinarily supportive, as are my in-laws” says Danie (O’Brien, 2007: 152).

Partnership between Katie and Danie, the two mothers bring forward the case of women entrepreneurship and their uniqueness in term of being social-oriented in the community. They help each other to turn their good ideas into great profitable business, and this is true for Katie as she expresses “Dani gave me the confidence to keep going. When you have a partner, there’s a sense of obligation – I wouldn’t have done it without her” (O’Brien, 2007: 152). Generally, Mumpreneurs tie a strong bond between each other; that is what makes the difference between men entrepreneurs and Mumpreneurs.

#### *CUDDLEFISH.COM.AU – GOING INTERNATIONAL*

International trade is a significant avenue for worldwide economic growth. Women owned businesses that operate internationally have shown to be more successful than those domestic-focused (McKay, 2001). Thus, it is important for businesses to seek out new markets and expand customer base. However, the exact numbers of women entrepreneurs who involve in international trade are still uncertain. The National Foundation for Women Business Owners (1998) has done several interviews, and the result shows that 12.5 percent to 33 percent of the female entrepreneurs were engaged in international trade (McClelland and Swail, 2005). Koreen (2001); cited in McClelland and Swail (2005: 87) points out that “comprehensive studies are lacking and there exist important gaps in statistics on the small firm in international trade broken down by gender”.

Only some of women entrepreneurs have lived in other countries than their own, which aid them to expand the business internationally (Allen et al., 2007). As otherwise, to start-up a business for mothers already seem difficult. Significantly, it is found that 100 percent of the

women entrepreneurs in Australia were trading internationally. The majority of the businesses could be seen as born global from the beginning (McClelland and Swail, 2005).

Caroline Hume a 37-year-old mother is one of the Mumpreneurs in Melbourne, who takes the advantage of overseas experiences to expand her business internationally. She used to live in Hong Kong, Switzerland, and London with her husband and worked overseas in marketing and event management. Even though she never had a dream to become a Mumpreneur when she was a teacher in 2001, during her holiday visit to France, Caroline brought a buoyancy suit for her one-year-old daughter, Isabella. There were many interests from people about where they can get the kind of buoyancy suit that has a 50+ UV sun-protection and very stylish. Afterwards, the products became unavailable and Caroline struggled to find it for her younger daughter, Eva. It was the passion to find the product for her daughter that drove her. Before long, Cuttlefish was founded (O'Brien, 2007).

Caroline did her market research, discussed with family and friends and prepared her new swimwear range to launch in 2003. By doing so, she made few appointments with the shop owners in Brighton beach and showed them the samples of her buoyancy swimsuits, and received great feedback. In 2007, the Australian made best-selling suit with built-in flotation went global to Hong Kong, America, England, Belgium, New Zealand, Japan, Singapore and many more. A great idea of the product made locally is now being exported internationally and throughout Australia. The company started up cost was \$10,000 from the savings of Caroline and her husband. It became profitable in year 2005 and met its target in the following year (O'Brien, 2007).

According to an objective of being a Mumpreneur, Caroline emphasises that her daughters "have always come first". She manages to work from home with a warehouse nearby

her place. Home-based business allows her to have more time for her kids; “I don’t have to rush the children out the door and I’m there for every single pick-up” says Caroline (O’Brien, 2007: 150). However, she has set her own boundary to make it work. This is an important part, as one of the tips, to remembering the objective is to balance work and family. Thus, managing and dedicating time to the kids is more than important. Caroline has two phone lines to separate between running daily business and personal life; no personal calls during working hours and no more working hours after five. Mumpreneurs have to be able to separate working hours and time spent for their family. “It’s like a mathematical sum – how much time you can give your business for it to work and how much time you can give your children to achieve the balance that people talk about” (O’Brien, 2007: 151). After all, “my business is just part of my life and I couldn’t be happier” says Caroline (O’Brien, 2007: 150). The underlying motive of having sense of achievement and self-satisfaction was there. Growing the business for Mumpreneurs especially going international may be difficult, but it is not impossible.

The headline author, Dr Alex Maritz was invited to participate on National Television (Channel 10) in 2007, with an Australian Mumpreneur. See <http://video.aol.com/video-detail/9am-alex-maritz-and-julie-haines-interview/3178958642>. With more and more Australian women trying to juggle the role of mum and managing director, the phrase Mumpreneur has been coined for all those mothers who’ve started a business from home. Business Expert, Dr Alex Maritz, and Small Business mum, Julie Haines, shared some tips on how to get started in your own small business. We share these with you in the next section.

#### Recommendations for Nascent Mumpreneurs

The roles and responsibilities for work and family are doubling up for Mumpreneurs, but nonetheless, it is amazing how many mothers can strive to earn incomes to support their children

and balance work and life. This is because they have the skills of being a mother, which can be used in businesses. Increasingly many mothers are developing new ventures while their babies are sleeping, as evident by the mini case studies. But what is however the right approach to facilitate success and how to?

We introduce these ten tips for newcomers to becoming Mumpreneurs, to raise the kids as well as raising a new business— as another baby of your own.

**1. Passions and talents drive:** Realising the full potential of your own true passions and talents is the ultimate drive for daily work life. As a Mumpreneurs, working seems like a fun job when you enjoy what you love and be able to do what you are skilled at. This could start from evaluating your interests like hobby, personality and skills to scope your viable business project (Parlapiano and Cobe, 2007). As found in the mini case studies, many mums are creating kid-inspired products to solve their problem they have experienced as parents.

Marry Toniolo, the founder of Bella products, a million-dollar toy company that has won many awards such Girl Toy of the Year at the American International Toy Fair from Dancerella Home Ballet Studio, an instructional video, ballet barre and mat says “Fun still drives me. I couldn’t work this hard unless I enjoyed it and, if you’re having fun, it’s not hard work”. “The financial rewards will come because you’ll be better at it” (O’Brien, 2007: 150).

**2. Do market research:** This is an important part to make certain that customers would buy the product or service from you. Internet and state/ local libraries are good sources to evaluate product/ service’s newness, analyse competitors, find suppliers, setting price, investigating trademarks and testing the potential customers in the market. Mumpreneurs are encouraged to do full of research to study the local or international market to stay competitive (Parlapiano and



Cobe, 2007). In high income country like Australia, the survey found that more than half of early-stage entrepreneurs expect to face many competitors (Allen et al., 2006).

**3. Go niche with your business plan:** You don't just jump into the franchise or business opportunities. The focus business should distinguish and "fit-in" with the talents and skills. Evaluation includes finding an attractive business niche, setting objective, mission/ vision statement, business goals, marketing, earning expectations (start-up costs, budgeting, turnovers, and taxations). Assistance accountant or attorney can help to project cash flow, work out financing, and plan on patent fees including insurance (Parlapiano and Cobe, 2007). Through the studies, it is found that all successful Mumpreneurs had their business plan before going into the market. They understand that businesses counting from start-up can take three to five years to become profitable.

**4. It's the brand image:** Trade marking protects the brand name to be unique. It is an ongoing marketing that includes several methods of promotion and advertisement. Mumpreneurs should target the market for their products or services and make sure to list their business names in such local newspapers, related magazines and telephone books. Building the "brand" also requires repetitive marketing for people to remember. A memorable name and well-designed publishing materials make the business outstands. Having business cards, Mumpreneurs can promote their businesses while attending local women's business events, community centres or wherever they go. A good website displays logo with navigation that is user-friendly. Contents should contain good comments from satisfied customers, press releases and recent news as well as links from other web sites to boost traffic (Parlapiano and Cobe, 2007).

**5. Support from spouse and family:** Family capital is the "Relationship between children and parents and, when families include other members', relationships with them as well"

(Coleman, 1988: S110; cited in Allen et al., 2007: 33). Constant family support has a positive and strong impact on the chance of becoming and continuing to be Mumpreneurs. On average, women with family base size from six people and above have higher chances of becoming an entrepreneur (Allen et al., 2007). Family support is a must, especially a support from spouse is very important in term of taking care of the babies or offering business and emotional support. Spouse must understand that there may be some changes in role and expectations as well as giving encouragement to their wives to raise their confidence.

Doily Couture's Sarina Tomchin, the founder of fashionable sleepwear as well as a 41-year-old mum says "My husband, Michael, has taken over a lot of the grocery shopping, helping with the girl's homework and all the driving around for their extra-curricular activities" (O'Brien, 2007: 152). This is about how a couple, in entrepreneurial activity, intimates and finds the balance between work and family life.

**6. Remember your objective:** "Moms have critical entrepreneurial skills such as patience, stamina and persistence" says Tamara Monosoff, author of *The Mom Inventors Handbook*. "They know how to prioritize and are master schedulers" (Dver, 2006). This is about time management. Mumpreneurs should keep a schedule and prioritize their tasks. The key point is about remembering the goal – the most important aspect in life, the kids and family. Afterwards, you can shape your business around the kids, work out the daily task on which needed done first and complete them in order. Being motivated and organized or even multi-tasking are important while taking roles of a mother and being one's own boss.

Mumpreneurs have to protect work and family time, as otherwise there will be no boundary unless you put in there. You have to separate and set working hours as child-free time, for instance children's nap time, and do not overwork on the weekend. Considering few days of

childcare, dividing household duties to spouse, housekeepers, part time assistant or part time nanny can help to sort out the time, maintain family balance and give customers the assistances they need. You can be more productive, stress-free and able to concentrate on the work much better when the kids are well taken care of (Parlapiano and Cobe, 2007). “It was my mum who said, you’re cleaning the bathroom in between everything else – this is crazy, you need to get a housekeeper” says Katie May of kidspot.com.au (O’Brien, 2007: 152).

**7. Build your own networks:** Social capital is “the ability of actors to secure benefits by virtue of membership in social networks or other social structures” (Portes, 1998: 6). The literature reviews that social capital enhances higher life satisfaction and healthier mentality. This social network that includes other entrepreneurs also increases the likelihood for a mother to become Mumpreneurs. It is also found that that being employed allows women greater access to resources, social capital, and ideas that may assist in developing new venture. The percentage of employed women engaging in early entrepreneurial activity is as high as 74.3 compared to 21.6 for those who is not working (Allen et al., 2007). They seem to have more confident and skills to proactively look for market opportunities.

Thus, it is vital to develop connections with co-workers, customers and other mothers through online and face-to-face networks. Mumpreneurs can join in associations, professional organizations, women’s business groups and online message boards/ chat or forum to be in the community relevant to their businesses. Having social network and peer support builds a stronger community between women to share ideas and information like lesson-learned, help each other in developing knowledge and skills required to start up and maintain the businesses as well as marketing the products without expenses (Parlapiano and Cobe, 2007). Kidspot.com.au is one of the businesses that found its partnership through networking.

**8. Seek resources and knowledge:** Male entrepreneurs may seek out their own ways to reach their business goal, whereas women entrepreneurs will look for help and support to achieve the objective (Druxman, 2007). Greater household income means greater likelihood for women to be involved in managing and owning a business (Allen et al., 2007). But not everyone will have enough savings to establish the business. Many non-profit organizations and online community, for instance BiB, provide resources and expertise to help Mumpreneurs to maximise their success to start the business. Resources include financing and easy-to-use calculators, mentoring, marketing and technology tools that Mumpreneurs need. Another good Australian website is [www.showmummythemoney.com.au](http://www.showmummythemoney.com.au), which acts as an online community offering interesting articles, great advices for mothers going in or already in business. Additionally, Women's Business Centres is a community-based centre which provides education, training, and technical assistance for women entrepreneurship. Their programs are available in Australia and many other countries, specializing to women's interests to best suit their needs to build relationships and networks nationally, access to opportunities and role modeling.

There are several books for Mumpreneurs. The Mom Inventors Handbook: How to Turn Your Great Idea into the Next Big Thing by Tamara Monosoff also offers useful steps and advice for putting Ideas into I do. It also includes guideline for product development from ideas to market research, manufacturing, licensing til product launch. Trillion-Dollar Moms: Marketing to a New Generation of Mothers is another book for Mumpreneurs who target other mums, by Bailey and Bonnie Ulman. This book integrates the strategies to study buying behaviours of today's mothers and marketing tactics. Moms Business Magazine is another resource for Mumpreneurs to fill up their knowledge. Such magazine can provide how-to and easy-to-follow

guide to start up and develop a new business venture. Furthermore, Working Mother is published countrywide to help Mumpreneurs to enjoy their work and family lives (Druxman, 2007).

Regardless of how Mumpreneurs seek resources to start the businesses, the great aspect to remember is that someone else has experienced all those challenges before you (Druxman, 2007). Hence, this requires for Mumpreneurs to rely upon more than ambition, self-motivated and a good idea.

**9. Deliver every promise:** The reality is there is no secret in this world. Mumpreneurs should be honest with clients and contacts about family commitments. They should be honest with families about running the business and not to hide the fact that they are mothers. Cuddle Fish's Caroline Hume, the founder of the global company selling kids-buoyancy product says "People are understanding if you are upfront with them and if you get your orders out on time and have a good product" (O'Brien, 2007: 151). Mumpreneurs can earn the respect by being professional business women and quality mothers.

**10. Managing business growth:** The business can just grow along as your kids grow. Mumpreneurs need to streamline the Internet-based/ business processes, and recruit extra people to delegate tasks and keep the work family balance. Cathy Slatter, a 32-years-old mother of 6 months-old daughter and the owner of corporate cake-delivery service from home, says "The main drawback is the danger of getting too big because you can't keep saying 'no' to new clients. It's maintaining a nice rate of growth so you can still stay at home. If that doesn't happen, you then ask yourself why you were doing it" (Herald Sun, 2007: 2). Julie Hanies, a 32-years-old mother of 8 months-old daughter and the owner of InviteMe — a personalised invitations for children's birthday and events, says "You have to be mindful of why we've done

this, to spend time at home with our babies, not build a big business” (Herald Sun, 2007: 3).  
Eventually, it is not about money. It is all about being a mother first.

### Conclusion

This section examines the emerging trend of Mumpreneurs, particularly in Australia. The underlying motivation for women entrepreneurs is the desire to help the overall community, environment or disadvantaged groups in society. Increasing numbers of Mumpreneurs and the rapid growth of their businesses have shown no reason why a mother cannot succeed as an entrepreneur. Women have the capabilities of breaking through the obstacles that hinder their business developments. Nevertheless, the rate of opportunity entrepreneurship and level of confidence to start a business successfully for men is remarkably outperforming that of women. A Significant gender gap still exists between countries as men believe themselves to have sufficient knowledge and skills for operating a business.

Global and domestic economic prosperity will be successful and sustained when all citizens regardless of gender are proactive and empowered in entrepreneurial activities. Political, legal and cultural factors also directly manipulate the development of the activities of the country. This calls for a change in business environment, social institutions and government to better support women being Mumpreneurs to develop their social and financial capital, and boosting self-confidence to establish the business. All in all, increasing the likelihood of starting a business is very much underpinned by a high level of self-confidence and opportunity identification. Thus, the position of the Mumpreneurs within the larger community is critical as it affects their capability to study role models and obtain resources. The policies should be customised to local context. More effective programs aimed at supporting Mumpreneurs would allow them to be more optimistic about their own ability, have greater valuable knowledge,

networking opportunities and more role models to guide the way in exploiting market opportunities.

A better understanding of the potential contribution of Mumpreneurs to the world's well-being and social equity will frame the importance of designing more satisfactory programs to enhance their participation in the market. As Nobel Peace Prize winner, Muhammad Yunus states "Economic growth and political democracy cannot achieve their full potential unless the female half of humanity participates on an equal footing with the male" (SPIEGEL, 2006).

We invite academics, entrepreneurs and practitioners to further enhance the research and study of this significant phenomenon, the Mumpreneurs. Furthermore, with the emergence of more and more males accepting the childcare role of "stay-at-home-Dads", research into this phenomenon may well introduce a new phenomenon of "Dadpreneurs". It will be interesting to see similarities (and differences) between genders within the Mumpreneurs and Dadpreneur phenomena.

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## THE ANALYSIS OF INNOVATION EFFICIENCY IN CHINESE MANUFACTURING INDUSTRIES

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### Abstract

In this paper we use the Super-SBM approach to evaluate the technical innovation efficiency of Chinese manufacturing industries. We simultaneously consider both intangible innovation activities (number of patents) and tangible innovation activities (sale of new products) in order to avoid an inaccurate evaluation of innovation efficiency. The dataset cover 29 manufacturing industries over 5 years including 1998, 2000, 2002, 2004, and 2005. The Number of Research Projects, Number of Patents item, and Revenue from Sale of New Products have been selected as output variables, and Personnel for R&D activities, Expenditure on R&D activities, and Number of R&D institutions are selected as inputs.

We summarize our empirical results from the Super-SBM approach as follows: 1) The innovation efficiencies among these 29 manufacturing industries are obviously diversified. 2) Both the high-technology industrial group and low-technology industrial group perform the best in innovation. 3) In the mid-high technical industrial group the industry of Transportation Equipment performs the best, but there are big differences among these industries in innovation efficiency for this group. 4) In the mid-low technical industries the Manufacturing and Processing of ferrous metals is the best in innovation efficiency for this group.

**Key Words:** Manufacturing Industry; R&D Innovation Efficiency; Super-SBM DEA

## Introduction

Under the current knowledge economy, innovation is the key for an enterprise to survive and improve its competitive advantage, and the capability and efficiency of innovation have been important factors for all countries. With China's huge manufacturing base, companies' technological innovation capability and efficiency affect the nation's competitive ability and can impact China's long-run economic development even more indirectly. Following China's economic reforms and its opening up to the world, the Chinese manufacturing products' share of the world's total extra value has increased by 0.26% every year, ranking first globally. "Made in China" can be seen everywhere and China is now the third largest manufacturing country.

According to the report of U.N. (United Nations), based on the price of 1995, from 1995 to 2005 the manufacturing production value of all the world increased by 34%, but developed countries like the U.K. and the U.S. increased only by 20%. China increased by 156% during this period and had the highest increasing ratio. China is now the third largest manufacturing country. China's government has at the same time realized that technological innovation contributes much to manufacturing industry development and has tried to build up innovative country. In 2006 China's central government proclaimed "National mid-long term technology development programming compendium (2006-2020)" in order to improve the ability of self-creation and to build an innovative country. The Ministry of Information Industry also established a system of information technology innovation under many measures. On April 26 in 2006, the State-owned Assets Supervision and Administration Commission of the State Council, the Ministry of Science and Technology of China, and China's Federation of Trade Unions united to carry out a program of one hundred enterprises to become experimental units to build an innovation system. At the same time, the government decided to put on a set of policies (fiscal policy, financial

policy, etc.) about technological innovation. From this, we can conclude that China's government has provided adequate support to build an innovative country and to promote enterprises' innovation activities.

China's has further considered improving self-innovation as a crucial point in the transformation of its economic growth model. As a huge manufacturing country, manufacturing technological innovation development has effects on both the domestic economy and the world economy. Related data from Chinese National Statistics Bureau indicate that the extra value of the manufacturing industry is equal to 40% of GDP, and the manufacturing industry contributes almost half of fiscal revenue for China. Simultaneously, China's national R&D expenditure has been growing steadily not only in total expenses, but also in intensity. From 1998, R&D intensity and R&D per capita expenditure have increased every year. R&D intensity increased from 0.65% in 1998 to 1.23% in 2004, and per capita expenditure increased from RMB44 in 1998 to RMB151 in 2004.

For high self-innovation, how is China's manufacturing industrial technology innovation? Specifically, how are innovational ability and efficiency? Such topics are worth studying. For the background of building innovational country, we pay high attention to a manufacturing industry's innovation and try our best to improve technological innovation ability, which is very important for enhancing the manufacturing industry level. Thus, the issue of manufacturing innovation efficiency has become more and more important.

There have been many studies about the manufacturing industry's R&D and innovation, but most studies focus on the effect R&D on productivity efficiency or what R&D contributes to the manufacturing industry. Moreover, it is rare to see a study on the manufacturing industry's innovation activities and efficiency. Also, those studies about technological innovation give

priority to the number of patents, which do not cover all innovational output, resulting in inaccurate efficiency estimates. Thus, this paper first considers simultaneously both intangible innovation activities (number of patents) and tangible activities (sale of new products) in order to avoid over-evaluation and under-evaluation. Secondly, we use the Super-SBM model to solve the problem that otherwise DMU's efficiencies are all one. Finally, we categorize 29 manufacturing industries into four groups according to their technical intensities. We then analyze and evaluate the innovation conditions of all 29 industries from 1998 to 2005 within each group.

This paper is organized as follows. Section I is the introduction of this study. Section II is the literature review. Section III is methodology and introduction to variables used. Section IV is the empirical analyses. Section V offers conclusions.

### Literature Review

In recent years academics, policy makers, and enterprises have paid great attention to estimate innovation ability and efficiency. The characteristics of innovation process mean one “cannot evaluate the quantity and quality of technological innovation directly” (Hill, 1979). Therefore, many scholars and constitutions have tried to establish a systemic index to evaluate innovational efficiency. They believe technological innovation is a knowledge-making process and hold that innovation can be explained comprehensively from a multilevel perspective. From a functional view, innovation is thought of as a process that transfers input into output, in which R&D is an important activity. J.A. Shumpeter believed that “innovation” is introducing production factors and production request to a production system, viz. “building a new production function”. OECD (1993) wrote that R&D activities run through all economic processes and are also important sections. To make a comprehensive view from many studies,

we define technological innovation efficiency as the ability that enterprises or industries can transfer input engaged in innovation activities into innovation output.

Some previous studies focus on the measurement of output elasticity and the affecting factors of R&D activities. Griliches (1980b) and Sveikauskas (1982) measured the output elasticity of R&D activities with different periods of manufacturing industry data. Mansfield (1988) and Bernstein (1988) evaluated the output elasticity of R&D with Japan's manufacturing data and Canada's data separately. The results from these studies are different from each other. Buxton and Kennally (2004) measured the effects of a new economy on R&D expenditure and innovation through estimating a manufacturing production function with 30 years of UK manufacturing data.

Some scholars have recently cared about the role of Chinese R&D expenditure on economic growth by checking the effects of R&D expenditure on productivity with various datasets. Gary (2006) used large and medium-size manufacturing enterprises' panel data from 1995 to 1999 to study China's manufacturing enterprise performances. He concluded that innovation efficiency is correlated with R&D intensity, enterprises' scale, and enterprises' capital density. Wu (2006) selected 537 Decision Making Units (DMU) of China's four-digit manufacturing industry and used two different production functions to evaluate output elasticity. He concluded that the high-tech industry's output elasticity is remarkably higher than the non-high-tech industry for R&D activities. Yu (2007) studied China's innovation performances of the manufacturing industry from the index system and efficiency, concluding that there are big differences among different manufacturing sections and new products that have a strong positive correlation with R&D input. Li and Wang (2006) analyzed the allocation efficiency of innovation resources among different manufacturing sections and concluded that the allocation

efficiency of R&D resources is low. Zabala-Iturriagoitia et al. (2007) applied the DEA to the evaluation of regional R&D performance based on information provided by European Innovation Scoreboard (EIS) for 2002 and 2003. The study indicated that although the amounts of resources within an RIS are important, it is not evident that those regions with larger amounts of resources are the most efficient ones and regions with fewer resources devoted to innovation achieve outstanding levels of efficiency. Asakawa & Som (2008) articulated the differences between conventional wisdom in guiding international R&D versus the realities of actual practices. Lin, Liang, Xu, Li, & Xie (2008) explored the role of knowledge management by moderating the relationship between information technology and firm performance. Chen, Wang and Shi (2009) applied DEA to estimate R&D efficiency of electronic industry and also investigates the relationship between R&D efficiency and long-term performance of the electronic companies.

Though some research studies have investigated the innovation of China's manufacturing using the DEA model, they mostly focus on one specific manufacturing section. Research on the manufacturing industry as a whole is rare, of which the methodology is simple and not comprehensive.

The differences between this paper and other earlier research are that: (1) the former research can underestimate (or overestimate) innovation efficiency; the former research considers patents as innovation output mostly, which could underestimate the innovation efficiency for those DMUs which had not applied for other innovation output. This paper considers both patents and new products as innovation outputs to avoid underestimation. (2) This paper considers a category of 29 sections based on their tech intensity. According to OECD, the manufacturing sections are grouped into 4 classes: high technical industry, mid-high technical industry, mid-low technical industry, low technical industry.



## The Methodology and Data Resources

### *Introduction to Methodology*

The Data envelopment analysis was originated in 1978 by Charnes, Cooper, and Rhodes (CCR). The CCR model efficiency concept is subject to a strong hypothesis of constant returns to scale. Banker, Charnes, and Cooper (BCC) (1984) proposed a variable returns to scale model. The BCC model can determine the returns to scale for each of the DMU. The objective of the DEA models is to evaluate the efficiencies of decision making units (DMUs). However, the problem that has been discussed in the early literature, such as Charnes et al (1985) and Seiford and Thrall (1990), is the lack of discrimination in the application of CCR and BCC. In particular, the efficient DMUs are not comparable among themselves in the CCR and BCC models.

Andersen and Petersen (1993) provided super-efficiency DEA models, giving the rank of the efficient DMUs relative to a reference technology spanned by all other units. Dula and Hickman (1997), Seiford and Zhu (1999), and Xue and Harker (2002) showed the infeasible problem in the variable returns to scale of the Andersen and Petersen (1993) super-efficiency model. Thrall (1996), Dula and Hickman (1997), Seiford and Zhu (1999), Xue and Harker (2002), Tone (2002), Lovell and Rouse (2003), and Bogetoft and Hougaard (2004) extended this issue in order to deal with infeasible problems in the super-efficiency model. This study uses SBM Super-Efficiency Estimation to investigate innovation efficiency indices. The SBM Super-Efficiency models are as follows.

**SBM Super Efficiency:** Following the Tone [2002] model, let us define the following variables:

$Y_{in}$  is the n-th output of the i-th DMU,  $X_{im}$  is the m-th input of the i-th DMU and the production possibility set  $P(X_0, Y_0)$  spanned by  $(X, Y)$  excluding  $(X_0, Y_0)$ .

$$P \setminus (X_0, Y_0) = \left[ (\bar{X}, \bar{Y}) \mid \bar{X} \geq \sum_{i \in I, i \neq 0}^n \lambda_i X_i, \bar{Y} \leq \sum_{i \in I, i \neq 0}^n \lambda_i Y_i, \bar{Y} \geq 0, \lambda \geq 0 \right]. \quad (3-1)$$

We define a subset  $\bar{P} \setminus (X_0, Y_0)$  of  $P \setminus (X_0, Y_0)$  as:

$$\bar{P} \setminus (X_0, Y_0) = (X_0, Y_0) \cap \left[ \bar{X} \geq X_0 \text{ and } \bar{Y} \leq Y_0 \right]. \quad (3-2)$$

$\bar{P} \setminus (X_0, Y_0)$  is not empty and  $X > 0, Y > 0$ .

From equation (3-2), we know that excluding  $(X_0, Y_0)$  has no effect on the original production possibility set. Thus, the SBM Super-Efficiency method used to calculate technical efficiency can be formulated as:

$$\phi^* = \min \phi = \frac{\frac{1}{s} \sum_{m=1}^s \bar{X}_m / X_{m0}}{\frac{1}{t} \sum_{n=1}^t \bar{Y}_n / Y_{n0}},$$

$$\text{subject to: } \bar{X} \geq \sum_{i \in I, i \neq 0}^n \lambda_i X_i,$$

$$\bar{Y} \leq \sum_{i \in I, i \neq 0}^n \lambda_i Y_i,$$

$$\bar{X} \geq X_0 \text{ and } \bar{Y} \leq Y_0$$

$$\bar{Y} \geq 0, \lambda \geq 0. \quad (3-3)$$

Equation (3-3) can be restructured as the following linear programming form:

$$\gamma^* = \min \gamma = \frac{1}{s} \sum_{m=1}^s \frac{\tilde{X}_m}{X_{m0}},$$

$$\text{subject to: } 1 = \frac{1}{t} \sum_{n=1}^t \frac{\tilde{Y}_n}{Y_{n0}}$$

$$\bar{X} \geq \sum_{i \in I, i \neq 0}^n \pi_i X_i,$$

$$\bar{Y} \leq \sum_{i \in I, i \neq 0}^n \pi_i Y_i,$$

$$\bar{X} \geq zX_0 \text{ and } \bar{Y} \geq zY_0$$

$$\pi \geq 0, \bar{Y} \geq 0, z \geq 0. \quad (3-4)$$

### *Data Sources And Variables Selection*

This study applied the data obtained from the “China Technical Statistics Yearbook” published by the China Bureau. The dataset covers 29 manufacturing industries for 5 years including 1998, 2000, 2002, 2004, and 2005. To analyze every year’s efficiency more thoroughly, we consult the OECD method of categorizing manufacturing sections. For a reference, see Martin Schaaper and “The method of categorizing high-tech industry, evaluating ICT and biology technology industry by OECD,” published in *Technology Management Study*, 2005(12). The 29 manufacturing sections are sorted into four groups: high technical industry, mid-high technical industry, mid-low technical industry, and low technical industry. There are four input factors: (1) number of R&D (persons), (2) number of R&D institutions, (3) R&D expenditure (RMB million), and two output factors of sale of new products (RMB million) and number of patents. New products do create value for enterprises. At the same time, the number of patent applications is output of innovation. Hence, we select two indices, including new products and patent applications as our output index.

We choose R&D personnel, R&D expenditure, and number of R&D institutions as inputs while revenue from sale of new products and patents are outputs. These inputs and outputs cover both tangible and intangible factors of innovation activities as a whole. In China’s economic

system, state-owned manufacturing is the dominant one and represents the national manufacturing level. Selecting state-owned manufacturing to study China's manufacturing innovation efficiency is instructive in that it embodies China's economic system characteristics. In addition, we want to make constructive suggestions for these manufacturing sections.

### Empirical Analyses

#### *The Empirical Result Of Super-SBM Efficiency Model*

This study employs the computer program DEA-Solver to estimate the non-parametric programming model. The dataset contains China's 29 manufacturing industries from 1998 to 2005. We categorize 29 industries into four groups (high-tech industry, mid-high-tech industry, mid-low-tech industry, and low-tech industry) to analyze manufacturing innovation efficiency. Table 1 lists the outcome of the average scores of 29 industries from the Super-SBM model. We can summarize the characteristics of 29 industries in 4 groups according to the results.

Table 1. Average Efficiency Scores of 4 Different Technological Industries from the Super SBM Efficiency Model

Groups	1998	2000	2002	2004	2005
High-tech industry	0.7185	0.9897	0.9218	1.2082	1.0101
Mid-high-tech industry	0.6301	0.8975	0.8616	0.9016	0.7969
Mid-low-tech industry	0.4479	0.6126	0.5622	0.7278	0.8149
Low-tech industry	1.1812	0.9203	1.1843	0.9722	1.0787
<b>Average</b>	0.8423	0.8485	0.9402	0.9230	0.9496

(a) On the whole, the average innovation efficiency score of China's manufacturing is 0.8423 in 1998, increases a little to 0.8485 in 2000, then goes on further to 0.9402 in 2002, but decreases to 0.9230 in 2004. In 2005 it again rises to 0.9496 and shows that the technological innovation takes on a non-linear rising path, but like a helix form.

(b) On the whole, the efficiency scores of the high-technology industry and low-technology industry are obviously higher than those of the mid-high-technology industry and the mid-low-technology industry. There is little difference between the high-technology industry and the low-technology industry.

*Analyses Of Technological Innovation Efficiency For Different Technological Industries*

We now analyze innovation efficiency for the four groups of industries as follows.

*Analysis On The High-Technology Industry*

Table 2 lists the average scores for each manufacturing industry of the high-technology industry group. Compared with the other three groups, the general efficiency of the high-technology industry is among the best, which reflects that there may be some advantages in innovation in the high-technology industry than for the other groups. At the same time, it shows a trend that innovation is improving.

Table 2. Technological Innovation Efficiency for the High-technology Industry from 1998 to 2005 from Super-SBM DEA

Industry	1998		2000		2002		2004		2005	
	Score	rank	score	rank	score	rank	score	rank	score	rank
Manufacturing communications, computers, other electronic equipment	1.3679	4	1.3331	6	1.1141	11	1.15	10	1.2383	5
Manufacturing measuring instruments, machinery for cultural and office work	0.432	12	1.0088	15	1.0708	14	1.44	3	0.6397	19
Manufacturing medicine	0.3556	17	0.6271	16	0.5805	17	1.0346	12	1.1523	10

In the technological innovation of the Communications, Computer, Other Electronic Equipment industry, there are always in the frontier of DEA. It ranks fourth in 1998, sixth in 2000, eleventh in 2002, tenth in 2004, and fifth in 2005. It performs well on the whole. The

major reason is that its R&D inputs among the 29 manufacturing industries are among the leading position. Except for 2002, R&D inputs tend to rise in the other years and the outputs of innovation increase every year.

In the manufacturing innovation efficiency of Measuring Instrument, Machinery for Cultural and Office Work industry, there perform well with innovation efficiency scores in 2000, 2002, and 2004 exceeding 1, except for 0.4320 in 1998 and 0.6397 in 2005.

The technology of manufacturing medicine shows an increasing trend. The scores of efficiency are 0.3556 in 1998, 0.6271 in 2000, and 0.5805 in 2002, increasing to 1.0346 in 2004 and 1.1523 in 2005. The efficiency rises rapidly and it benefits from the industry's policy and macro economic environment. In fact, the medicine industry in China has developed relatively late compared with foreign countries, and so the innovation capability is weak and it lacks the protection of intellectual property rights.

#### *Analysis On The Mid-High-Technology Industry*

We list the mid-high-technology industry's efficiency in Table 3.

Table 3. Technological Innovation Efficiency of Mid-high-technology Industry from 1998 to 2005 from Super-SBM DEA

Industry	1998		2000		2002		2004		2005	
	score	rank	score	rank	score	rank	score	rank	score	rank
Manufacturing chemical raw materials and chemical products	0.4029	13	0.4170	19	0.3479	23	0.5786	20	0.3545	24
Manufacturing chemical fibers	0.1424	26	0.1863	25	0.1473	28	0.6505	18	0.3597	23
Manufacturing general purpose machinery	0.5273	11	1.0859	12	1.0363	15	1.144	11	1.1554	9
Manufacturing special purpose machinery	1.1081	7	1.0971	10	0.5507	18	0.6439	19	0.6465	18
Manufacturing transport equipment	1.4507	2	1.4532	3	1.7529	2	1.5015	2	1.5222	3
Manufacturing electrical machinery and equipment	0.1493	25	1.1454	8	1.3343	3	0.8912	14	0.7433	17

From Table 3 we conclude that in the mid-high-technology industry the innovation efficiency of different sections show big differences among each other. Manufacturing transport equipment performs the best, which is always on the efficiency frontier. Manufacturing general machinery, manufacturing special purpose machinery, and manufacturing electrical machinery and equipment take second place. Some chemical industries like manufacturing chemical raw materials and chemical products and manufacturing chemical fibers rank the worst level.

#### *Analysis Of Mid-Low-Technology Industry*

We list the mid-low-technology industry's efficiency in Table 4.

Table 4. Technological Innovation Efficiency for Mid-low-technology Industry from 1998 to 2005 from Super-SBM DEA

Industry	1998		2000		2002		2004		2005	
	score	rank	Score	Rank	score	rank	score	Rank	score	rank
Processing of petroleum, coking, and processing of nucleus fuel	0.1812	23	1.3383	5	0.8083	16	0.6542	17	1.0271	14
Manufacturing rubber	0.3713	15	0.5198	18	0.4466	19	1.1549	9	1.0958	12
Manufacturing non-metallic mineral products	0.3689	16	0.5958	17	0.3703	21	0.4111	25	0.4755	21
Manufacturing and processing ferrous metals	1.3093	5	1.1402	9	1.2435	5	1.3697	4	1.1998	7
Manufacturing and processing non-ferrous metals	0.3791	14	0.2521	24	0.3603	22	0.4368	24	0.4814	20
Manufacturing metal products	0.3057	18	0.3441	23	0.3939	20	0.5277	22	1.0028	15
Manufacturing plastic	0.2196	20	0.0979	29	0.3126	24	0.5399	21	0.4222	22

According to Table 4, in the mid-low-technology industry the best performance is manufacturing and processing ferrous metals. After that, processing petroleum and coking and processing nucleus fuel takes second place. The worst performance is manufacturing plastic, which almost ranks after 20.

#### *Analysis On Low-Technology Industries*

We list the low-technology industry's efficiency in Table 5.

According to Table 5, in the low-technology group there are big differences in innovation efficiency among industries. As to the average scores, the low-tech industry takes first place along with the high-technology industry.

In the low-tech group, manufacturing furniture performs the best with efficiency scores exceeding 1 every year. It ranks first in 1998, 2000, 2002, and 2005, while fifth in 2004. Due to the low requirement of innovation and low demand for R&D input, it performs the best in innovation efficiency. In manufacturing of foods, manufacturing of beverage, manufacturing of textile, manufacturing of textile wearing apparel, footwear and caps, manufacturing of leather, fur, feather and its products and Printing, reproduction of recording media etc., their efficiency of these industries are above 1 in many years, but is not steady.. The average efficiency score is almost above 0.9. Some worse behaving industries include processing food from agricultural products, processing timber, manufacturing wood, bamboo, rattan, palm, and straw and manufacturing paper and paper products. The efficiencies of manufacturing artwork and other manufacturing fluctuate most widely.

### Conclusions and Suggestions

In this paper we evaluate the innovation efficiency and categorize the efficiency of 29 state-owned manufacturing industries and make a conclusion as follows.

1. The innovation efficiency of the manufacturing industry forms a helix with obvious differences among these industries. The best performers are the high-technology industry and low-technology industry.
2. In the mid-high group the best performer is manufacturing transport equipment. At the same time, there are significant differences among these industries.



3. In the mid-low group the best performer is manufacturing and processing ferrous metals. Processing petroleum and coking and processing nucleus fuel takes second place.

Table 5. Technological Innovation Efficiency of Low-technology Industry in 1998-2005 from Super-SBM DEA

Industry	1998		2000		2002		2004		2005	
	score	rank	Score	Rank	score	rank	score	rank	score	rank
Processing food from agricultural products	0.2799	19	0.3465	22	0.1415	29	0.3285	26	0.1705	28
Manufacturing foods	1.4379	3	1.0537	14	1.1805	9	0.4950	23	0.2644	26
Manufacturing beverages	0.6367	10	1.0670	13	1.2395	7	0.6570	16	1.0621	13
Manufacturing tobacco	1.1879	6	0.4069	20	1.2406	6	1.2221	6	1.2074	6
Manufacturing textile	1.0452	8	1.0966	11	0.3071	25	0.7448	15	1.1646	8
Manufacturing textile wearing apparel, footwear, and caps	1.0253	9	0.4008	21	1.0782	12	1.2014	7	1.1281	11
Manufacturing leather, fur, feather, and its products	0.2091	21	1.2149	7	1.0761	13	4.0137	1	2.3775	2
Processing timber, manufacturing wood, bamboo, rattan, palm, straw	0.1416	27	0.1709	26	0.1772	27	0.2396	27	0.1767	27
Manufacturing furniture	8.8656	1	2.8778	1	5.0518	1	1.2697	5	3.7760	1
Manufacturing paper and paper products	0.0996	28	0.1130	28	0.2577	26	0.16	28	0.1295	29
Printing, reproduction of recording media	0.2037	22	1.3925	4	1.2567	4	1.0213	13	0.8467	16
Manufacturing articles for culture, education and sport activity	0.1778	24	1.7030	2	1.1588	10	1.1865	8	1.3774	4
Manufacturing artwork, other manufacturing	0.0452	29	0.1197	27	1.2308	8	0.0996	29	0.3422	25

4. The low-technology group and high-technology group take first place, but there are big differences among the industries in the low-technology group. The efficiency in each industry changes throughout the period, indicating that low-technology industries have unsteady innovation efficiencies.

Based on the empirical study, we can conclude that so many industries are inefficient, because of a lack of R&D inputs. Through a comparison with other countries, we find out that

there exists a big gap (R&D inputs) between China and other developed countries. Therefore, it is beneficial for China to increase R&D input. Second, we should hold a correct view as to the big differences among the industries. Under the circumstances of building an information society, we must try our best to improve the efficiency of innovation in order to improve self-innovated ability, so that the competitive power of manufacturing in an international market can be strengthened. However, on the other hand, we should realize that the characteristics of traditional industries influence the position of innovation. Under the environment of industry transformation and upgrading, many other factors affect innovation efficiency. We should consider the characteristics of the industry when judging innovation efficiency.

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## THE EXPLANATIONS OF AGENCY THEORY ON INTERNATIONAL MULTI-UNIT FRANCHISING IN THE TAIWANESE MARKETPLACE

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### Abstract

The purpose of this article is to interpret the strategic motives for the adoption of a multiple unit franchising agreement as the expanded strategy into Taiwan from the perspective of the master franchisors. The geographical and cultural distances makes the agency problems more complex in the international market than in the domestic market that results in a higher level of monitoring costs. The empirical investigation of the study revealed that with area development franchising, a kind of multiple-unit outlet, the master franchisees operate outlets using hired managers instead of practicing with sub-franchised ones, which are largely contributed to the selection of master franchisee, franchisee opportunism, agency cost minimization, franchise system uniformity, and the Taiwanese culture.

The role of the master franchisee is not only as the agent but also as the principal in the multiple-unit franchising agreement. For many agency problems, referred to franchisee opportunism, the adverse selection can be explained better by multiple-unit franchising than by single unit franchising. In addition, several propositions are provided that can assist franchisors in solving the difficulties of foreign expansion. Managerial and academic implications are delineated and directions for future research are offered.

**Keywords:** International Franchising, Agency Theory, Area Development Franchising Multiple Unit Franchising, Franchisee Opportunism, The Taiwanese Culture.

## Introduction

Master franchising is regarded as the most popular entry mode for most US franchisors entering Asian markets among different types of international franchising (Arthur Anderson , 1996; Choo, Mazzarol & Soutar, 2007; Alon, 2006). Master franchising refers to the contractual-based agreement that the franchisor empowers, the master franchisee has the right to develop/sub-franchise a specified number of franchisees within the given territory, creating a three-level franchise relationship. The master franchisee, the intermediary party between the franchisor and local franchisee, has the responsibility to sell the business format, search and train the local franchisee (Justis & Judd, 1986; Quinn, 1998). Many researchers have focused exclusively on master franchising on the assumption that agency problems are reduced by having owner operators.

Multi-unit franchising, area development or sequential multi-unit franchising, is distinguished from master franchising because a master franchisee is not permitted to sell the business format to an independent sub-franchisee. An outlet is required to be opened and operated by employee-managers instead of a local franchisee within a geographical area (Doherty & Quinn, 1999; Teegen, 2000). Studies suggest that American international franchisors preferred their master franchisees to own and run entire units rather than sub-franchising outlets in overseas markets (Welch, 1989; Forward & Fulop, 1997; Ryans Jr., Lotz & Krampf, 1999; Alon, 2006). Thus, in the perspective of international franchisors, multi-unit outlets appear to be the prime expansion strategy rather than single- unit outlets. This argument is different from master (single-unit) franchising.

The objective of this paper is to explain this anomaly and to focus on the specific context of international franchising because the widespread prevalence of multi-unit outlets is more

popular in international markets than in domestic markets. However, multi-unit franchising research focuses on the domestic markets with the explanation of multi-unit franchising from the capital acquisition perspective (Kaufman & Dant, 1996), the extent of multi-unit ownership in franchised chains (Kalnins & Lafontaine, 2004) and the motivational incentives driving franchising choice from the perspective of a franchisee (Grunbagen & Mittelstaedt, 2005; Weaven & Frazer, 2007). The international multi-unit franchising is still under-researched. It requires a more complete explanation for the prevalence of multi-unit franchising as the international expansion strategy. Thus, the research question of the paper is to address: *What are the motivations for international franchisors to expand and grow through multi-unit agreements in the Taiwanese marketplace?*

## Review of Literature

### *Agency Theory v. s. International Franchising*

The domain of agency theory essentially focuses on relationships, in particular, where one entity, the principal, depends on another entity, the agent. The agent undertakes action on the behalf of the principal with benefits to both parties (Bergen et al, 1992; Eisenhardt, 1989). Any employment relationship is an agency relationship (Harris & Raviv, 1978) and the franchisor-franchisee relationship is considered to be a unique case of agency consideration (Garg, et al., 2005). With regard to franchising, principals, called franchisors, grant the right to agents, called franchisees, to operate an outlet. The franchisee then pays royalties and other expenses to the franchisor (Combs, et al., 2004).

The agency argument for the franchising is well established (Cave & Murphy, 1976; Rubin, 1978; Lafontaine, 1992). The basic assumptions of the agency theory are grounded in human opportunism, bounded rationality, potential goal conflict and perceived risk preferences

(Bergen, et al., 1992). Under these premises, there exist the agency problems in terms of moral hazards and adverse selections (Shane, 1996).

The agency-based theory explains the main reason for franchising as that it can reduce the agency problems of adverse selection and moral hazards through either residual claimancy, or monitoring (Shane, 1996). The problem of adverse selection can be mitigated through the effect of the franchisee by self-enforcement and self-selection before entering the franchising agreement (Carney & Gedajlovic 1991; Shane, 1996). Residual claimancy aims the alignment of franchisee incentives with those of franchisors. The franchisee is the residual claimant on the profit of his/her outlet in a franchising contract; therefore, he/she has no incentives to shirk on effects (Alchian & Demsetz, 1972; Brick & Dark, 1987 and Carney & Gedajlovic 1991). Monitoring, on the other hand, aims at providing franchisors with the information concerning behavior of franchisees (Eisenhardt, 1989). The monitoring cost can be relieved through franchising because the franchising contract can be terminated in the event of violation of the contract that will lead to the failure of the franchisee's wealth and investment. Thus, franchising allows a larger system without high monitoring costs of large firms that do not franchise by substituting franchisees for the hired managers.

The assumption of agency theory has primarily provided the explanation of single-unit franchising but the single-unit franchisee does not fit the reality, particularly, in international franchising. Although the higher cultural distances between the home and host country, make the issue more difficult for the franchisor to manage a service business, another issue, that of the monitoring problem is becoming more severe in distant, unfamiliar, overseas markets (Fladmoe-Lindquist & Jacque, 1995; Dant & Nasr, 1998). Studies suggest that many large international franchisors, such as McDonald's and Kott Koatings, prefer to make investments with their local



partner and run employee-manager outlets instead of sub-franchising outlets to access the local partner's capabilities in sales, local market know-how and most importantly, contacts with decision-makers and business networks ( Ryans Jr., Lotz & Krampf,1999 ; Teegen, 2000). In addition, in the study of Dant and Nasr (1998) it proposed that there is 100% incidence of multi-unit franchising in the overseas markets. Although multi-unit franchising agreements may reduce some of the agency benefits of franchising, such as the moral hazard problem because the master needs to employ a store manager to operate the entire unit, it may decrease the likelihood of adverse selection if the master is a present franchisee. Thus, more attention needs to be paid to multi-unit franchising. The argument of multi-unit franchising will be discussed in the following section.

#### *Multi-unit Franchising*

The multi-unit franchising refers to a franchisee that owns and runs more than one outlet (Kaufmann & Dant, 1996). Although there are detrimental effects on MUF from the aspects of agency theory, there are also many reasons for franchisors to adopt multi-unit franchising as the expansion strategy. From the aspects of resource-scarcity theory, multi-unit franchising appears to have a relative advantage based on the capital acquisition and is positively associated with growth rate (Kaufmann & Dant, 1996). Previous studies suggest that multi-unit franchising can reduce the problems of franchisee opportunism in terms of free-riding and underinvestment because the incentive for franchisee opportunism is to reduce the operational cost and maximize the profit by using low- quality input or little advertising (Brickley & Dark, 1987; Michael, 2000, 2002; Kidwell, et al, 2007). If a franchisee owns many proximate outlets, there are no incentives for him to consider free-riding or underinvestment, as the role of the franchisee is regarded as the mini-chain franchisor to manage their own mini-chains (Garg & Rasheed, 2003). In addition,

multi-unit franchising can avoid the intra-chain competition with the sales of contiguous units (Bolton, 2002). Although the degree of intra-chain competition will tend to enhance the franchisor profit, it can deteriorate the long-term franchise relationship (Kalnins & Lafontaine, 2004). An area development agreement can prevent any localized conflict and improve the commitment and performance by receiving the pre-specified territory without the conflict expectation (Kaufman & Kim, 1995; Grunbagen & Mittelstaedt, 2005). Thus, multi-unit franchising can address some agency problems better than single-unit franchising can.

## Research Design

### *The Rational for Methodology*

The qualitative method tends to adopt an inductive approach that leads to the creation and integration of new concepts or theories through the data collection process and its examination (Neuman, 2003). Within international franchising research, previous studies have been conducted by the quantitative method through face to face meetings or mail surveys (Hackett, 1976; Aydin & Kacker, 1990; Preble, 1992). Further, Doherty and Quinn (1999), Frazer (2003) advocate that the adoption of the qualitative study of international franchising is required in order to obtain richness as well as relevant data concerning the company operations. In addition, the adoption of interactive methods of data collection and the acquisition of qualitative data can complement and redress some of the weaknesses of the large scale statistical survey (Fulop & Forward, 1997). As the study is of an explanatory and descriptive nature, case study is considered to be an elastic, empirical inquiry that investigates a contemporary phenomenon within its real-life context (Yin, 2003). It is useful when the boundaries between phenomenon and context are not clear and where there has been limited prior research undertaken (Yin, 2003). Case studies also provide an in-depth explanation of the particular context and situation that may lead to further exploratory

research (Yin, 2003). The case study method also offers a flexible and innovative method to collect and examine data and allows an intensive description and analysis of single respondents, an individual, group or organization (Eisenhardt, 1989). The data may not be limited to the interview process but can be gathered from different sources including naturalistic observation, interviews, personal documents archival records and secondary data (Blalock, 1969). Based on the comprehensive data, theoretical propositions and a framework were developed.

### *Sampling Strategy*

Taiwan is a significant context for examining international franchising in the economy due to the political and cultural idiosyncrasies it presents and a lack of research in this country's domain. The development of international franchising in Taiwan began in the 1980s and reached a peak in the 1990s. Currently there are over ten large franchise systems in Taiwan from America and Japan, including 7-11 convenience stores, McDonalds and Mos Burger. International franchisors were attracted to Taiwan because of the political stability, economic status and growth, a rising middle class and concurrent rise of dual wage-earning families. Taiwan has been considered one of the Four Asian Dragons that have become the fastest-growing economies in the Asia-Pacific region after World War II.

Consumer food organizations play an important role in the business format franchising industry (Preble, 1992; Hoffman & Preble, 1993; Pizanti & Lerner, 2003). In recent decades, there has been a significant change in the division of roles in the Taiwanese family. Taiwan has seen a marked increase in the number of working women who have substantially removed themselves from domestic duties such as home cooking (Stanworth, 1996). There are many well-known international food franchising chains in Taiwan that have largely filled that market need. The majority of the franchises that have emerged are of American and Japanese origin or at least

modeled on those countries (Preble & Hoffman, 1995; Alon, 2004). Thus, an American food franchising cluster is selected because it can be regarded as typically representing western style organizations (Pizanti & Lerner, 2003; Alon, 2004). To make broader comparisons Japan has also been selected, as Japan is representative of a country that has a high degree of similarity to Taiwan.

### *Data Collection*

In this study, in depth interviewing and document research were the primary sources of data. The interviews were conducted with the franchisee key decision makers, senior franchisee managers, and international franchise managers. All participants were informed by telephone, and had looked at the interview protocol beforehand. Participants agreed to conduct the face-to-face interview as well as the tape-recorded interview without divulging the important secrets of the company. The researcher transcribed the manuscripts word by word according to the tape-recorded interviews and these transcripts were regarded as the foundation of the research analysis.

The interviews were conducted in Mandarin and were tape recorded and textually transcribed. The typical interview took up to one hour to complete. To meet ethical requirements the transcripts did not contain any individual's names and the companies' names were not recorded. The typed material was destroyed following the transcriptions. Document research will be used in this study to provide triangulation. Documents are good sources of evidence as many documents are often accessible, free and contain information that otherwise will take the researcher some considerable time and resources to collect (Dexter, 1970). The data may be collected from documents such as annual reports, internal memoranda, newspaper clippings, magazine articles, books and websites

## Results

The four case firms currently doing business in Taiwan entered the country in the 1980s. All of them utilized master franchising as their expanding strategy in the Taiwanese market. Instead of sub-franchising outlets, a unique form of master franchising - master franchisees were awarded the right to develop the number of outlets by employee-managers in a prescribed region (Kaufmann & Kim, 1995; Burton, Cross & Rhodes, 2000; Teegen, 2000; Petersen & Welch, 2000). The study interprets that these reasons for the adoption of area development franchising can be incorporated in the selection of a master franchisee, franchisee opportunism, agency cost minimization, franchise system uniformity, and Taiwanese culture. The detailed will be discussed as the following.

### *The Selection of Master Franchisee*

Area development franchising requires that master franchisees have to own and operate the entire chain utilizing employee-managers, therefore, master franchisees in general are huge enterprises possessing a significant level of financial resources, considerable managerial experience (Oxenfeldt & Kelly 1968), country-specific experience (Choo, Mazzarol & Soutar, 2007) and good relationships with local governments and suppliers (Teegen, 2000) to facilitate the development of the entire chain. The study indicates that the master franchisee appears to be a business group or Conglomerate Corporation rather than an individual with sufficient resources to establish and manage the entire franchise system. In particular, it is difficult for international franchisors to access high capitals from many individuals in developing countries. In addition, the master franchisor can access local market networks, accumulate local knowledge and information and customer taste through owner-operator outlets (Welch, 1989; Teegen, 2000). This finding is consistent with the study of Teegen (2000), Alon (2006) and Choo, Mazzarol &

Soutar (2007) who suggest that in the early stage of a franchise development, international franchisors are highly dependent on the local franchisees with strong financial resources to engage in repaid expansion, good contacts to secure outlets in prime retail locations and well-proven local knowledge to modify the concept to suit particular market needs.

### *Franchisee Opportunism*

Franchisee opportunism refers to a franchisee engaged in a contractual relationship with a franchisor who might to seek to lower his/her own costs by failing to participate in activities that would collectively be profitable for the overall franchise network. The relational for international franchisors who utilize international multiple units franchising as the growth strategy can be explained from the insights in the reduction of franchisee opportunistically. The study indicated that the area development franchising is a device to reduce the potential of franchisee opportunism based on the following reasons.

First, in fact, the detrimental effect of free-riding and underinvestment would largely be borne by the master franchisee himself, when multiple unit franchising in a geographical and cultural area are franchised to a single franchisee, if he/she were doing it, that would be considered as counterproductive. It will dilute their own subsystem's brand equity and negatively affect the own sales.

Second, in area development franchising, franchisees act as the local master franchisors given the obligations and responsibilities to develop a certain number of outlets in a specific territory depending on the contractual schedule so that they seem to engage in long-term strategic factors such as planning, coordination and building their subsystem brand instead of daily operation. Therefore, there are fewer incentives in the relation to the behavior of the franchisee opportunism.

Third, the international multiple unit franchising can foster the provision of information in the franchise channel. The possession of superior local knowledge is an important franchisee's resource in the franchise relationship (Dant, Kaufmann & Paswan, 1992). To be effectively utilized and share imperative resources, it depends on an efficient flow of information, especially, in international franchising context. Therefore, the less possibility of loss or distortion of information, the better the types of franchising that will be practiced. When international master franchisees have the tendency to provide the helpful and authentic information to their master franchisors partners that is a signal of the mutual trust and commitment, regarded as a key safeguard for the relationship continuance and social form of control (Dant & Nasr, 1998; Cocbet, Dormann & Ebrmann, 2008). The information sharing between the franchise relationships is a critical activity as it can not only strengthen development of complementary goals, share values and create a greater understanding of each party's perspective but also foster the joint development of a marketing plan and enhance the attitude of cooperation. Thus, the master franchisee has less incentives to free-riding and under-investment.

#### *Agency Cost Minimization*

The employment of international multi-unit franchising can reduce the agency problems in the development and management of the franchising network. The issues of adverse selection, unlike the sequential multi-unit franchising, where the actual opening of outlets of area development franchising typically occurs based on a contract schedule, the initial commitment of the contract indeed entails the obligation to complete the entire chain by the end of the contract period (Grunbagen & Mittelstaedt , 2005). Therefore, when considering engaging in the franchise relationship, master franchisees have to start their endeavor with a very good estimate of the whole investment. Only under that condition can they evaluate the viability of the contract

they are about to enter into. The behaviors of self-assessment of the master franchisee can reduce the potential of adverse selection.

In addition, due to geographical and cultural proximity, the hazards of adverse selection of unit level monitors would be less for the local multi-unit franchisee than for the foreign franchisor. The role of master franchisees in the development of unit-level monitors is important given the cultural distance between those monitors and the international franchisor. The task of recruiting, screening, and training outlet managers is delegated to the international master franchisee; therefore, instead of searching for several franchisees in foreign countries, search costs can be reduced in an international multiple-unit franchisor through the master franchisee (Grag & Rasheed, 2006). Therefore, the problem of selection adverse is lower in the international multi-unit franchising than single-unit franchising.

The issues of shirking, when franchising systems grow, particularly, expanding into an unfamiliar market, the support and maintenance of franchisees or employees will be more difficult and complicated on an international scale that leads to the higher monitoring cost (Fladmoe-Lindquist & Jacque, 1995; Shane, 1996 ). In the cases of international multi-unit franchising, the task of monitoring local outlets was designated to local multi-unit franchisees (Alon, 2000), therefore, the interests of multi-unit owners are closely aligned with those of the entire chain (Grag & Rasheed, 2006) because the master franchisee should be responsible for the overall performance of the franchise system that allows him/her to reduce the likelihood of shirking at a country level.

#### *Franchise System Uniformity*

The goal of franchise system uniformity is crucial to the maintenance of brand name capital at both a store and country level. Brand name capital leads to customer beliefs that each



unit in an outlet provides the same levels of quality across borders .With the significant level of investment motives in the franchise relationship (Dant & Gundlach, 1998; Grunbagen & Mittelstaedt, 2005; Weaven & Frazer, 2006); the master franchisee requires strong levels of dependence on the master franchisors (Dant & Gundlach, 1998). In addition, the study indicated that initially, with the limited potential of the Taiwanese market, the high cost of real estate rental and initial investment where balance is hard to achieve in the short time period, particularly, in the early stage of the system development, the establishment and protection of a brand name seems to be a cornerstone of international expansion of the franchise system. International multiple unit franchising has the likelihood to maintain uniformity, brand name and shared identify through the operation of company-owned outlets in local markets.

The company-owned outlets are supposed to operate the outlet by maintaining standards instead of responding to local marketing conditions (Bradch, 1998; Yin & Zajac, 2004). The incentives of company-owned outlets focus on maintaining standards and following rules set by the company and therefore are given less incentives to free-riding (Bradch, 1998; Yin & Zajac, 2004). Further, company-owned stores are subject to the centralized structure where the owner-operators initiate actions and direct their employees to follow their rules. Thus, area development franchising shows a unique organizational form between franchisors and franchisees, who assume responsibilities for franchise sales and quality assurance monitoring.

### *The Taiwanese Culture*

Taiwanese culture is the critical factor for the utilization of area development franchising. Franchise is conceptualized in vastly different ways within Taiwanese culture, which contrast and conflict with assumptions held by franchisors operating within developed nations. A franchised business is regarded within Taiwanese culture as a family business. It has minimal

management structure, a low level of skilled staff and is dominantly cash-based. It most clearly resembles the 1990 Chinese Family Business management style (Chen, 1995). The management style has become the dominant form of an overseas Chinese business organization, and one of the major forms of Asian business within Asia itself. Under this management style, franchisees assume that the franchise outlet, its products and its profits are the sole domain of the core owning family. This can lead to endemic problems such as free-riding and brand hijacking. In addition, the legislative protection of intellectual property does not appear to be respected in most parts of Asia (Deng, Townsend, Robert & Quensel, 1996) that lead to increase the probability of “brand hijacking” behaviors once franchisees have gained the operational expertise in running the business. Under the environment, a master franchisor prefers to entail area development franchising as the expansion strategy to maintain the value of the brand name overseas.

### Summary and Conclusions

Based on the above arguments, multi-unit franchisees can change the problem of agency costs and cultural adaptations, in particular, in maintaining brand capital and provide country-specific knowledge therefore the international multi-unit franchising outlet is better than the international single-unit franchising outlet in overseas expansion. The four cases also provided empirical evidence that master franchisors utilized multi-unit franchising as a growth strategy to develop their own outlet within a specified territory depending on the effort of master franchisees. It also can maintain brand capital as all outlets operated by franchisees themselves have reasons for them to partake in free-riding or underinvestment, which leads to a decreased service quality. Therefore, some propositions may be posited as follows.

First, international franchisors would like to run and operate their own outlets using master franchisee instead of sub-franchising in foreign markets. Second, to acquire the amount of resources for operating in a foreign country and the likelihood of adopting multi-unit franchising instead of single unit franchising in the Taiwanese market. Thirdly, it is expected that master franchisors have the ability to provide franchisees with an incentive not to act opportunistically, in the likelihood of adopting multi-unit franchising in the Taiwanese market. Furthermore, due to the nature of the Taiwanese culture, master franchisors have the likelihood of adopting multi-unit franchising in the Taiwanese market. Moreover, due to the potential of agency costs, again, master franchisors have the likelihood of adopting multi-unit franchising in the Taiwanese market. Finally, it is expected to maintain franchise system uniformity, the likelihood of adopting multi-unit franchising instead of single unit franchising in the Taiwanese market.

In brief, this study has produced a preliminary examination of the strategies used by franchisors to enter the Taiwanese market. These propositions need to be tested on a larger sample of franchisors who operate internationally, using quantitative analysis techniques to complement the findings of the current exploratory study.

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## A STUDY ON COGNITION DESIGN IN INTERFACE USABILITY OF E-LEARNING WEBSITES

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### Abstract

This study aims to inspect cognition in interface usability of the e-Learning website of National Palace Museum (NPM). This study designs a questionnaire based on both structured and unstructured methods. Then, it invites experts to apply an unstructured heuristic evaluation to inspect interface usability. Finally, it collects opinions from the experts for a statistical analysis.

Substantial results of this study show that in the category of overall interface operation, “content descriptions through chapters and sections” is the most significant, showing that learning on SCORM™ platform is most influential to learners. In the category of visual communication design, “fonts” is the most significant, showing that word recognition is most influential to learners. The second most significant aspect is “pictures and animation”. In the category of satisfaction with quality and service, “learning motive and attitude” is the most significant, showing that an active or passive attitude is affected by “content description through chapters and sections”, “navigator”, “technical issues”, and “colors”. Regarding this, the above-mentioned aspects affecting e-learning usability are proposed to interface designers as a reference for future planning and design of e-learning platforms.

Keywords: E-Learning, Usability, Heuristic Evaluation



## Research Motive and Objective

Rapidly developing Internet, communication, and multimedia have brought a revolution to traditional learning methods and created an e-learning environment. In a world dominated by borderless learning and knowledge-based economy, learners really need to improve their competitiveness with the help of learning of various forms. E-Learning, which is based on Internet and information technology, provides more diverse and faster sources of knowledge. Moreover, it cuts educational costs, improves education quality and learning efficiency, and eventually achieves the goal of life-long learning.

Important e-Learning programs in effect in Taiwan are mainly initiated by the Ministry of Education, including “Learning Technology Programs of the Excellent Project” and “Standard Format for E-Learning Systems, Platforms, and Contents”. Other related programs include “Taiwan E-Learning Program” by the National Science Council (NSC) and “E-Learning Park” by Institution for Information Industry. Led by these large scale programs, many schools and institutions have started planning e-Learning curriculum, making e-Learning a mainstream trend in the education community of Taiwan.

An interface is the part encountered by learners the most directly. A well or poorly designed interface is closely related to digital media usability, learners’ enthusiasm, and learning effects. Therefore, it is usually a challenging task to integrate various teaching materials and learning management system (LMS), making reusing e-Learning materials or sharing teaching resources impossible or difficult.

In compliance to the e-Taiwan program in “Challenge 2008: Six-Year National Development Plan” promoted by the government, NPM has carried out three large scale

national programs, which are Taiwan E-Learning Program—National Palace Museum E-Learning, Taiwan Digital Archives Program—National Palace Museum Digital Archive Project, and Establishment and Value-added Program of National Palace Museum E-Learning. Among these programs, National Palace Museum E-Learning was initiated by NSC from 2003 to 2007. During this period, NSC established “demonstration of National Palace Museum e-Learning” in an attempt to set a museum e-learning model complying with international standards.

Course design of “NPM e-Learning” followed the widely recommended SCORM™ in domestic and overseas e-learning industries. SCORM™ is also known as sharable content object reference model. SCORM™ is characterized by its reusability of learning units. Learners can recombine teaching materials based on their needs and share materials on other SCORM™ based platforms, which helps to achieve the goal of saving costs.

Regarding this, this study has the following objectives:

1. Integrate essential evaluation guidelines for SCORM™ platforms.
2. Discuss influential aspects of an interface and select suitable functions for the e-Learning interface;
3. Provide a reference for the design of museum e-Learning interfaces and course interfaces.

Literature Review

### *E- Learning*

E-learning is not a face-to-face type of learning; instead, it is an electric or computer-based interactive training opportunity. E-learning is a type of training that takes place through a network, such as the Internet or a company intranet. Harasim, Hiltz,

Teles, and Turoff (1995), Khan (1997), Porter (1997), and Windschitl (1998) described various forms of E-learning, such as virtual learning, online learning, distance learning, computer-assisted learning, and Web-based learning. Instructors have expressed considerable interest in blending several e-learning methods, especially synchronous and asynchronous learning, through the Web (Ravaglia, 2001). This is supported by the characteristics and resources of the Internet (Khan, 1997; Gillani & Relan, 1997) and is growing at a quick pace in universities across the country (Carr, 2000; Charp, 2002). Schrum (1998) spoke of the need for comprehensive, in-depth appraisals in the current study.

Rosenberg (2001) defined e-Learning as applying Internet technology to convey various digital contents in an attempt to gain knowledge and improve performance. E-Learning has three basic essentials.

1. E- learning is based on Internet: It updates, stores and accesses, conveys, and shares teaching materials or information in a real time manner;
2. E- learning applies computer and Internet technologies: It conveys digital courses to end users;
3. E- learning changes the ways of learning: It goes beyond traditional learning solutions.

E-Learning was a term firstly introduced by American scholar Jay Cross in 1999. “E” specifically stands for electronic, but it also speaks for the spirits of exploration, experience, engagement, excitement, empowerment, ease of use, and effective. American Society of Training and Education defines e-Learning as a learning method which conveys teaching materials or learning experiences through electronics technology. Electronics technology includes applications of computer based training, compact discs,

and various Internet applications. A more specific definition says that e-Learning is a process in which learners learn through digital media, including the Internet, enterprise networks, computers, satellite radio, tapes, videos, interactive televisions and compact discs. Its applications include Internet-based learning, computer-based learning, virtual classrooms, and digital cooperation (Zou, 2003).

### *SCORM™*

SCORM™, also known as sharable content object reference model, was firstly introduced in the Advanced Distributed Learning Initiative by the United States Department of Defense. The purpose was to promote an international standard for e-Learning units which served as a guideline for designing and sharing reusable courses.

In Figure 1, learning objects in teaching materials are separated like building blocks and then regrouped into new courses. A common standard is essential to serve the purpose of combining learning objects smoothly.

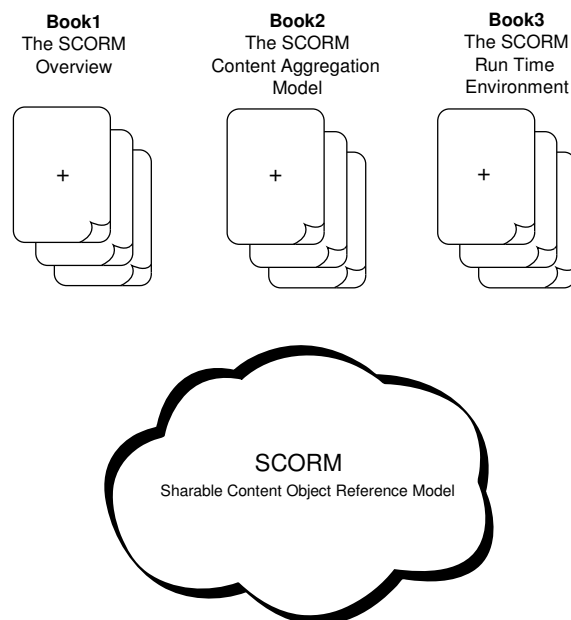


Figure 1. Configuration and Content of SCORM™

### *Cognitive Walkthrough*

A cognitive walkthrough is an expert inspection of usability, and this process does not require user participation. This evaluation method tries to form a model for actions and opinions of the first interface use by an individual or a group of people.

### *Focus Group*

A focus group is an analytical and evaluative diagnosis method which involves user participation. It is an informal evaluation applied to learn users' demands and perceptions before an interface is designed. In addition, it can learn the users' opinions after they use the interface for a period of time. It is one of the most frequently used methods in an exploratory research.

### *Questionnaires*

Questionnaires and interviews are indirect inspection methods. Instead of directly examining a user interface, both methods review only users' opinions about using the interface. The questionnaire of this study aims to explore users' cognition in e-Learning website usability. The questionnaire applies principles of usability engineering to ensure that respondents comprehend questions correctly. However, a questionnaire may trouble users if it is too lengthy, difficult, or unprofessional (Nielsen, 1993).

## Methodology

Prior to the formal research, a front-end research was conducted to select several representative e-Learning websites in effect through literature review and cognitive walkthrough. Members in a focus group then examined these websites and selected one

suitable for the study of e-Learning website usability. In this case, the focus group members selected NPM E-learning for case study. (<http://elearning.npm.gov.tw>).

Secondly, a questionnaire survey was designed based on structured and unstructured methods and then carried out a heuristic evaluation. Expert respondents were asked to operate the representative e-Learning websites and evaluate the usability of the interfaces based on their own expertise. Later, the experts' opinions were collected and analyzed for further planning and design of e-Learning platforms. Figure 2 shows the structure of this research.

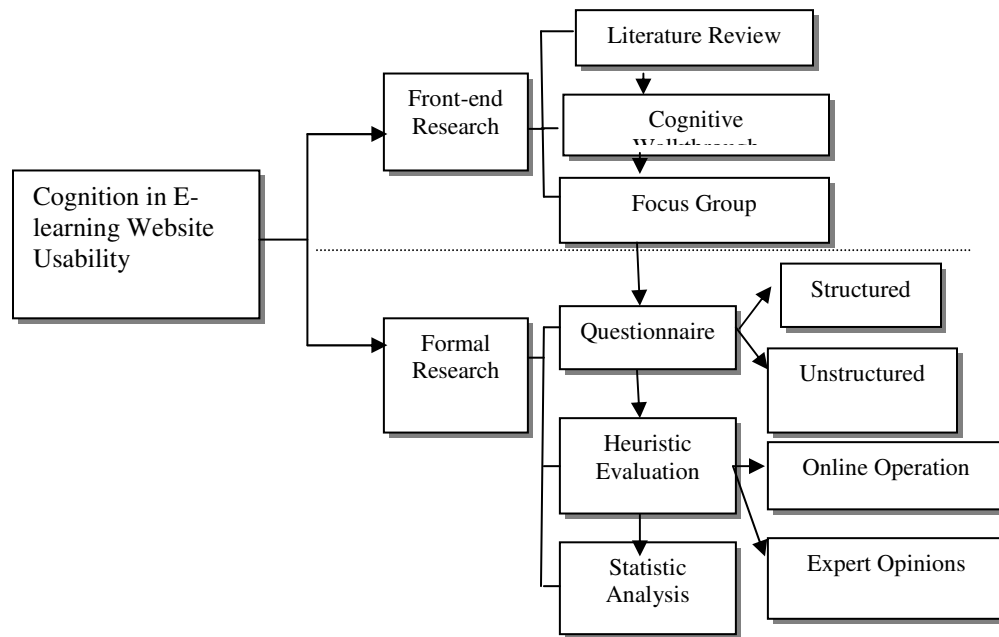


Figure 2. Research Structure

### *Front-end Research*

At this stage, keywords like “e-Learning” and “SCORM” (See Figure 3 for the details) were searched on web-based search engines for entries about SCORM™ based e-Learning platforms. The research results included platforms of British Museum, Tate

Modern in London, Metropolitan Museum of Art in New York, and National Palace Museum in Taiwan. After discussion and selection, the focus group members chose NPM e-Learning for case study.

Related literature was reviewed, and a telephone interview was given to Mistress Huang Xiu –ling of the Department of Exhibition, NPM, in an attempt to gain an in-depth understanding of “target learners” and “course orientation” of NPM e-Learning. In the mean time, this study searched online for literature about museum e-Learning platforms. The results of the telephone interview are as follows: regarding that this was the first year for NPM e-Learning, NPM expected to promote the platform to as many learners as possible. Therefore, courses in Mandarin targeted adult learners, or more specifically, general adult learners with at least secondary educational level. Courses in English targeted foreign learners interested in bronze vessels. As for course direction, the courses about bronze vessels provided by NPM served the following functions both to adults and schools. First, it allowed learners to gain an understanding of bronze vessels prior to visiting NPM. Second, it helped learners in learning the art and history of Chinese bronze vessels. Third, it served as a complementary material for school teachers.

#### *Formal Research*

Due to geographical convenience, the questionnaire survey of interface was carried out on fifteen graduate students and doctoral candidates from the Department of Industrial Design, National Cheng Kung University (NCKU). Four experts were also invited to inspect the design and usability of the interface through heuristic evaluation. The details are as follows.

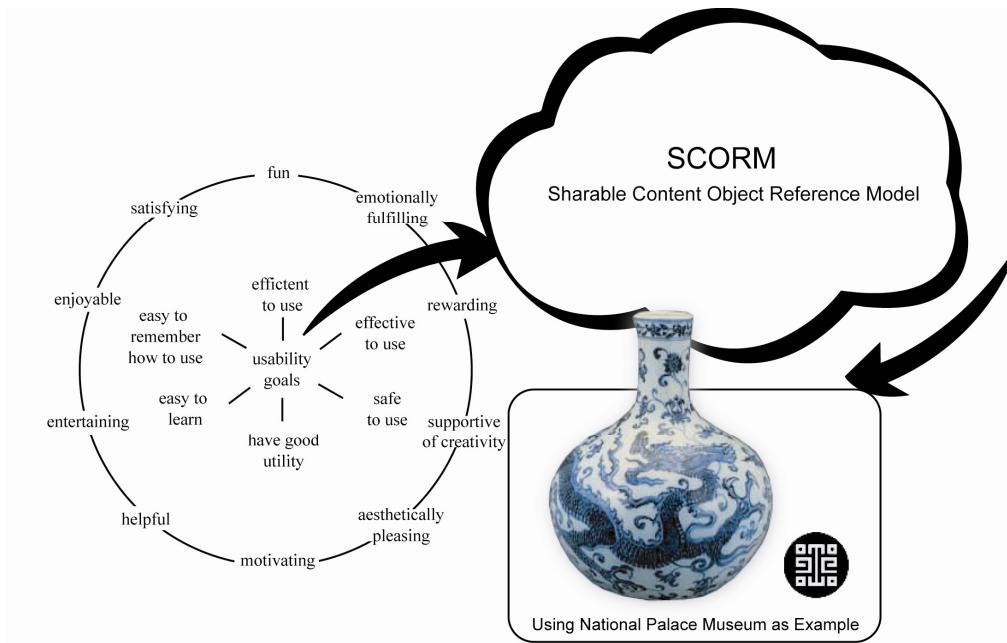


Figure 3. Cognitive Walkthrough

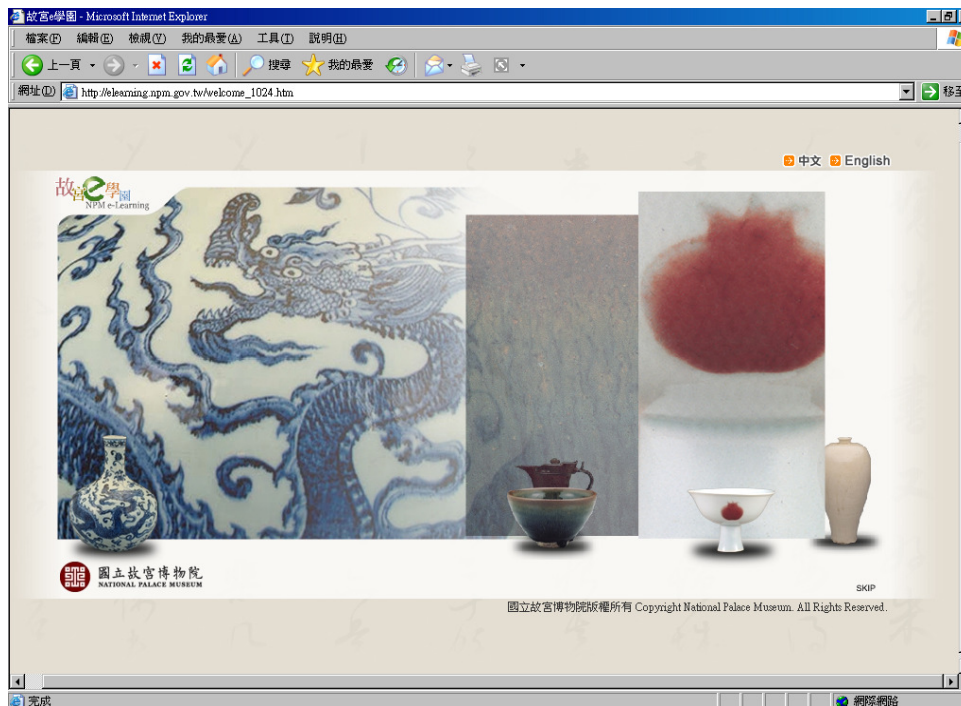


Figure 4. NPM E-Learning Entry Page





Figure 5. SCROM™ Interface of NPM E-Learning

Table 1. Evaluation Guidelines (by the Authors of this Study)

Item No.	Evaluation Guidelines
<b>I Overall Interface Operation</b>	
1	Website Design Intentions
2	Unit Information Transfer
3	Content Descriptions
4	Content Descriptions through Chapters and Sections
5	Navigator
6	Interaction
7	Window Titles
8	Web Address
9	Linkage
10	Technical Issues
<b>II Visual Communication Design</b>	
11	Interface Composition and Design
12	Pictures and Animations
13	Fonts
14	Colors
<b>III Satisfaction with Quality and Service</b>	
15	Information Quality
16	Service Quality
17	Learning Motivation and Attitude
18	User Satisfaction

Table 2. Evaluation Items and Questionnaire (by the Authors of this Study)

(12) Pictures and Animations	Strongly Disagree	Disagree	Fair	Agree	Strongly Agree
Pictures in the interface are clear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pictures in the interface come with text description	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pictures in the interface match texts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Button icons come in high resolution	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pictures are consistent with the overall website style	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pictures and graphs come in proper proportion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The interface provides watermark icons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Important items are presented with flash animations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The interface forces users to view flash animations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The contrast between texts and background colors is high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The interface uses different template designs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The interface uses the registered trademark of the NPM carefully	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The picture quality is sufficient	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pictures are complemented with texts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pictures use consistent light source	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feedbacks are provided above the mouse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In Table 2, respondents were required to answer the questions in the questionnaire by rating the Likert-scale (Strongly Disagree, Disagree, Fair, Agree, Strongly Agree). Later, the results were used for a linear analysis and correlation coefficient statistics.

### *Respondents*

The subjects of the questionnaire survey were graduate students and doctoral candidates from the Department of Industrial Design, NCKU. Among the fifteen respondents, there were eight males and seven females. Eight out of the respondents had experience in teaching (arts, technology, and design). Therefore, it is highly possible that these respondents will use informational technology as a teaching aid in the future. Figure 6 shows the operation process and environment for the questionnaire survey.

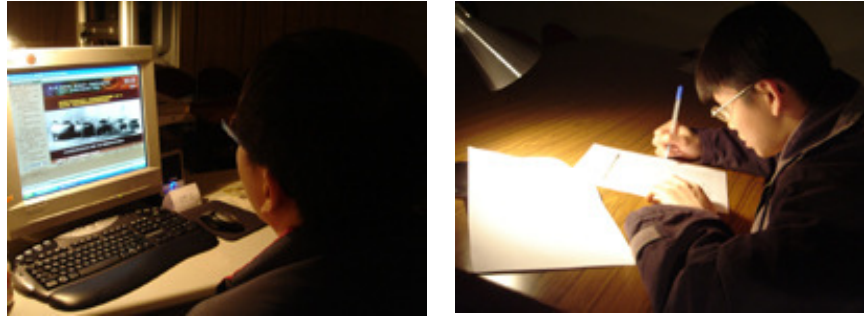


Figure 6. Operation Process and Environment

### *Heuristic Evaluation and Case Study*

Four experts were invited to operate and evaluate web pages of the case at the same time and same place. The web pages included the entry page of NPM E-Learning, the homepage of NPM E-Learning, and the SCORM system of bronze vessel courses. The evaluation process was divided into three stages. The first stage was open cognitive walkthrough which lasted for ten minutes. The second stage was individual expert evaluation which lasted for an hour. In the third stage, the four experts discussed their evaluations at the same time and same place.

### Data Analysis

#### *Statistics of Correlation Coefficient*

The results of Likert scale of the fifteen respondents were entered into SPSS12.0 word by word for a descriptive statistic analysis. Strongly Disagree marked one score, while Strongly Agree marked five. Figure 7 shows the mean value of each evaluation item of the sequence charts of the fifteen samples.

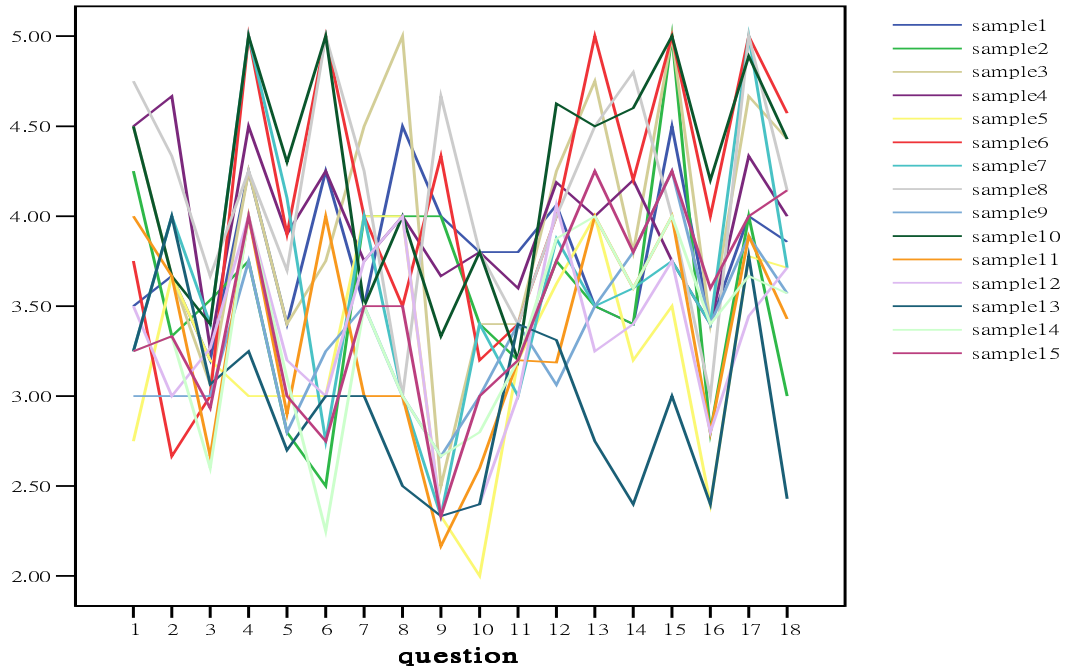


Figure 7. The sequence charts for the mean value of each evaluation item

Table 3 shows the mean and standard deviation of each evaluation item. Later, the means of the eighteen evaluation items of the fifteen respondents were entered into the statistical software respectively for correlation coefficients (See the Table 4 for the details). The correlation

Table 3. Descriptive Statistics

Evaluation Items	Mean	Standard Deviation	Number
(1) Website Design Intentions	3.7333	.6371	15
(2) Unit Information Transfer	3.6007	.5228	15
(3) Content Description	3.1520	.2943	15
(4) Content Descriptions through Chapters and Sections	4.1333	.5891	15
(5) Navigator	3.3467	.5181	15
(6) Interaction	3.5833	.9481	15
(7) Window Titles	3.7167	.4212	15
(8) Web Address	3.6000	.6866	15
(9) Linkage	3.0440	.8655	15

(10) Technical Issues	3.1200	.5846	15
(11) Interface Composition and Design	3.3067	.2120	15
(12) Pictures and Animations	3.8427	.4173	15
(13) Fonts	3.9333	.6085	15
(14) Colors	3.7200	.5846	15
(15) Information Quality	4.1833	.6158	15
(16) Service Quality	3.2267	.5230	15
(17) Learning Motivation and Attitude	4.2227	.5444	15
(18) User Satisfaction	3.7800	.5631	15

Table 4. Correlation Coefficient Statistics

Items	Items / Significant Levels of Correlation Coefficient (Two-tailed)					
(5)	4	--	--	--	--	--
	.000*	--	--	--	--	--
(10)	1	4	5	9	--	--
	.005*	.003*	.007*	.004*	--	--
(12)	5	--	--	--	--	--
	.001*	--	--	--	--	--
(14)	4	5	6	10	13	--
	.006*	.005*	.005*	.006*	.001*	--
(16)	4	5	14	15	--	--
	.000*	.006*	.006*	.007*	--	--
(17)	4	5	10	14	--	--
	.001*	.000*	.005*	.005*	--	--
(18)	4	5	12	13	14	16
	.007*	.004*	.007*	.000*	.000*	.002*

\* When significance level is at 0.01 (two tailed), the correlation is significant.

Table 5. Correlation Coefficient Statistics

(5) Navigator	
p=.000	(4) Content descriptions through chapters and sections, significance achieved
(10) Technical Issues	
p=.005	(1) Web design intentions, significance achieved
p=.003	(4) Content descriptions through chapters and sections, significance achieved
p=.007	(5) Navigator , significance achieved
p=.004	(9) Linkage, significance achieved
(12) Pictures and Animations	
p=.001	(5) Navigator , significance achieved
(14)Color	
p=.006	(4) Content descriptions through chapters and sections, significance achieved
p=.005	(5) Navigator , significance achieved
p=.005	(6) Interaction, significance achieved

p=.006	(10) Technical issues, significance achieved
p=.001	(13) Fonts, significance achieved
(16) Service Quality	
p=.000	(4) Content descriptions through chapters and sections, significance achieved
p=.006	(5) Navigator , significance achieved
p=.006	(14) Colors , significance achieved
p=.007	(15) Information quality , significance achieved
(17) Learning Motivation and Attitude	
p=.001	(4) Content descriptions through chapters and sections, significance achieved
p=.000	(5) Navigator , significance achieved
p=.005	(10) Technical issues, significance achieved
p=.005	(14) Colors, significance achieved
(18) User Satisfaction	
p=.007	(4) Content descriptions through chapters and sections, significance achieved
p=.004	(5) Navigator , significance achieved
p=.007	(12) Pictures and animations, significance achieved
p=.000	(13) Fonts, significance achieved
p=.000	(14) Colors, significance achieved
p=.002	(16) Service quality, significance achieved

coefficient statistics of the study is shown in Table 5.

#### *Results of Heuristic Evaluation*

At this stage, questions were extracted based on an “unstructured heuristic evaluation”. The four experts who were invited to evaluate the interface had more than two years of experience in web page design, so they understood usability engineering. After the evaluation, the experts discussed the results together and discovered several usability problems of NPM e-Learning. The experts proposed the following concrete suggestions.

1. Guideline for “content descriptions through chapters and sections”: “Content descriptions through chapters and sections” showed a mean of 4.1333 (Agree) in the statistic analysis. However, feedbacks about the function of content descriptions were not favorable during the post-operation discussion stage. Learners were constantly confused by web tiers. The experts suggested that buttons like “End” or “Next Chapter” to be inserted at the end of each section to direct users to the next chapter. “Chronology”

showed the historical contexts of a description. The experts suggested that highlight or flash should be used in combination with course narration to help learners to clearly distinguish different historical contexts. The aspects which are significantly correlated with this guideline are “colors” and “navigator”.

2. Guideline for “navigator”: NPM e-Learning placed the navigator at the left column of the webpage. Learners could adjust the navigator based on their habits. However, learners were easily confused by “chapters” and “sections”. The main reason was that the font sizes and colors of chapters and sections were too similar for users to select one correctly. The experts suggested that colors should be used to distinguish chapters from sections. In addition, the “Replay” button at the upper right of the webpage did not function, making the replay function available only for the first chapter. The replay function should be made available to every chapter and section. The aspects which are significantly correlated with this guideline are “pictures and animations” and “colors”.

3. Guideline for “pictures and animations”: NPM e-Learning demonstrated pictures and animations both two-dimensionally (2D) and three-dimensionally (3D). Therefore, it took a few seconds for learners to get accustomed to the shift from 2D to 3D. The experts suggested that only 3D or 2D-simulated 3D should be used for integration. The aspect which is significantly correlated with this guideline is “navigator”.

4. Guideline for “colors”: NPM e-Learning used mainly warm colors, making learners feel that every page seemed to be identical. The experts suggested that suitable color combinations should be selected in compliance with course contents. The aspects

which are significantly correlated with this guideline are “navigator”, “font”, and “content description through chapters and sections”.

5. Guideline for “font”: The demonstration of words in NPM e-Learning was not reader-friendly. In addition to the left navigator which was described in words, there were also other contents described in words below video clips. The experts suggested that contrast colors should be used to improve feedbacks to interface. The aspects which are significantly correlated with this guideline are “colors” and “user satisfaction”.

6. Guideline for “interaction”: The mean value of the interaction of NPM e-Learning was 3.5833 (Fair). From the standpoint of information-aided technology, there was still room to improve the interaction. The experts suggested that 360-degree rotation (including X, Y, Z axes) should be applied to allow learners to manipulate contents with the mouse and increase control over the interaction. In addition, NPM e-Learning presented “full texts” word by word through synchronized narration, which made learners become passive in the interaction. The experts suggested that a synchronization mechanism of “pictures” and “texts” should be provided to learners. The aspect which is significantly correlated with this guideline is “colors”.

7. Guideline for “website design intentions”: In addition to increasing learners’ learning interests, a more important intention of designing NPM e-Learning was to tell learners what they would learn from the website. Therefore, the experts suggested that an abstract should be provided at the beginning of every section. The aspects which are significantly correlated with this guideline are “pictures and animations” and “colors”.

8. Guideline for “technical issues”: NPM e-Learning should avoid situations such as data errors or content unavailable. The experts suggested that the website use built-in



software which required no plug-in programs for viewing. Aspects significantly correlated to this guideline are “pictures and animations” and “colors”.

### Conclusion and Future Research

This study follows evaluation guidelines and checklists proposed of Nielsen & Tahir (2002) and the nine guidelines and 54 evaluation checklists of Brink, Gergle, & Wood to design eighteen guidelines and 112 checklists for usability evaluation. Research results indicate that most of the aspects show significant levels.

In the category of overall interface operation, “content descriptions through chapters and sections” is the most significant, showing that learning on SCORM™ platform is most influential to learners. In the category of visual communication design, “fonts” is the most significant, showing that word recognition is most influential to learners. The second most significant aspect is “pictures and animation”. In the category of satisfaction with quality and service, “learning motivation and attitude” is the most significant, showing that an active or passive attitude is affected by “content description through chapters and sections”, “navigator”, “technical issues”, and “colors”. The above-mentioned aspects are influential to e-Learning users thus are proposed to interface designers for reference.

This study aims for evaluation of interface usability. Other issues regarding interface should also be discussed in the future. Future research can extend to the evaluation of emotions and learning benefits related to interface.

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## UNIVERSITY-DISTRICT PARTNERSHIP FOR IMPLEMENTING SCHOOL LEADER SUCCESSION PLANNING

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### Abstract

This practitioner story uses qualitative methods to describe the phenomenon of succession planning through a university-school district partnership. Universities have been charged with providing school leader preparation programs to be more responsive to the needs of school districts by forming partnerships with them for the purposes of selection and tapping future degree candidates. This succession planning model is from the business sector and poses some controversy in the education field. The state of Louisiana with the help of Southern Regional Education Board consultants is trying to facilitate the formation of these partnerships through workshops. Some basic questions concerning policies, leaders, and purposes are posed and answers proposed through charting perceptual themes about succession planning from the results of university-school district discussion at a two-day workshop. The researchers concluded that there is a definite disconnect between university leadership preparation and school district succession planning. Because university-district partnership in the succession planning process is in its very early stages, it is yet to be seen if the circumstances are right to create the “perfect storm” that could motivate universities and school districts to form a solid partnership to prepare the future leadership of our PK-12 schools.

Keywords: Succession, Leadership, Partnership, Schools, University

## Introduction

Universities across the nation have been charged with redesigning their master's degree programs in school leadership to be more responsive to school districts by forming partnerships with them. Murphy (1992) and Levine (2005) have proposed that school districts are the consumers of university programs and individuals should not self select into university principal preparation programs. Rather they should be purposefully selected for future leadership. Murphy (1992) and Levine (2005) explained further that school districts need to support these chosen aspiring school leaders' internships by providing authentic school settings. Businesses typically refer to the selection, tapping and internship as succession planning. Whatever term is used, successful organizations need a plan in place to ensure continued growth and success beyond the tenure of the present leaders. Succession planning is practiced in some large school districts across the nation because districts need to have a qualified administrative workforce ready to take the helm when vacancies occur. One example is the plethora of Aspiring Principals' or Administrators' Academies that have emerged over the last decade.

As some of the largest institutions in the country, employing thousands, school districts are accountable to their state and community to produce responsible graduates who will become the next generation of educated citizens. Because of this serious responsibility, the Southern Regional Education Board (SREB) has challenged schools to place a highly qualified administrator in every school. What are the requirements for administrators and teachers to achieve a highly qualified status?

Although specific requirements may vary from state to state, in general, the highly qualified status requires that school principals be certified and hold a master's degree

while teachers must be certified and have a minimum of a bachelor's degree to work in any public school. While universities are not charged with succession planning in PK-12 schools, they are charged with providing a high-quality, field-based preparation program for both teachers and administrators. Currently teachers' practicum (student teaching) is provided and supported by a university-school district policy; however school administrators' practicum (internship) is not. The purpose of the present paper is to emphasize the importance of implementing a school district succession planning policy led by a university-school district partnership. If this were in place in each school district, aspiring school administrators would have a genuine internship in authentic school settings where they would solve real school problems and be ready to take a leadership role in any school.

University-district partnerships across the south have been the recipients of grants from the Wallace Foundation and facilitated by SREB to establish enabling conditions for such unions to flourish. The premise is that if these conditions are present, candidates in educational leadership preparation programs in universities will receive the field-based experiences and internships necessary to succeed in leadership positions upon graduation. In other words, if the university-district partnerships have succession plan policies in place, "hands-on" or "learning-by-doing" education will be supported, which will prepare aspiring principals to assume school leadership positions upon graduation.

In addition, job-embedded professional development must be provided to existing school leaders. Although these experienced school leaders across the country are the backbone of the school districts, many are retiring. Districts also need to replace excellent but retiring school leaders as well as attract the best and brightest school leaders to

sustain high performing schools and turn-around low-performing schools. The issue is complex. To support a redesigned educational leadership master degree program many factors must be in place. Perhaps the most important factor is the partnership of the school district with the university preparation program for succession planning.

Succession planning needs to be part of the standard practices and policies and have the approval of the superintendent, district leaders and the district board. Succession plans need to provide for release time for aspiring school leaders from regular classroom teaching, mentors to guide authentic leadership actions, and diverse opportunities for leadership in a variety of age and socioeconomic levels. Universities alone cannot ensure these district level responsibilities and school districts are not required to meet these standards. States and organizations such as SREB have proposed a partnership between districts and universities to fulfill the requirement of succession planning and create the circumstances for an improved plan where the district is the consumer of the university master of educational leadership program. These circumstances conspire to create the “perfect storm,” which could motivate universities and school districts to form a solid partnership with the goal of preparing the future leadership of our PK-12 schools.

What are the challenges of the university/school district partnership in succession planning? The purpose of this paper is to describe the present state of the university-district partnership in the succession planning process. Are the right circumstances, standards, state policies in place? Are the right players (decision makers, district and university leaders) at the negotiation table? Are the right questions (those that can lead to change) being asked?

## Perspectives

The Southern Regional Education Board (SREB, 2007) has identified enabling conditions from research, focus groups, and other literature of sustainability for university/school district partnerships. These enabling conditions have been developed and defined as conditions that may be in place or may need to be put in place to help the partnership achieve its goals. Each organization's willingness to change and develop enabling conditions must be established through changed practices and policies (SREB Module 18. LG p. 104). Succession planning is listed as one of Southern Regional Education Board's (SREB) Enabling Conditions for a successful university-district partnership. For the partnership it is called the joint screening process to select the future leaders to fit the district need. SREB states, "Partnerships should tap potential leaders with demonstrated knowledge of curriculum and instruction and plan quality growth opportunities for them." (SREB Module 18. Slide 61). Succession planning is listed as a district condition, but not a university condition.

Even though the university is not directly responsible for succession planning, it can support the district and the university/district partnership in this endeavor. The university and district enabling conditions that support the partnership in succession planning is shown in Table 1 and 2. Notice that the district has an extra set of conditions that specifically identify succession planning.

This paper examines succession planning from the perspective of these selected enabling conditions. One example for the university might be that the university faculty who devote substantial energy and attention to the school leadership preparation program are rewarded for participating in district work rather than for publishing. A district

example might be to establish the structure to allow district leaders to have a dialog and reach consensus about the ideal knowledge, skills, and dispositions they need for their school leaders. SREB (2007) states that partnerships must pay attention to these conditions, build on strengths and develop conditions not met. Are the right circumstances in place to enable the university-district partnership to pay attention to these conditions? Are the right people at the decision-making table to strengthen and develop the enabling conditions? Are the right questions being asked that will lead to fulfilling

Table 1. Enabling Conditions: University

Table 2. Enabling Conditions: District

Condition U5:	The faculty in the leadership preparation program shares a belief that field-based experiences offer significant learning opportunities to support the application of theory to practice.	Condition D5:	School and district leaders share a belief that school-based experiences offer significant learning opportunities for aspiring principals to apply theory to practice.
Faculty members incorporate field-based experiences in their dialog about a common vision of graduates, discussion about course requirements and policy changes, and evaluation of program goals and objectives.		School and district leaders incorporate school-based experiences in their dialog about a common vision of ideal school leaders, discussion about leadership preparation, and evaluation of leadership succession plans, goals and objectives.	
Faculty members work to develop the structure and support to provide field-based experiences that offer significant learning opportunities.		School and district leaders work to develop the structure and support to provide school-based experiences that offer significant learning opportunities	
Field-based experiences are provided to candidates throughout their leadership preparation program.		School-based experiences are provided to aspiring leaders throughout their leadership preparation program.	
Faculty members provide support to candidates and their mentors to ensure application of theory to practice.		School and district leaders provide the support to aspiring leaders and their mentors to ensure application of theory to practice.	
		Condition D6:	Partnering with a university preparation program is part of the district's leadership succession and professional development plans for learning-centered leaders in each school.
		Leadership preparation and professional development is competency-based and aligned with the state's standards for new leaders.	
		Leadership succession plans have been approved by the district's leaders and the district's board of control.	
		Leadership preparation and professional development is designed to specifically develop learning-centered leaders — leaders who can focus improvement on	



		curriculum, instruction and student achievement.	
		District leaders regularly review the preparation program and monitor its results in developing learning-centered leaders for the needs of the local schools.	
Condition U7:	The university and department expect and reward partnership development as a component of faculty member's work load.	Condition D7:	The school district expects and rewards partnership development as a component of the central office and school level leaders' workload.
		District and school leaders are provided orientation and training for partnership development.	
Faculty members are cited for outreach and service to local school districts.		District and school leaders are cited for partnership development with universities.	
Faculty members are expected to regularly contribute to outreach and service to local school districts.		District and school leaders are expected to regularly contribute to ongoing partnership efforts and university leadership preparation programs.	
University leaders recognize the contributions to partnership development and service to school districts during tenure and promotion decisions.		District and school leaders recognize the contributions to partnership development and mentoring	

these conditions? The present paper is a qualitative study intended to describe the phenomenon of succession planning through a university-school district partnership.

### Review of the Literature

Succession planning is exercised in business, public sectors and education fields with varied strategies and with varied results. For example, while Shen and Cannella's (2003) findings are mixed regarding investor reactions toward the traditional succession process of promotion from within the organization, Leibman et al (1996) contend that the current day succession process tends to choose leadership talent for CEO positions from without the organization. Ip and Jacobs (2006), in a review of literature, state that there is a lack of research in the area of the Business Succession Planning process and that it does require a continuous investment of time, resources, and support. Altman (2009) contends that corporations should identify early the potential leadership talent within the organization and provide the necessary experiences for them to develop. Perman (2009) states, "Companies can experience tremendous financial losses when they're unprepared

for a key employee's departure.” Business financial losses parallel school district losses in student achievement.

In the field of education, school leadership succession is just beginning to be thought of as a planning process. In earlier studies there were varied findings regarding the succession of school leaders. Miskel & Owens (1983) found no evidence to suggest that principal succession increases or decreases school effectiveness. In contrast, in a study of two schools that were undergoing multiple turnovers of new principals during a school restructuring process, Davidson and Taylor (1999) found that teachers preferred the continuity of strong principal leadership and felt that a solid match between the principal and the school’s culture was of utmost importance. However, they also felt that strong teacher leadership could compensate, at least temporarily, for the lack thereof

Although there is a shortage of viable candidates for school leadership positions, Nugent (2008) claims that “following best practices in succession planning can help us transcend the inherent obstacles” (p. 33) and that “[d]ue to the leadership shortage school districts are facing, succession planning is more critical than ever” (p. 33.) Further describing succession planning as a “process of systematically identifying, developing, retaining, and promoting people with high potential to ensure leadership continuity,” Nugent (2008, p. 33) also asserts that “growing your own” can save time and money for school districts. Succession planning, however, is broadly based on the assumption that classroom teaching competencies or counseling children proficiencies can easily be transferred to school leadership positions. Nugent (2008) disagrees, claiming that teaching children and leading a school may both be a calling, “but the skill sets are far from identical” (p. 34).

Fullan (2002) asserts that sustained organizational effectiveness cannot rest on the shoulders of one leader alone. “[C]rucial to sustained improvement is the effective succession of leaders” (p. 20) whereby schools “nurture, cultivate, and appoint successive leaders” (p. 20). Fullan also offers the caveat that the pool of quality principals is impossible without a pool of quality teachers “because teachers form the ranks of the quality principal pipeline” (p. 20).

Hargreaves (2005) states, “One of the most significant events in the life of a school is a change in its leadership. Yet few things in education succeed less than leadership succession” (p. 163) and he further claims that “Leadership succession is not just a temporary episodic problem in individual schools but a pervasive crisis in the system” (p. 164). As evidence of the need for deliberate succession planning, he cites the plethora of baby boomer principal retirements and early retirements triggered by the standardization reform movement as well as school districts’ rotation every few years of temporary principals deployed to help failing schools. Such practices create an unstable school community, unable to sustain any improvements made by the outbound principal. However, Hargreaves also maintains that poor succession planning is not the only problem. “Three other issues also are important: leaders’ knowledge of improvement and succession processes, frequency of succession, and the changing nature of leadership in times of large scale reform” (p. 169).

Fink and Brayman (2006) assert that succession planning is not the critical issue in continuing effective school leadership but rather the degree of autonomy that principals have to impact their school communities. They view the erosion of the

principal's autonomy as a deterrent to potential leaders from aspiring to the school leadership role.

The Maryland State Board of Education recognized the alarming rate with which baby boomer principals were retiring, and declared the school principalship a critical shortage area in August, 2005. The Maryland Department of Education subsequently developed and published *Leadership Succession Planning Guide for Maryland Schools* (2006), a manual for succession planning for school principals.

In a case study of a school that was preparing for a new principal to take the helm, Jones and Webber (2001) found that "A change of principal precipitates a complex social process that affects all individuals within a school community" (p. 6). They found that stakeholders experienced fear, detachment, expectation of change, enchantment, and disenchantment (p. 7). They advised that principal succession not be viewed as a single event but rather as a process, the effectiveness of which depends on the facilitation of relationships in the school culture. Hart (1993), likewise, in an earlier work, asserted that the succession of school leadership was a "complex social process" (p. xi) which gave school districts an opportunity to "influence leadership development and school change" (p. xiii).

#### Participants, Methods and Procedures

The state with the consultation of SREB staff arranged for a three day focus group workshop titled, Developing Collaborative University-District Partnerships to Prepare Learning-Centered Principals, and led the workshop and focus group discussions. All university deans of education and department heads in the state were requested to attend a three day focus group workshop. Each university was told to bring faculty and the highest

level representatives (those with decision-making power) from one of their service area districts, and this was the first phase of an evaluation of the university-district partnership each university was required to maintain. The universities were told that the second phase of the evaluation would take place a few months later called “Quality Measures” ([http://www.edc.org/projects/school\\_leadership\\_project](http://www.edc.org/projects/school_leadership_project)).

Focus groups convened in November, 2009 to review the progress of the partnerships. Two main activities were held. One consisted of a discussion of three issues, the responses of which were posted on the walls around the room. The issues were the benefits that each member of the partnership receives; questions, problems and solutions; and skills a new leader needs to lead a school to success. Next the focus groups completed *Enabling Conditions of the University/District Partnerships* (SREB, 2007) by consensus.

The researchers sought to describe the workshop and focus group discussions that occurred during this three day period. Through the detailed recording of focus group conversations and their charting, the research questions were addressed.

The data were the conversation and charts of these discussions created by each university-district partnership. Are the right circumstances in place to enable the university-district partnership to pay attention to these conditions? Are the right people at the decision-making table to strengthen and develop the enabling conditions? Are the right questions being asked that will lead to fulfilling these conditions? The present paper is a qualitative study intended to describe the phenomenon of succession planning through a university-school district partnership.

## Presentation of the Data

Demographics: Who sat at the table?

The participants were faculty members from 13 universities, educational leaders from school districts, and private providers of educational leadership preparation programs.

Table 3. Participants

Position Held	Number of Participants
Deans of Department of Education	0
Department Heads of Educational Leadership	0
Faculty teaching in Master of Educational Leadership Programs -	54
Superintendents	2
District Central Office Staff –	12
Building Principals	23

### Enabling Conditions Results

Even though each of the university-district enabling conditions was important, only those that related specifically to succession planning were chosen. The chart listed the enabling condition in the center, with indicators beneath. On the left side three boxes indicated the level of change the individuals and group chose. The levels were need to change, willing to change, able to change. The fact that “not willing to change” was not one of the choices proved very frustrating for some focus groups. Nonverbal language such as folded arms and shaking heads was noted on several indicators. On the right side of the chart four boxes indicated whether each indicator was consistently evident, somewhat evident, seldom evident, and don’t know.

Each university-district partnership filled out an Enabling Conditions Chart individually and then by consensus. University faculty filled out the left side of the chart concerning change for the university indicators and district representatives filled out the left side of the chart concerning change for the district indicators. Both university faculty

and district representatives filled out the right side of the chart concerning evidence.

Ideally, universities and districts in a partnership should know what the other is doing.

University:

Condition U5 states, “The faculty in the leadership preparation program shares a belief that field-based experiences offer significant learning opportunities to support the application of theory to practice.” University faculty are directly responsible for this condition. It is part of the accreditation process and faculty evaluation. Most participants were university faculty.

Condition U7 states, “The university and department expect and reward partnership development as a component of each faculty member’s work load.” University faculty are not directly responsible for this condition; however they know the criteria upon which they are evaluated as well as the expectations and rewards. This condition is not part of the faculty members’ workload. The major part of the faculty members’ workload is scholarly research publications and presentations, second is teaching, and a distant third is community service. The weight is approximately 50% scholarly research, 40% teaching, and 10% community service. Tenure and promotion is withheld if any of these workload weights is below average.

Districts:

Condition D5 states, “School and district leaders share a belief that school-based experiences offer significant learning opportunities for aspiring principals to apply theory to practice.” The district representatives present at this workshop are not responsible for this condition in any way. Those present at this meeting were chosen on the basis of their favorable perceptions of the university program. While many support this condition and belief as professionals, they have many other duties of perceived higher priority.

Table 4. University Enabling Conditions - Results and Conversations of Focus Groups

Need to change	Willing to change	Able to change	Indicator	Consistently Evident	Somewhat Evident	Seldom Evident	Don't know
Condition U5: The faculty in the leadership preparation program shares a belief that field-based experiences offer significant learning opportunities to support the application of theory to practice.							
	x		Faculty members incorporate field-based experiences in their dialog about a common vision of graduates, discussion about course requirements and policy changes, and evaluation of program goals and objectives.	x			
Conversation: University faculty members checked willing to change on the left and consistently evident on the right. "Since this indicator is part of the accreditation process, we do this." District leaders checked this as consistently evident.							
	x		Faculty members work to develop the structure and support to provide field-based experiences that offer significant learning opportunities.	x			
Conversation: University faculty members checked willing to change on the left and consistently evident on the right. "This indicator is part of our requirements and we do this." District leaders also checked this as consistently evident.							
	x		Field-based experiences are provided to candidates throughout their leadership preparation program.	x			
Conversation: University faculty members checked willing to change on the left and consistently evident on the right. "This indicator is part of our requirements and most activities required in course work have required field components." District leaders also checked this as consistently evident.							
	x		Faculty members provide support to candidates and their mentors to ensure application of theory to practice.	x			
Conversation: University faculty members checked willing to change on the left and consistently evident on the right. "This indicator is part of our requirements. We do not go out into the field often, because of time issues." District leaders also checked this as consistently evident.							
Condition U7: The university and department expect and reward partnership development as a component of each faculty member's work load.							
x			Faculty members are cited for outreach and service to local school districts.			x	
Conversation: University faculty members checked need to change on the left and seldom evident on the right. District leaders checked "don't know"							
	x		Faculty members are expected to regularly contribute to outreach and service to local school districts.			x	
Conversation: Faculty checked willing to change on the left, but stated that without release time that this would not be possible. Faculty also checked seldom evident on the right. District leaders checked "don't know"							
	x		University leaders recognize the contributions to partnership development and service to school districts during tenure and promotion decisions.			x	
Conversation: Faculty checked willing to change on the left side and seldom evident on the right. Very few were present with decision-making power, but one of the university's goals is to become a research institution. Without requirements for research, the university cannot meet this goal. Hiring those without terminal degrees also counts against the university for accreditation. The district checked "don't know"							

Condition D6 states, "Partnering with a university preparation program is part of the district's leadership succession and professional development plans for learning-



centered leaders in each school.” This condition did not align with a university condition, since succession planning must be supported by practice and policy at the district level. Most of the district representatives were not in the position to make decisions regarding this condition, so most reported that while they were willing to change, it was not in their scope of responsibilities or power. Some said that while they welcomed aspiring leaders with enthusiasm, many school building leaders did not. Some suggested that this program be delivered to only those schools that had building principals who were willing to support succession plans and “grow their own” learning centered leaders. One school district had a program for succession planning, but it was not affiliated with the university. The candidates in their aspiring school leader program already had Master of Education degrees in school leadership. Their program was designed to provide the authentic field-based experiences after the university program.

Condition D7 states, “The school district expects and rewards partnership development as a component of the central office and school level leaders’ workload.” District representatives are not expected or rewarded for partnership development. This condition is not part of the central office and school level leaders’ workload. The major parts of their workloads are varied, but none are dependent on this condition.

Table 5. District Enabling Conditions - Results and Conversations of Focus Groups

Need to change	Willing to change	Able to change	Indicators	Consistently Evident	Somewhat Evident	Seldom Evident	Don't know
Condition D5: School and district leaders share a belief that school-based experiences offer significant learning							

opportunities for aspiring principals to apply theory to practice.							
	x		School and district leaders incorporate school-based experiences in their dialog about a common vision of ideal school leaders, discussion about leadership preparation, and evaluation of leadership succession plans, goals and objectives.				x
Conversation: District representatives checked willing to change on the left and don't know on the right. Some said that they were unwilling to change since this would cost money in terms of release time for candidates from teaching. They checked somewhat evident on the right. University faculty checked somewhat evident.							
	x		School and district leaders work to develop the structure and support to provide school-based experiences that offer significant learning opportunities				x
Conversation: District representatives checked willing to change on the left and don't know on the right. They added that they were willing to work with university staff, but their time was very limited. University faculty checked somewhat evident and offered the same conversation as in U5 Indicator.							
	x		School-based experiences are provided to aspiring leaders throughout their leadership preparation program.				x
Conversation: District representatives checked willing to change on the left and don't know on the right. Some stated that they were unwilling to change since this would take teachers away from teaching, hurt student achievement, and cost money. University faculty checked somewhat evident.							
	x		School and district leaders provide the support to aspiring leaders and their mentors to ensure application of theory to practice.		x		
Conversation: District representatives checked willing to change on the left and somewhat evident on the right. They added that money is not given for support, but private verbal praise among peers was evident. Mentors were encouraged to attend mentor training on weekends, since being away from school during the week was discouraged. University faculty checked somewhat evident, citing that release time was not a main issue with mentors.							
Condition D6: Partnering with a university preparation program is part of the district's leadership succession and professional development plans for learning-centered leaders in each school.							
	x		Leadership preparation and professional development is competency-based and aligned with the state's standards for new leaders.		x		
Conversation: District representatives checked willing to change on the left and somewhat evident on the right. They said that school leader evaluation is aligned with state standards, but leadership preparation is up to the university.							
	x		Leadership succession plans have been approved by the district's leaders and the district's board of control.			x	
Conversation: Most of the district representatives were not in the position to make decisions regarding this condition, so some reported that while they were willing to change, it was not in their scope of responsibilities or power. They also marked seldom evident on the right and university faculty agreed. Some said that while they welcomed aspiring leaders with enthusiasm, many school building leaders did not. This subject had not been discussed in the district as far as they knew, nor did it seem urgent.							
			Leadership preparation and professional development is designed to specifically develop learning-centered leaders — leaders who can focus improvement on curriculum, instruction and student achievement.			x	
Conversation: Most school district representatives said that leadership preparation was not part of the school districts' responsibility, so they did not mark anything on the left side and marked seldom evident on the right side. Professional development is a responsibility of the individual and most principals attended professional development with their teachers.							
			District leaders regularly review the preparation program and monitor its results in developing learning-centered leaders for the needs of the local				

			schools.				
			Conversation: Most school district representatives said that leadership preparation was not part of the school districts' responsibility, and they had so much to monitor that adding one more thing to their duties seemed unreasonable. They did not mark anything on the left side and marked seldom evident on the right side.				
			Condition D7: The school district expects and rewards partnership development as a component of the central office and school level leaders' workload.				
			District and school leaders are provided orientation and training for partnership development.			x	
			Conversation: Most school district representatives said that orientation and training for partnership development was an interesting idea. They didn't know how it would be received by those in power. They did not mark anything on the left side and marked seldom evident on the right side.				
			District and school leaders are cited for partnership development with universities.				x
			Conversation: This indicator was not able to be discussed, since partnership development with the university is unknown. They did not mark anything on the left side and marked don't know on the right side.				
			District and school leaders are expected to regularly contribute to ongoing partnership efforts and university leadership preparation programs.				
			Conversation: This indicator was not able to be discussed, since partnership development with the university is unknown. They did not mark anything on the left side and marked don't know on the right side.				
			District and school leaders recognize the contributions to partnership development and mentoring				
			Conversation: Conversation: This indicator was not able to be discussed, since partnership development with the university is unknown. They knew of mentoring and some were mentors, but these efforts were not recognized at the district level. They did not mark anything on the left side and marked don't know on the right side.				

Table 5. District Enabling Conditions - Results and Conversations of Focus Groups (continued)

Need to change	Willing to change	Able to change	Indicators	Consistently Evident	Somewhat Evident	Seldom Evident	Don't know
			Condition D5: School and district leaders share a belief that school-based experiences offer significant learning opportunities for aspiring principals to apply theory to practice.				
	x		School and district leaders incorporate school-based experiences in their dialog about a common vision of ideal school leaders, discussion about leadership preparation, and evaluation of leadership succession plans, goals and objectives.				x
			Conversation: District representatives checked willing to change on the left and don't know on the right. Some said that they were unwilling to change since this would cost money in terms of release time for candidates from teaching. They checked somewhat evident on the right. University faculty checked somewhat evident.				
	x		School and district leaders work to develop the structure and support to provide school-based experiences that offer significant learning opportunities				x
			Conversation: District representatives checked willing to change on the left and don't know on the right. They added that they were willing to work with university staff, but their time was very limited. University faculty checked				

somewhat evident and offered the same conversation as in U5 Indicator.							
	x		School-based experiences are provided to aspiring leaders throughout their leadership preparation program.				x
Conversation: District representatives checked willing to change on the left and don't know on the right. Some stated that they were unwilling to change since this would take teachers away from teaching, hurt student achievement, and cost money. University faculty checked somewhat evident.							
	x		School and district leaders provide the support to aspiring leaders and their mentors to ensure application of theory to practice.		x		
Conversation: District representatives checked willing to change on the left and somewhat evident on the right. They added that money is not given for support, but private verbal praise among peers was evident. Mentors were encouraged to attend mentor training on weekends, since being away from school during the week was discouraged. University faculty checked somewhat evident, citing that release time was not a main issue with mentors.							
Condition D6: Partnering with a university preparation program is part of the district's leadership succession and professional development plans for learning-centered leaders in each school.							
	x		Leadership preparation and professional development is competency-based and aligned with the state's standards for new leaders.		x		
Conversation: District representatives checked willing to change on the left and somewhat evident on the right. They said that school leader evaluation is aligned with state standards, but leadership preparation is up to the university.							
	x		Leadership succession plans have been approved by the district's leaders and the district's board of control.			x	
Conversation: Most of the district representatives were not in the position to make decisions regarding this condition, so some reported that while they were willing to change, it was not in their scope of responsibilities or power. They also marked seldom evident on the right and university faculty agreed. Some said that while they welcomed aspiring leaders with enthusiasm, many school building leaders did not. This subject had not been discussed in the district as far as they knew, nor did it seem urgent.							
			Leadership preparation and professional development is designed to specifically develop learning-centered leaders — leaders who can focus improvement on curriculum, instruction and student achievement.			x	
Conversation: Most school district representatives said that leadership preparation was not part of the school districts' responsibility, so they did not mark anything on the left side and marked seldom evident on the right side. Professional development is a responsibility of the individual and most principals attended professional development with their teachers.							
			District leaders regularly review the preparation program and monitor its results in developing learning-centered leaders for the needs of the local schools.				
Conversation: Most school district representatives said that leadership preparation was not part of the school districts' responsibility, and they had so much to monitor that adding one more thing to their duties seemed unreasonable. They did not mark anything on the left side and marked seldom evident on the right side.							
Condition D7: The school district expects and rewards partnership development as a component of the central office and school level leaders' workload.							
			District and school leaders are provided orientation and training for partnership development.			x	
Conversation: Most school district representatives said that orientation and training for partnership development was an interesting idea. They didn't know how it would be received by those in power. They did not mark anything on the left side and marked seldom evident on the right side.							
			District and school leaders are cited for partnership development with				x

		universities.				
Conversation:	unknown.	This indicator was not able to be discussed, since partnership development with the university is unknown. They did not mark anything on the left side and marked don't know on the right side.				
		District and school leaders are expected to regularly contribute to ongoing partnership efforts and university leadership preparation programs.				
Conversation:	unknown.	This indicator was not able to be discussed, since partnership development with the university is unknown. They did not mark anything on the left side and marked don't know on the right side.				
		District and school leaders recognize the contributions to partnership development and mentoring				
Conversation:	unknown.	This indicator was not able to be discussed, since partnership development with the university is unknown. They knew of mentoring and some were mentors, but these efforts were not recognized at the district level. They did not mark anything on the left side and marked don't know on the right side.				

Table 6. Four Themes of Conversations

Succession Planning	Accountability for University-District Partnership	Long-held Perceptions of University M.Ed. Program (held by both university and district)	Procedures and Policies of state, university, district
<p>Hiring needs met in the district's cultural context</p> <p>Meshing theory with practice</p> <p>Universities can better prepare candidates who meet district needs</p> <p>Co-construction of knowledge (context specific)</p> <p>Observable impact on student achievement</p> <p>Selection process needed</p> <p>University takes everyone</p> <p>Is there an apprenticeship model and what does it look like?</p> <p>Districts develop own workforce</p> <p>Hire practitioners to teach principal preparation courses</p> <p>A collaborative relationship built on a shared vision in a PK-12 context</p>	<p>No accountability measurement for the degree program with district</p> <p>Disconnect between PK-12 education and higher education</p> <p>Perceived lack of accountability in higher education</p> <p>Blame game between universities and districts</p> <p>Accountability – reciprocal university accountability for training – district accountability for tapping or selecting candidates</p> <p>Does the preparation program prepare the candidate well enough to satisfy the district?</p> <p>What is the responsibility of the district in developing high quality school leaders?</p> <p>There is a gulf between administration, training programs, tools, skills and knowledge necessary for successful practice.</p>	<p>Who is the consumer of the Leadership Program?</p> <p>The university considers the student as the consumer instead of the school district. District Leadership does not know what is happening at the university level, such as redesign of programs for school leaders, districts as consumers to create a succession plan where future leaders are tapped.</p> <p>There is a paradigm shift that few are aware of and here it is</p> <ul style="list-style-type: none"> <li>• University is the provider</li> <li>• District is the consumer</li> <li>• Candidate is the product</li> </ul> <p>There needs to be clarity between who is the consumer and who is the product</p>	<p>What are the rules, policies, norms and behaviors that cause a resistance to change that is the creation of the university – district partnership?</p> <p>Lack of communication among DOE, Universities and Districts</p> <p>There needs to be a circular relationship among major players</p> <p>The candidate pays for a university degree; therefore the candidate is the consumer.</p> <p>University evaluation system – research, teaching (candidates opinion of teaching), service</p> <p>University funding is dependent on student tuition</p> <p>University provides instruction and research</p> <p>Need a UPS (University Performance Score) based on district satisfaction</p>

Develop a consumer driven relationship and set of core beliefs  What role can the superintendent play in the selection process?			
	Superintendents hire and are held accountable where universities and alternate providers do the training. (Value-added) This creates a dilemma.	Lack of real, practical relationships between partners – no reason for the university-district partnership	
	Needs: Balance between creating relevance (eventually useful, not confused with immediately useful) learning experiences and a shared sense of accountability. Reciprocal accountability District provides time off for authentic experiences; a mentor for candidate How do we know if districts' needs are being met?	University-district partnerships are superficial  University working to reach candidate goals	

## Results

The present state of the university-district partnership in the succession planning process is in its very early stages. It is yet to be seen if the circumstances are right to create the “perfect storm” that could motivate universities and school districts to form a solid partnership with the goal of preparing the future leadership of our PK-12 schools. It seems accurate to ask what the right circumstances are before we ask if the right circumstances are in place. Standards are different for universities and school districts. States are not holding universities and school districts to the same expectations. The right players are not even at the table. However, the right questions may be being asked because they are posed by the consulting organization and the universities. Even those questions may cause resistance to change, however, because they are perceived as

offensive. The university and district institutions are being asked to change their core beliefs and values without sincere ownership.

The data indicate that there is a definite disconnect between university leadership preparation and succession planning. Ideas such as the importance of leadership in student achievement, leadership knowledge, skills and dispositions, the importance of placing a highly qualified leader in every school, and succession planning were not topics of conversation. Even the idea of a university-district partnership was nebulous.

Both university and district believed there was somewhat of a common vision of the ideal school leaders' knowledge, skills and dispositions. Both groups of participants believed the university-district partnership was seeking a common ideal, but had not discovered the answers. There was a shared belief among university participants that field-based experience is very important in linking theory to practice, but there were varying beliefs among school district participants about field-experience. They commented that although it was important, their superintendents and school boards would not support release time for aspiring school leaders.

Mentors were volunteering for training and working with candidates. It was also noted by both organizations that self-selection rather than succession planning or tapping by the district was the rule. In the same vein, school districts have not been convinced that school leadership is very important in creating successful schools and have not "bought in" to succession plans or learning-centered leaders. Rather, they saw the school leader as a manager of the building. There was a difference in perceived expectations and rewards for partnership development between university and districts. The university participants said that they did not receive any support for partnership development, and

district partners sometimes received stipends, recognition and other rewards for partnership development through grants. Overall, district participants' responses were more positive than university participants; however comments revealed optimism from both groups. Yet there were no reports of significant progress toward school leadership succession planning. Self-selection is still the norm and hard to break away from. Many school districts are unwilling to engage in succession planning because of the political context in which schools are governed. This is especially true in small school districts where succession planning is perceived as favoritism by school board members toward friends or relatives without regard to competence for school leadership.

Latter parts of the succession planning process that anticipate barriers and caring for the partnership have not been addressed yet. Both organizations in the partnership get “busy” with the many demands of the day-to-day work. In addition there are no policies and procedures in place to sustain the partnership, and it is not within the job description of either the university faculty or the school district staff. [See enabling conditions.] Professors get “points” for research and rating scales from students, mainly. “Service” could serve as a policy, but it only accounts for 10% of a professor's evaluation.

There is another disconnect here. Universities need tuition money to pay the bills and salaries, but may not be able to sustain this redesigned program without a strong partnership with districts. Districts are capable of doing succession planning alone, without universities; however, that would lead to universities' reverting to the “ivory tower” mindset of the past, leaving “hands-on learning” to the districts. On the other hand, states could require a certification policy similar to student teaching called “administrative internship,” which may be the solution.



## Educational Importance

Succession planning is the key to guaranteeing authentic field-based experience and internships for aspiring school leaders. In order to meet the demands of improved teaching and learning in the PK-12 schools, a partnership that concentrates on school leadership succession planning between the university and PK-12 school district is needed. The university must have the support of school districts for authentic field experiences through release time and support of a PK-12 mentor school leader. The school districts needs to hire high quality leadership candidates who can improve instruction and student learning, and sustain excellence after a school leader retires. This is a paradigm shift for both the university and the school district, but especially the university, which has traditionally enjoyed academic freedom. A university-district partnership can be sustained through a planned effort designed to establish a formal, mutually beneficial inter-institutional relationship. Development of a university-school partnership generally takes place at the intersection of two cultures with differing aims and values (Brookhart & Loadman, 1992), which may cause the development of such a partnership to be difficult. It is believed that both university and districts can come to embrace the concept of a true partnership for school leadership preparation and professional development. This paper offers suggestions for school leadership succession planning that will benefit both the university and PK-12 school districts.

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## THE INTEGRATION OF FOLK ART INTO THE ART CURRICULA WITH IMPLICATIONS FOR TEACHER EDUCATION

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### Abstract

This article begins with a short history and definition of folk art and its relationship to visual culture and art education. The major focus of the article is a discussion of the attitudes and beliefs of art educators toward folk art and visual culture. Qualitative research results are presented with the perceptions of practicing teachers and pre-service educators given. From the findings, it was determined that in order to integrate Folk Art into the curriculum, it needs to be included in pre-service courses and professional development for art teachers. Inclusion of folk art could expand the educational base and help students develop wider cultural and world views. In addition, educational programs need to foster more opportunities for teachers to study abroad or to provide more cultural exchange programs with other countries. Finally, suggestions are made with respect to the integration of folk art as a teaching method into the art education curriculum.

Keywords: Folk Art, Teacher Education

## Introduction

This article examines folk art from an aesthetic and art historical point of view, with emphasis placed on the objects as works of art. Folk art bridges history and culture; it is a treasure of our daily life. Folk art education is a valuable art form and affects education in many ways. It is useful for teachers and students, and invaluable for teacher educators. Also, folk art broadens students' multicultural point of view and reinforces their human concern.

According to ArtLex Art Dictionary (2006), folk art is an art that is “made by people who have had little or no formal schooling in art. Folk artists usually made works of art with traditional techniques and content, in styles handed down through many generations, and often of a particular region. Paintings, sculptures, ceramics, metal work, costume, tools, and other everyday objects all may be folk art” (p.1). Since folk art usually reflects the specialty of local culture, folk art is looked at as a regional art. Folk art is not only made for daily life use or self pleasure but also made for commercial purposes.

The term “folk art” was first used in 1924 after a public exhibition of folk art held at the Whitney Studio Club in New York (Congdon, 1983). Then, Holger Cahill, in 1932, the acting Director of the Museum of Modern Art, claimed folk art was the “expression of the common people, made by them and intended for their use and enjoyment” (Delacruz, 1999, p. 24). Folk Art has been a neglected topic in the academic art arena. In the past, critics used the term “Folk Art” to define art that was naïve and unschooled. Then, in the 1960s, many art educators and scholars began to advocate that Folk Art should be part of art education curricula (Congdon, 1983). In 1976, the National

Endowment for the Arts established the first Folk Artist in Schools (FAIS) program (MacDowell, 1987). Many States followed by setting up their Folk Art in Education (FAIE) or FAIS programs. Today, many states have FAIE programs in schools, and there are several participants and key organizations concerned with Folk Art issues.

Recently, under the impact of visual culture, all artwork is looked at equally, no art-work considered superior to any others (Duncum, 2001; Mirzoeff, 1999); folk art is no longer a peripheral art area. That is to say, folk art has now evolved and become one of the areas of development in the visual arts. In order to develop folk art education, this study investigated the attitudes and opinions of art educators and also tried to create a rich base of folk art education research, including the history and theory of folk art.

#### Background of the Study

Folk art addresses various styles of folk people's history and culture; however, until recently it was looked at as a naïve and unschooled art form and was not included in regular art education. Traditionally, academic art historians had considered art works to be of particular aesthetic value and cultural significance. There has been little research about the history of folk art in education, methodologies, or evaluation in the United States. Most folk art research focuses on the folk art (Delacruz, 1999) or related curriculum activities (Bowman & Zeitlin, 1993, Gomez & Sullivan, 1995; Lambrecht & Bell, 1992; Moonsammy, 1992; Nikoltsos, 2000; Rosenberg, 1996). While every state in the United States has a public folk art cultural program and while several key organizations take responsibility for folk art issues, not all of the folk art in education programs are active (National Endowment for the Arts, 2004, p.1). Therefore, the field needs continued research on folk art teaching pedagogy and training courses.

As Toelken said, “we often encounter art in books, in museums or studios, and on stage--where the articulate voice of living culture is not always heard” (Toelken, 2003, p. 2). Typically, art educators focus their teaching on a fine arts curriculum, with an emphasis on artworks considered to be of particular aesthetic value and cultural significance (Kamhi, 2003). In addition, it is problematic to use a fine arts viewpoint to evaluate folk art’s value. The value of folk art must be regarded as not only encompassing the basics of design but also cultural essentials.

The purpose of this study was twofold. First, it explored the way folk art can be taught in art education by focusing on how educators can integrate folk art into their curriculum. Second, this study also discusses the reasons of that folk art—as a visual cultural tool—needs to be taught in art education. From the visual cultural perspective, every piece of art work is looked at equally. That is to say, folk art has now evolved as one of the areas of development in the visual arts. In order to develop folk art education, this study investigated the attitudes and opinions of art educators toward folk art education.

This study determined and answered the following questions:

1. What are the attitudes and beliefs of art educators toward folk art?
2. What are the attitudes and beliefs of art educators toward visual culture?
3. What are the attitudes and beliefs of art educators toward Visual Culture in Art Education?
4. What are the attitudes and beliefs of art educators toward Folk Art in Art Education?

## Data Sources & Method

The participants in the study were eleven art education major students and sixteen in-service art educators from the state of Idaho, USA. The study employed a qualitative framework. This methodology helped me to investigate the educational meanings of folk art held by art teachers, and thus, offered many possible interpretations of the data. The design of this study included a survey and the collection of artifacts. The survey was conducted by an Internet questionnaire. All of the questions in the survey were open-ended. The data were generated through surveys over a one month period.

The data analysis used content analysis and cross-site analysis methods. The content analysis procedure uses the following sorting categories: participant views, processes, activities and methods. Cross-site analysis generated themes by illuminating integrated findings from several content areas.

In this study, trustworthiness was achieved through ongoing peer examination and researcher's field notes. The following strategies ensured internal validity:

1. Peer examination—colleagues were asked to make comments on my interpretations.
2. Researcher's field notes— filed notes and reflective thinking of qualitative research theories helped me in analyzing to avoid the involvement of my personal bias.

## Findings

The findings focus on art educators' attitudes toward and opinions of folk art with responses divided into four categories: Beliefs about Folk Art vs. Fine Art, Beliefs of Visual Culture, Beliefs about Visual Culture in Art Education, and Beliefs about Folk Art in Art Education.



### *Beliefs about Folk Art vs. Fine Art*

This category dealt with the timely issue of what is folk art as compared to fine art. The surveys revealed that the more teaching experience the respondents had, the more they understood and appreciated folk art. One teacher reported the following historical viewpoint to interpret the gap between fine art and folk art and believes in the value of folk art to understand culture.

I think that the gap between fine art and folk art is closing. Fine art historically came from an academic program where artists were trained very seriously for their work and has always been appreciated for given criteria. Folk art came from traditions handed down through a specific culture through informal teaching. The folk art has been best understood by the culture in which it was produced (T.W.).

For those students who had little or no teaching experience, they were not familiar with folk art. Since their educational training was mostly in the fine arts, they had had few opportunities to study folk art. Even though most of them took a visual culture class last semester, they still believed that there was a hierarchical relationship between fine art and folk art. One participant said: "Fine art stands the test of time and is regarded as masterpieces by all people. Folk art is kitschy, trashy souvenirs. But maybe I don't understand the definition of folk art? Maybe folk art doesn't follow patterns and techniques but is representative of a small segment of a society, whereas fine art transcends these boundaries and pays attention to the aforementioned methodologies (V. K.)."

Some participants believed that there was no boundary between fine art and folk art. Likewise, folk art and fine art sometimes have similar elements and representation.

Folk art can be fine art. Breughel is folk art and considered a fine artist. But not all fine art is folk art. David and Michaelangelo are both really fine artists, but not folk artists (M.M.).

### *Belief of Visual Culture*

Most of the participants defined visual culture as images around us that encompass a vast number of visual elements. One teacher stated the following. "Visual culture is everything that the eye sees. It includes many different types of media. Examples of visual culture can be seen on television, in magazines, movies, pictures, displays, advertisement, books, posters, the internet, newspapers, billboards, and in shopping malls. From the moment we wake, if we have the gift of sight, we are literally bombarded by the visual (T.C.).".

The participant who had not taken a visual culture class had this similar understanding of visual culture: "In my opinion, visual culture would be anything produced by a culture that would help to inform society about that culture. In other words, anything that serves to record the values and processes of a specific culture (T.W.)."

### *Beliefs about Visual Culture in Art Education*

Most of the participants believed that visual culture plays an important role in our society and education. One even suggested that every social science student and all artists should take a visual culture class. Those opinions verify the importance and value of studying visual culture to the responses. A participant believed following. "I think it would be fascinating to integrate visual culture with art education. I am not sure how one would go about this but it would be a powerful way to introduce philosophy and history

to younger students, as well as make them aware of the power images have on them as members of our society (V. K.)."

### *Beliefs about Folk Art in Art Education*

The participants believed that folk art would be a great way for everyone to enjoy art production and develop their self-expression. Folk art is also a historical production for students to learn about their surroundings and society. Two teachers thought the following. "The contributions of folk art are more practical than that of fine art. They encourage functionality as well as self-expression. They diminish the artist as gifted so that everyone can enjoy art production. They broaden our world socially (T.W.)."

Another response was: "It is good to teach folk art/cultural production education. It is fun and enriches the students. I can't think of any bad points about bringing folk art/cultural production education into the classroom (T.C.)."

From the responses of the participants, those who had experiences abroad, multicultural family backgrounds, or who had experienced Folk Art in their childhoods were more likely to support the integration of Folk Art into their art classes. In-service teacher participants provided more teaching experiences of Folk Art and insights of the issues of Folk Art in education. Moreover, most pre-service teacher participants had taken Visual Cultural classes; they had a deepened knowledge about Visual Culture. Visual Culture is a way to remind us of the lines between Fine Art and Folk Art, but few teacher participants understand the framework of Visual Culture. It shows a need for teachers' professional development.

## Discussion and Conclusions

Since the conceptualization of visual culture, folk art is no longer an abandoned area. Even more importantly, folk art is an unconventional outlet for people to cultivate their imagination and ideas. Folk art education is not only a good resource to understand tradition, but also a good tool for teachers. Through folk art, students can learn both theoretical and practical aspects of the arts. Moreover, it is a stylized communication and cooperative tool for people who come from various communities and different generations. Besides, the importance and pleasure of folk art is not only the product, but also the process of making it.

The underlying belief of educators and students driving this investigation was that it is problematic to use a typical fine arts viewpoint to evaluate folk art's value. In traditional academic art training, few teachers have been taught folk art. Thus, they seldom integrate folk art into their art classes and feel clueless about teaching folk art. Furthermore, they have not had the opportunity to attend a folk art education training course. Their lack of folk art education training prevents them from integrating it into their curriculum.

From the perspective of visual culture, art educators might change their thoughts toward folk art and respect the unique nature of folk art. As MacDowell said, "The challenge, then, is for educators to find meaningful ways in which to incorporate new information about traditional knowledge into formal educational structures" (MacDowell, 1987). In order to develop folk art education, we need to create a rich base of folk art education research, including folk art education history and theory research. Hopefully,

this study can make art educators and the public aware of the need to emphasis and improve folk art education.

The importance of art to the education curricula cannot be overstated. Similarly, integrating folk art into the art curricula is imperative and must be done so that local culture and art, as a free form of expression, can be made integral to any area of humanities study. At a time when so much discussion among teacher educators focuses on the integrated curriculum, what better way than folk art as a vehicle to study art in relation to culture, music, social studies, language arts and science. Folk art can bring alive the contribution that all of these areas have made to each other and show that the curricula can be enriched through integration.

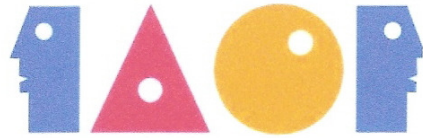
#### Implications for Teacher Education

It is the responsibility of art teacher educators to discover and teach new teachers this wonderful and innovative approach to Art teaching. It not only adds a unique dimension to art education but one that leads students to a greater understanding of the human spirit. Teacher educators must be open to inquiry and new ways to teach art. Folk art can be one of these new and exciting approaches.

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INTERDISCIPLINARY COLLABORATION FOR  
DIGITAL CONTENT SERVICE DESIGN

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Abstract

Digital Content Services (DCS) is considered cutting edge in today's emerging industries; however, a number of its radical innovations raise cautionary hesitation among venture capitalists. Moreover, the recruitment of outstanding talent is sometimes challenging because misunderstanding of the job of the service design team occasionally results in clashes with management. This study proposes the DCS Interdisciplinary Collaboration Model (DCSICD Model) based on the award-winning MAPMARK project for understanding workflow in DCS development. The DCSICD Model focuses on cross-disciplinary development team members' tasks and their symbiosis. DCS is discussed on three dimensions: service development, cross-disciplinary integration, and knowledge exchange.

Key Words: Interdisciplinary Collaboration, Digital Content Service, Design Model, Creative Industries, Knowledge Exchange.

## Introduction

Many successful DCS companies, such as Google, Facebook, and Yahoo, grow and thrive under a small creative team, the members of which come from a variety of professional backgrounds. The fledgling DCS industry, born after the popularization of the Internet and mobile Internet services, requires the cooperation of a variety of professions, including service design, information engineering, interaction design, user-experience analysis, marketing, and integrated service design. Although utilizing a multidisciplinary team has the potential to generate a wide variety of ideas, develop new ideas, and produce more creative designs (Humphreys, Leung, & Weakley, 2008; Sharp, Rogers, & Preece, 2006), the assembling of professionals from different fields raises the importance of developing an efficient and creative cooperative environment.

Many studies focus on Delft Innovation Model (Buijs, 2007), Design Process, and New Product Development (NPD) (Ulrich & Eppinger, 2007). This study proposes a new development process model: the DCSICD Model (Digital Content Service Interdisciplinary Collaboration Development Model), which is primarily targeted at DCS interdisciplinary collaboration in the development mode, and emphasizes the personal experience of the DCS interdisciplinary collaboration team via the MAPMARK project when analyzing its interaction with innovation management. This study serves as a reference for understanding DCS both for corporations as well as for students taking part in entrepreneurship competitions.

This paper is organized into chapters: “Introduction” introduces the MAPMARK project, the anticipated team members, and each member’s responsibilities. “Challenges of Interdisciplinary Collaboration” discusses the advantages and difficulties faced during



the development of MAPMARK. “Multi-faceted DCSICD Model” presents several practical development models that explain the significant features of the DCS industry.

“Conclusions” reviews the key points of this study and specifies its contributions.

### MAPMARK

MAPMARK is a location-based Internet and mobile device search engine (Figure 1) that works in combination with the concept of Web 2.0 / UGC (Tsai, Hsu, Chen, & Jeng, 2008). In 2008, the project was awarded 3rd place in the 9th Industrial Bank of Taiwan WE-WIN Entrepreneurship Competition, obtaining funding for formal listing of its services, and also won 1st Place in Chung-Hwa Telecom's Content Service Competition: Communication Technology Division. In its early experimental stages, the location-based tracking concept, dubbed Open Space 2.0, earned honorable mention in the Leonardo International Student Contest, and was introduced in the gallery section of the first 2010 issue of Leonard Journal.

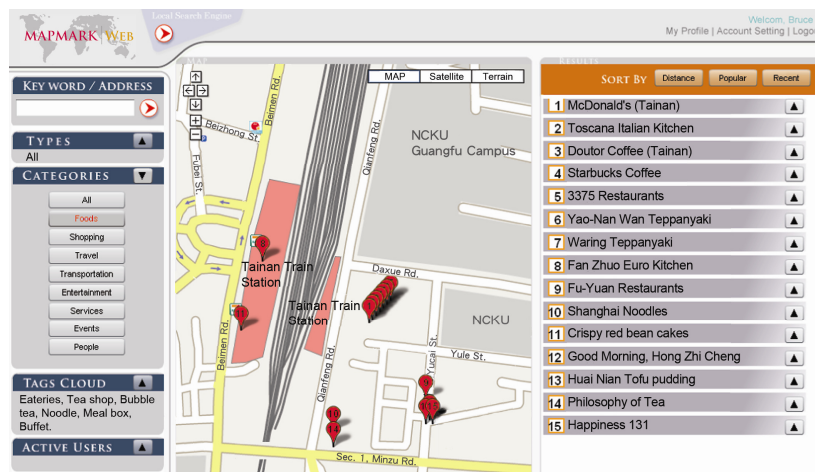


Figure 1. MAPMARK webpage: Users are able to search by locations, making it easy to know regional relations and to gather related local information.

The project was conceived in 2008 by H.L. Hsu upon observing that in planning a trip to a foreign country, current text search engines (e.g. Google, Yahoo, etc.) easily retrieve hundreds of bits of data, a vast majority of which does not directly meet the users' specific criteria, forcing the need to click each link, a time-consuming process in which it is difficult to connect gathered information, resulting in an unsatisfying experience. Various travel guides mostly offer similar general introductions, while online mapping sites, which usually require the exact address in the native language, provide only general or business-oriented information and the marked location on a map. Hence, Hsu developed a 5-point goal:

1. To establish a location-oriented data query mechanism.
2. For the database to be built by users rather than businesses.
3. To allow users to create their own map markings.
4. To provide a platform for users to establish a regional community in the process (e.g. the Internet community established by a Taipei-area bicycling group).
5. To be extended to the mobile platform, allowing universal 24/7 access to the service.

#### *Team Members*

Several key players were invited by Hsu to join the team, including C. I. Tsai, a specialist in visual communication and digital media design, to contribute to interface design and user experience, Y. J. Chen, an expert on Chinese literature and marketing, to prepare the business proposal, as well as two Ph.D. candidates and five graduate students from the Network Computing Lab of the Department of Engineering Science at National Cheng Kung University (NCKU) to assist with programming and database set up. Figure

2 depicts the complete DCS development process, which can be described as an integrated service design.

### *Responsibilities*

Team members were assigned duties according to their expertise:

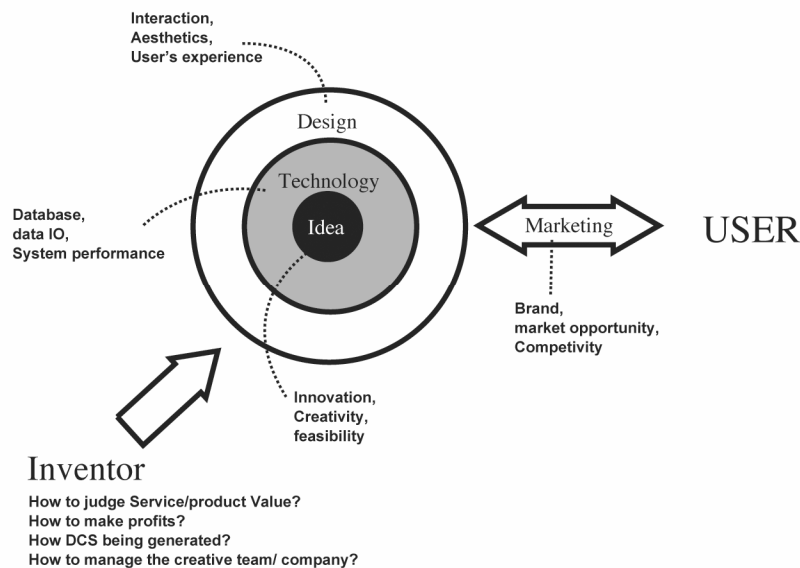


Figure 2. DCS development concept: There are many different talents needed for DCS development: from the core idea, to product, to end-users. Some inventors dread this kind of product because of misgivings about this process.

### *Interaction designer*

Responsible for visual communication design, interface design, and user-experience design. Interaction design (Sharp, et al., 2006) is to establish good human-computer interaction (HCI), the scope of which covers a variety of research areas as well as a large array of academic theories. Saffer (2006) argued a clear concept of interaction design and academic relationships will have key overlapping disciplines: communication

design, user-experience design, user-interface engineering, usability engineering, and HCI.

Communication design focuses on the aesthetic presentation and effective transmission of information. The Aesthetic-Usability Effect (Lidwell, Holden, & Butler, 2003) cited in “Emotional Design” (Norman, 2005), distinguishes three levels of user behaviors: visceral, behavioral, and reflective. Hence, an appealing appearance makes a service psychologically easier to use, bringing greater inclusiveness to the service.

User-experience design (Kuniavsky, 2003) is the concept providing a better user experience. There is an enormous difference between the concept of HCI and excellent usability. Sener and Wormald (2008), in their study of user experiences with 3-D industrial design and drawing software, found a significant difference between real users’ (e.g. industrial designers) expectations and current user interface design. Kuniavsky (2003) indicates user experience includes three elements:

1. Information Architecture: The process of creating an underlying organizational system for the information the product is trying to convey.
2. Interaction Design: The method by which the structure is presented to its users.
3. Identity Design: The amplification of the product’s personality and attraction.

Identity design is jointly established by communication design, marketing, and product/service design, which makes that product/service identifiable for users. Sharp et al. (2006) presented the extension from interaction design to user-experience design in detail. Interaction design focuses on usability, emphasizing efficiency, effectiveness, safety, utility, learnability, and memorability. Simultaneously, user-experience design aims at an enjoyable experience in the interactive process, characterized as satisfying,

enjoyable, fun, entertaining, helpful, motivating, aesthetically pleasing, supportive of creativity, rewarding, and emotionally fulfilling. Content can no longer be merely functional, but also perceptual; closer to the real expectations of users. Bilda, Edmonds, & Candy (2008) proposed the Creative Engagement Model by experimenting with interactive art installations to demonstrate the relationship between user's experiences and creativity, showing that a good interaction design arouses users' interest, building anticipation in them for learning the product, adopting it, deeply understanding it, putting it to good use, and eventually using it to produce creative behavior. Bilda's model echoed Edmond, Muller, & Connell's (2006) three phases of user behaviors: initiators, attractors, and sustainers. Forlizzi et al. (Forlizzi, Zimmerman, & Evenson, 2008) also introduced a model of interaction design research in HCI, suggesting three areas of expertise an interaction designer should have: engineers, anthropologists, and behavioral scientists. The three areas respectively represent the How (the current scientific knowledge and applications), the Real (the real users and the environment), and the True (users' real behavior). Fallman (2008) indicated that interaction designers must also possess the capability of design studies and design exploration, in addition to design practice ability, to cope with today's changing environment.

Initially, a number of interaction design studies were conducted for this project. After the development of a prototype, user-experience research was conducted, adopting a "focus group" method for meeting and confirmation of users' expectations of this service (Tsai, et al., 2008).

### *Information Engineer*

Responsible for coding, information structure, database, system performance, etc. Information engineers learn the demand for services in discussion sessions and convert them into data structures that can be accessed. With UGC/Web 2.0, data input and output need to be user-oriented, which is different from that found in traditional systems that are engineer-oriented. Therefore, in-depth discussions with team members and testing are vital for desired results. Although the data system is wrapped in the design (Figure 2), the ability to quickly respond to interface requests is tied to user-experience design.

### *Market Planner*

Responsible for the business-model operation, market analysis, marketing, etc. A new DCS must not only help users recognize and understand its advantages, but also be recognized as a feasible business to attract venture capital, which might be skeptical of a new type of service offering intangible goods. A vital component, the business plan includes the operating plan, market-competition analysis, opportunity point, and SWOT (Strengths, Weaknesses, Opportunities and Threats). Market planning should also anticipate business activities following the service launch.

### *Creative Team Leader*

Responsible for directing the project, able to acknowledge different views in search of a solution, and convincing potential backers of the project's feasibility and profitability. Because other team members come with different expertise, each approaches the production process differently. However, with new creative technology industries, multifaceted knowledge and the courage to take risks are required of the

creative team leader. Figure 3 depicts a graphic conception of the responsibilities of the creative team leader.



Figure 3. Responsibilities of the creative team leader: A visual synopsis of the capabilities and jobs of the team leader.

1. Personal Capabilities: Because the creative team brings various professional talents together, T-Shaped (Barton, 1998) capability or even A-Shaped capability is required. In the former, the vertical of the “T” represents one’s professional skill and knowledge, whereas the horizontal of the “T” represents one’s generally proficiency with the work of the team members in order to integrate their work processes. A-Shaped means a person actually has two professions. Our team leader, Hsu, has bachelors and masters degrees in architecture design, including undergraduate studies in computer. He is currently studying in the Ph. D. program at NCKU, and working in Prof. Jeng’s Information Architecture Lab. He is proficient in two major professions: design and programming. Those skills are very important for DCS development, and he has shown his abilities greatly during the process.

2. Leadership Style: As different phases of product/service development are reached, the leadership style needs to adapt in to the changing situation. Hohn (2000) proposed two leadership modes: Generative and Focusing for explaining the difference between creative management and manufacture management. If the wrong method is employed, managers soon face leadership conflicts and crisis.

The Generative Mode focuses on the idea-development and product-concept-development phases in the DCS development process. Creativity growth should be neither constrained nor criticized by any practical considerations, and should be allowed to bravely challenge current situations and limitations. The leader plays the key role in stimulating the team members. Upon entering the production, evaluation, and marketing phases of the project, the leadership style should turn to the business-manufacture oriented Focusing Mode. The leader should be able to control the DCS project to meet time schedule and cost targets as well as solve problems. Integrating the two leadership modes with Ulrich’s NPD (Ulrich & Eppinger, 2007) results in the relation presented in Figure 4.

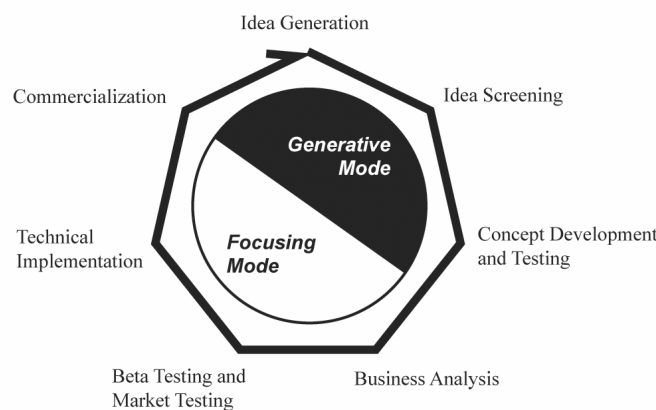


Figure 4. Integration of NPD model and leadership modes: The leadership mode must change to fit different stages of development.



In “Making Innovation Work” (2006), Davila, Epstein, & Shelton refer to a new thinking concept declaring that a manager or leader needs to strike a balance between creativity and profitability, be able to provide vision and direction, as well as sustain team members’ passion and coherence in order to deal with emergencies as a centripetal team.

3. Integration and Moderator: Responsible for constructing the project framework in order to arrange individual assignments and integrate contributions from all team members. Furthermore, scheduling, development of a timeline, communicating, and conflict- moderation are vital requirements.

4. Decision Making: In dealing with problems, development of solutions and defining the action to be taken in each of the process steps toward those solutions are critical.

5. Polarities of Partners and Investors: Partner and investor are depicted as polar opposites because the goals of each (creativity and profit) tend to produce conflicts, which the leader must mediate. Chang & Chiang(2008) state that while the importance of innovation is recognized by companies, it may be abandoned under particular circumstances such as cost reduction or the need for rapid production. Although leaning to the investor side might limit creativity, favoring the partner side might reduce funding. Therefore, a leader’s abilities in integration, moderation, and decision making are important to investors, while the leadership style is a key to partners.

#### Challenges of Interdisciplinary collaboration

Interdisciplinary collaboration is important in nearly all disciplines or industries because it assists in expanding the existing scope of development. Forman & Markus (2005) stated that knowledge of one another's disciplines is based on experiencing an

insider's perspective from another discipline and constitutes a tacit knowledge of the other discipline. Alves, Marques, & Marques (2007) argued that multidisciplinary and multi-sectoral networks can play important roles in the competitiveness of members, provided they exhibit diversity, coherence, and complementarities. However, a trial period is required upon enrollment of a new person or team of a different discipline before real success is achieved. Two critical challenges to be overcome were encountered by this team during its collaboration: differences in logical thinking and mutual learning of knowledge. They are discussed below.

#### *Differences in Logical Thinking*

A review of the literature reveals that interdisciplinary collaboration among experts is conducive to the development of projects or studies. Herman, Rummel & Spada (2001) discuss complementary expertise: collaboration partners complement one another in that each of them possesses a relevant part of unshared knowledge. In other words, each of partners is a "novice" in the other's domain, at the same time being expert in his or her own. Henneke & Lüthje (2007) also indicate that education heterogeneity is positively related to environment scanning and strategy planning openness, two key elements for innovation. Recognizing that indirect relationship exists between education heterogeneity and innovation, Cohen & Levinthal (1990) found that a team that encompasses diverse educational backgrounds seems to have a higher level of absorptive capacity to identify and interpret relevant pieces of information in different sub-areas of the company. In this team's project development process, many differences in logical thinking could be easily identified (Figure 5).

Upon concluding a decision, members of different job responsibilities/backgrounds inevitably interpret and respond with their own logic, a natural phenomenon which is neither right nor wrong. The development of clear communication and mutual understanding over time was required for integrating the different ideas of the members. Unfortunately, time is often of the essence in the face of problems. Therefore, it is necessary to include “clearly communicating with members of different disciplines” as an important job requirement. Spada, Meier, Rummel, & Hauser (2005) offer nine dimensions of the collaborative process in showing the importance of communication inside a team. The top two were sustaining mutual understanding and coordinating communication.

		<b>Interaction Designer</b>	<b>Information Engineer</b>	<b>Marketing Planner</b>
Explicit	Educational Background	Design	Computer Science	Commerce
	Main Jobs	User experience	Programming	Market Strategy
	Working Priorities	Graphics / Interaction	Database / Data process.	Product Values / Competitiveness
Implicit	Thinking Priorities	User-centered / Aesthetics	Effectiveness / Accuracy	Opportunities / Cost & Profit
	Thinking Logic	Perceptive	Rational	Rational

Figure 5. Differences in logical thinking of DCS members: Each member demonstrates different characteristics in various facets.

<b>Tacit knowledge</b>	<b>Explicit knowledge</b>
Knowledge built on experiences (empirical)	Knowledge built on rationality (intellectual)
Synchronized knowledge (right now right here)	Continuous knowledge (not right now right here)
Analog knowledge (practical)	Digital knowledge (theoretical)

Figure 6. Tacit vs. Explicit Knowledge, coordinated by Yang (2003)

### *Mutual learning of knowledge*

The knowledge generation process is knowledge exchange and mutual learning. Huseman & Goodman (1998) looked at knowledge as the information extracted from experience, truth, judgment, intuition, and value. Miller & Morris (1999), on the other hand, believed that knowledge was not only “to know what could be done” but, more importantly, “to know how it can be done.” Knowledge is gained by integrating information, theories, and applicable experiences on one’s own, a process referred to as “learning.”

Classification of knowledge: Polanyi (1974) distinguished two types of knowledge: tacit knowledge is more individual, involves individual scenarios, and is not easily formalized or communicated, whereas explicit knowledge is the knowledge that could be formalized, systemized, and communicated with language. Nonaka (1997) indicated that tacit knowledge is context-specific, personal, difficult to develop, and difficult to communicate. It is the agreement that has to be generated through interpersonal interactions. Explicit knowledge can be transmitted in forms, systems, and languages, and it can be compiled and clearly expressed with training tools such as reference manuals and computer programs. Therefore, explicit knowledge can be directly copied from the database and used. The differences between tacit and explicit knowledge, coordinated by Yang (2003), are charted in Figure 8.

Because tacit knowledge is generated through close teamwork and mutual-learning, it is more important than explicit knowledge. Dorothy Leonard-Barton (1998) believed that an organization is where knowledge is both stored and generated. An organization also establishes its unique organizational competencies through creation of

knowledge. There are four major innovative activities: (a) Solving problems together: pluralistic professions, professional management techniques (A-shaped and T-shaped), and clear goals; (b) utilizing and integrating new technologies and tools; (c) experimenting and striving to produce a prototype; (d) importing and absorbing external knowledge. Nonaka (1997) introduced five sequentially related phases in the knowledge innovation organizing process, including sharing tacit knowledge, conceptualizing, proving adequacy of the concepts, establishing the prototype, and spreading inter-level knowledge. Vice (2007) argued that a successful team leader not only needs to coordinate, but also unify purpose, strategy, culture, people, and the interaction between each. His creative problem-solving model showed the connection between knowledge and the design process.

Davila (2006) believed that knowledge management requires systematic data processing and structuring so that everyone in the organization can gain the knowledge. In addition, for aggressive innovation (e.g. many new DCS), because there are no preceding examples to be followed, “ignorance management” is required for managing what is yet unknown. Ignorance management is the process of identifying important flows unknown by the team and the attempt to minimize ignorance in order to move on. Technological problems and potential difficulties encountered during business model design can be discovered via experiments and prototypes. The new experiment model, the living lab, is also one of the appropriate solutions. The living lab experiments with a small target-user group in order to gather real feedback or results, such as the most closed beta testing of DCS services. For MAPMARK, about twenty people were invited to test

the system and report their feelings. This experiment was executed in order to avoid mistakes caused by aggressive innovation and ignorance.

The process by which knowledge is exchanged is also the process by which knowledge is created. These processes are constantly repeated in interdisciplinary collaboration to generate new idea sparks during each design and development phase. Utilization of a number of processes closely aligns with current design and innovation models. In the following section, the DCSICD model is introduced and discussed.

### Development of Models

For the current collaborative project, after completion of the project beta version, two information engineers and the team leader were interviewed, the complete contents of which were recorded and transcribed verbatim. Important but differing perspectives of the team members were integrated into the results of this study. In addition, literature review synthesis and the author's past work experiences in related industries have been brought into the results.

### *The Multi-faceted DCSICD Models*

This thesis primarily examines the process of DCS interdisciplinary collaboration based on successful experiences with DCS project development. The multi-faceted DCS development process is discussed as a reference for future development of DCS. The six conceptual drawings presented are centered on the DCSICD basic model. The drawings are correlated and can be discussed alternately on Figures 7~12.

### *DCSICD Basic Model*

Commonalities can be drawn between the DCSICD basic model inducted through the project development process (Figure 7) and the previously discussed design mode and

innovation design flow, the only difference being that DCS can perform a pre-marketing beta version test

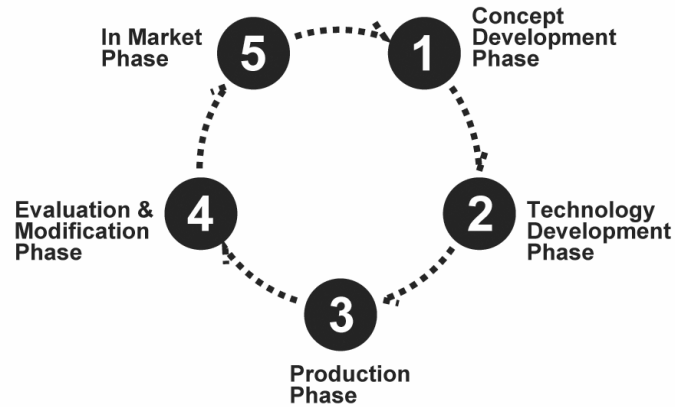


Figure 7. DCSICD basic model: There are five phases in development of a DCS project.

phase, allowing target users to provide feedback for reference when the version is subsequently updated.

The DCSICD basic model is composed of 5 phases:

1. Concept Development Phase: The concept development is the creativity segment, which is primarily the result of customer demand. User behaviors are observed and market trends are studied before demand is analyzed and feasible solutions, which gradually turn into the main contents of the service, are introduced.
2. Technology Development Phase: New concept technologies related to the service are tested for feasibility and restrictions. Meanwhile, the interface design (data input/output and interaction appearances) is tested, data transmission criteria are established, and prototypes are generated for practical testing.

3. Production Phase: Programs and interactive interface design are combined and emphasis is placed on the efficacy and stability of the system.
4. Evaluation & Modification Phase: Closed tests are performed to check for utilization and system design problems. Simultaneously, market entry strategies are considered.
5. In Market Phase: The service is put online for user access. Initially, it is opened for testing to collect feedback from real users and initiate market promotion. User reaction is an important basis for modifications during the next phase (Phase 1 in loop 2) (Figure 8).

Different from alternative design flows, DCS enables a market-open beta version, the contents of which can be further reinforced. The concept is closer to the development process for software. The first loop, which is composed of the five previously discussed phases, can be referred to as the beta version loop, which features generation of the service-test version for open testing. Feedback collected in Phase 5 from real users feeds into the first phase, the data concept development phase, of the second loop, the release version loop (Figure 8). Upon completion of Phase 5 of the second loop, the formal release version is produced. The same flow phases can be repeated to generate newer versions and further enrich content of the service, enhancing competitive advantage.

#### *Digital Content Development Aspect*

Literature review and interview-data analysis reveal that DCS primarily consists of four elements, referred to as the 3+1 (Three Plus One) digital content service: three major elements plus marketing.

1. Digital = Technology and medium or digital technology. Team members must possess digital technology maneuverability and be able to utilize their knowledge of the features and trends associated with the medium, e.g. Web 2.0, personal micro communication.



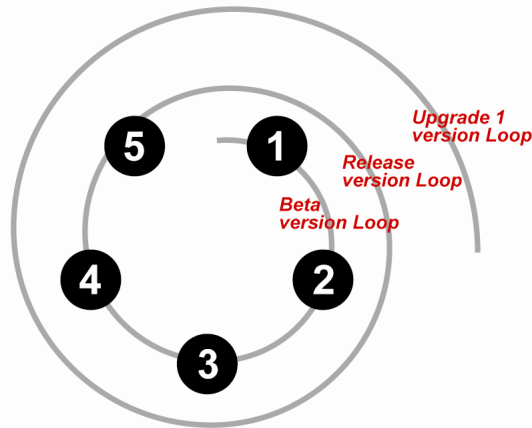


Figure 8. DCS development stage: Unlike other product development models, DCS allows closed and open beta testing before official release of the service. After release, DCS is able to do upgrade to improve content and quality.

2. Content = Resource and knowledge or content development. Digital contents can be compared to factory-manufactured products. Digital contents require raw materials which are processed to bring about the “product”, which is something usable provided by the service. This is the content of the service, which under most circumstances is referred to as “knowledge.”

3. Service = Design and experience or service design. Design competence and the provision of good user experiences are required to turn content into an attractive “service” that transforms users into loyal customers, positive-feedback providers, and contributors.

4. Marketing = Promotion and customer service or marketing strategy. An excellent product will not be a commodity that can compete on the market without good marketing strategies.

Figure 9 is the content development process, in which data is repeatedly converted to knowledge and then service during the five phases of the DCSICD basic model.

The DCS content development process is composed of five phases:

1. Data: First-hand data, primarily from users, but also collected by the team, are usually sporadic and discontinuous. In this project, Web 2.0 technology is used to collect spontaneous user-uploaded data, such as coordinates of a location, messages on a photo, location directions, etc.

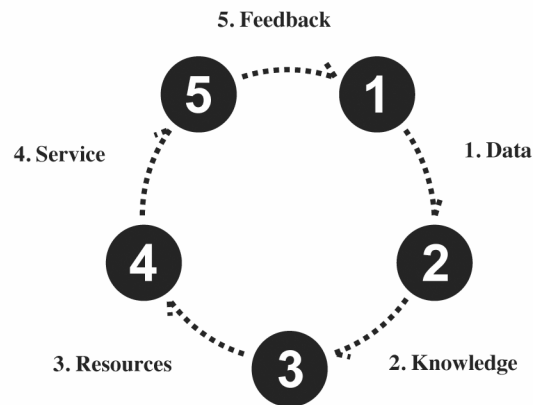


Figure 9. DCS content development process: A visual description of how digital contents are generated.

During this period, team members seek relevance and utility among the pieces of information.

2. Knowledge: After data are sorted, they are transformed into user-desired messages, usually the result of combining multiple pieces of information. For example in MAPMARK, an inquiry for the best restaurant in an area will generate a message that will include the coordinates of the restaurant, ratings by previous users, bulletin board messages, the distance provided by the system, and approximate travel time. Rather than requiring users to understand data broken into segments, they are given complete “content” through the service.

3. Resources: Content must be constantly produced and manufactured, just like real products, so that it is able to satisfy users’ needs. The accumulated content becomes the

resources of the service. For DCS, it is primarily the establishment of an abundant database and the user data that are the real “products”, e.g. in this project, the location-based search database and user-behavior records.

4. Service: The process by which the “product” is converted into a “commodity”, allowing for brand recognition, it is primarily about packaging, marketing, and establishing an image. In this era of information explosion, marketing via digital network and media power is exponentially faster than word-of-mouth advertising.

5. Feedback: Categorized as one of two types. One is response-dependent feedback where weaknesses of the service or experiences in its use, which are important references for improvement, are provided to the system. The other is user-data feedback, referred to as user-generated content (UGC) which the system can analyze and transform into useful knowledge and resources, where data is continuously provided during the using process. This is a non-stop loop. Content development must continuously take place.

The process by which content is generated requires professional competencies and knowledge of team members. In this process, those in different positions not only must possess professional knowledge, but also need to be able to generate the efficacy of collective learning, especially in the sharing of tacit knowledge, so that the core knowledge of each team member can be further advanced, and the team becomes an even more cohesive group. Figure 10 visualizes the relation among the four major scopes of responsibilities that take on different priorities during the development process.

1. Interaction Designer: The early development phase is focused on effectively recognizing the needs of prospective users, constructing the user-experience model, and designing an attractive interface. During this phase, content of DCS will be confirmed,

the target user group will be collaboratively identified by the team, and the feasibility of the developed content will be confirmed.

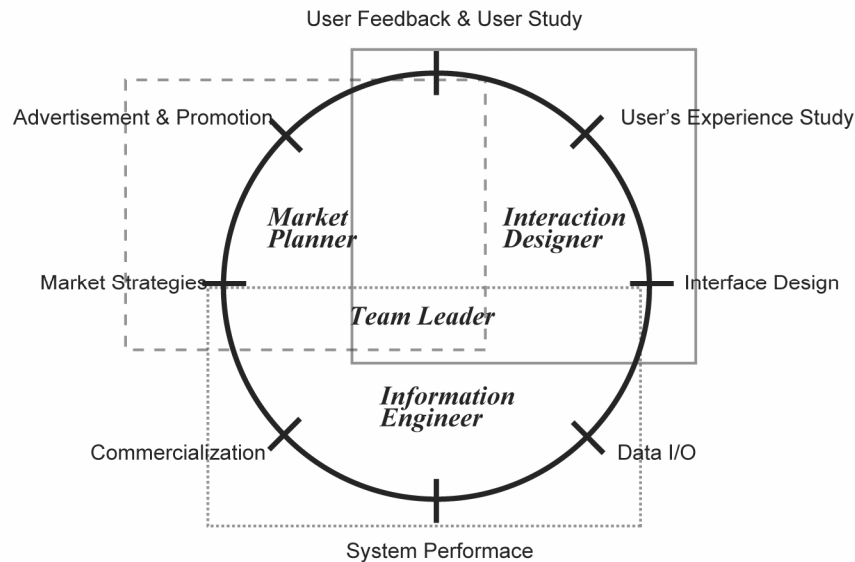


Figure 10. DCSICD knowledge exchange aspect: Major developers must be equipped with unique specialities in order to collaborate on the team.

2. Information Engineer: During the mid-development phase, engineers must accurately construct the service system and maximize its efficiency. In terms of confirming data input/output, it must perfectly match the interface design. As the system construction nears completion, the commercialization process must begin to make the system user-friendly.

3. Market Planner: During the final marketing phase, marketing planners implement market strategies, advertise, and promote. Engineers write promotion programs. Interaction designers work with planners in collecting user feedback, which will become the basis for analysis and modification during the next phase.

4. Team Leader: The leader is the coordinator, integrator, and guide throughout the process, enabling smooth, pleasant knowledge exchange and learning processes among

team members while avoiding member conflicts that result from different professional logics and biases. In addition, the leader admonishes members to follow the active model of collaboration so that core knowledge can be established more effectively.

*Interdisciplinary Collaboration Aspect*

In the previous section, the importance of teamwork, especially in terms of integrating different professionals, is discussed. Figure 11 gives a graphic representation of the tasks of the four roles during these three major phases from the perspective of interdisciplinary collaboration. Initially the development phase is focused on creativity, flowing into the mid-development phase, which is focused on R&D competence, leading to the later marketing phase, focused on commerce.

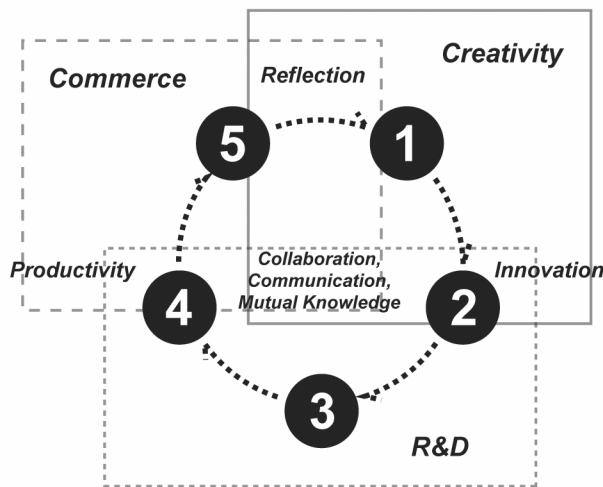


Figure 11. DCS interdisciplinary collaboration aspect: There are three major phases in interdisciplinary collaboration and three overlapping sections.

Indispensable, the three sections overlap in (a) innovation: bringing creativity to existing R&D technology to create new products; (b) productivity: providing a service that is productive and competitive so as to satisfy the vast number of users upon market launch; and (c) reflection: successfully transforming user feedback into useful data for

future use. For reflection-creativity-innovation, users must participate and provide feedback before reflection takes place, and users generate creative activities through interaction design competence, as verified by various interactive works (Amitani, Bilda, & Edmonds, 2008; Seevinck & Edmonds, 2008). In the center are collaboration, communication, and mutual knowledge, the three major elements.

Figure 12 represents the tasks in the overlapping innovation-productivity-reflection sections:

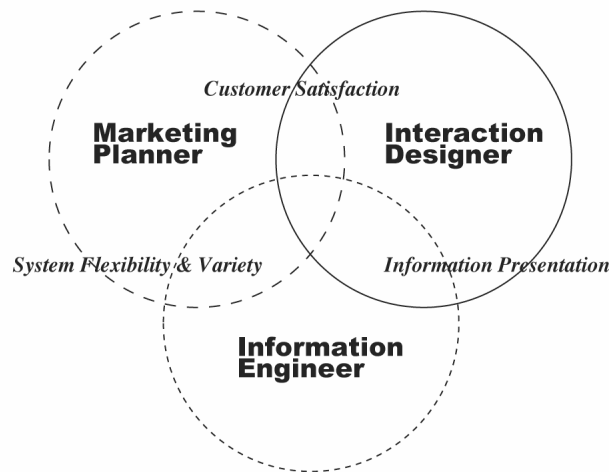


Figure 12. DCSICD collaboration & integration aspect: Three important tasks need to be integrated by DCS team members.

1. Information Presentation: Content and information must be presented on the interface allowing easy access and the belief that it is innovative and different from other services. Because DCS content is primarily information, the way the information is presented has the most direct influence on users.
2. System Flexibility & Variety: A flexible and diversified system able to adapt to the changes in market demand is a prerequisite for commercialization, as is a highly efficient performance.

3. Customer Satisfaction: A service with satisfied users takes not only customer service that works on effectively boosting satisfaction in the next version update, but also a system equipped to collect users' experiences. Often times, users are unable to specifically inform customer service of their real problems. Overcoming this requires designers with knowledge of user experience.

### Conclusions

There are several significant contributions of this study. (a) Current development or design models are not able to fully apply the DCS development process; therefore, the DCSICD model is presented to do fill this gap. The model was developed based on practical MAPMARK experiences based on an academic literature foundation. It focuses on cross-interdisciplinary teamwork collaborative workflow more than previous studies, and is especially suited for the need of designers, engineers, and marketing to work closely together in innovate creative industries. (b) The several multi-faceted models were illustrated and discussed in order to give investors a better understand of the DCS developing process in different aspects, thus avoiding misunderstandings concerning the DCS industry and facilitating interest in investing. (c) People interested in entering the DCS industry have a better idea as to what specialties they should be equipped with as well as what to expect in working in such type of cross-disciplinary collaborative environment.

Four conclusions are drawn as summaries:

1. DCS is primarily a 3+1 process consisting of digital technology, content development, and service design, plus marketing strategy. Content is the core product of DCS. Its generation goes through the loop comprising data, knowledge, resources and

feedback via a five-step process. Implementation of these steps requires collaboration among members on the DCS team.

2. Development of DCS requires a combination of diversified professional knowledge: interaction designer, information engineer, marketing planner, and creative team leader. The core value of the team lies in how they work closely and learn from each other. The interaction designer must be equipped with the capabilities to study the users, collect user's experiences, and design the interface. The information engineer needs to be capable of data I/O process and programming. The marketing planner needs to be able to handle commercialization, marketing promotion, and user feedback. The leader of the creative team needs not only to have a certain understanding of each member's specialty, but also to be equipped with a flexible leadership style and the competence of an integrator and moderator, capable of making marketing decisions in order to handle the needs of and conflicts between investors and partners.

3. Interdisciplinary collaboration requires a proactive attitude to take initiative as well as the generosity to share personal, explicit, and tacit professional knowledge. Exchange of tacit knowledge is the key to the exclusive competencies of the team. Learning from each other, creation of knowledge, coordination and integration, conceptualization, challenging existing stream of thought, and generation of aggressive innovations are the core competencies of a team and are especially important for an emerging technology industry like DCS.

4. The DCSICD mode shows that the development of DCS primarily consists of five phases: the concept development phase, the technology development phase, the production phase, the evaluation & modification phase, and the in-market phase. If



examined from the perspective of content development, a majority of the DCS content comes from pieces of information provided by users, with only a small part configured by the enterprise itself. However, “processing” is required to turn the information into useful “content commodities”, and those doing the processing are the core competencies comprised by the professional knowledge of the team members. From the perspective of interdisciplinary collaboration, DCS development requires three major competencies: creativity, R&D, and commerce. The overlapping innovation- productivity-reflection relies on a close collaborative relationship, as their corresponding tasks are information presentation, system flexibility, and customer satisfaction.

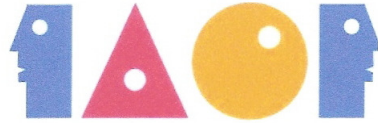
The findings of project MAPMARK can contribute significantly in the development of a DCS creative team or company and serve as useful reference for DCS-related projects.

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## A STUDY OF THE SERVICE INNOVATION ACTIVITIES OF TOURIST HOTELS IN TAIWAN

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### Abstract

New technologies enhance the trend of internationalization. The nature of the commerce environment and the information technology industries are thus changed. In such turbulent environments, innovation has become the key to building sustainable competitive advantages for organizations. Many researchers have focused their studies on the innovation activities in industries such as information, manufacturing, financial service and high-tech, yet few studies have addressed the innovation activities and behaviors in the realm of service industries.

This study focused on innovative service activities in the hotel business. The purposes of this study were to investigate the importance of service innovations to the hotel industry and identify the differences of service innovation between the various types of international tourist hotels.

This thesis utilized questionnaires about industrial innovation activities surveyed in EU countries as the foundation and distributed questionnaires to a variety of hotels in order to acquire knowledge regarding the innovation activities of this industry. The intent is that readers may understand the importance of innovative services in the hotel industry, and determine how hotels integrate innovative services with operation activities.. The study results, based on ANOVA analysis, indicate that nature of several innovative activities, both positive and negative effects of innovation activities, were different between types of international tourism hotels.

Keywords: Service Innovation, Tourist Hotel, Questionnaire Survey, ANOVA

## Introduction

With the gradually increased competition of the globalization trend and the increase in operating costs, services have to develop a continually innovative environment in order to respond to the competition market of globalization and to improve customer service quality, the core competitiveness of enterprise and to reduce costs. There are differences between the characteristics of the service and manufacturing industries. For example, customers will have high engagement during the course of the service. In that case, customers' attitudes and behavior will affect the awareness of service innovation. In addition, the concept of business strategy is also different, i.e. different pricing strategies. The Manufacturing industry determines the price on the function and appearance of the product. However, the price level of service is dependant on the service innovation quality which customers have received. Therefore, the management of developing new services has become an important consideration of competitiveness. Innovation and competitive advantage are connected to each other. However, in the past, there have been many research studies which focus on the positive impacts of sustainable competitive advantage of innovation in the field of manufacturing industry. Relatively few research studies focus on the competitive advantage, productivity and economic growth of the enterprise in which the service innovation has playing an important role. "Innovation" has become a top priority of organization development. Global enterprise and government are gradually putting their focus on it. Changes in business often depend on services, the intensity of competition and technological change. For this reason, for the service industry, innovation is the key factor of acquiring the competitive advantage.

Comparatively, an enterprise must manage a series of value chains in order to communicate superior value to the customers and achieve competitive advantage by conceiving new methods. This series of management activities can be defined as innovative activities. Therefore, innovation applies new knowledge to enhance the enterprise ability, and to develop new products and new services to create business value (Porter,1985). According to the above, organizations must innovate continuously to maintain its competitive advantage in such a rapidly changing environment. In view of the importance of service gradually improve, most of the research studies only focus on the development of new products in the manufacturing applications. For all industries, innovation is the core of their ability. A persistent innovation model covers the concept of new products development and product family, and enterprises must create new knowledge continuously in order to enhance the capacity of innovative products. There have been many studies probing into the innovation of the information industry, manufacturing, financial services or high-tech industries in the past, but few into the services innovative. Thus, this study examines into how the hotel industry innovates in service.

The purposes of this study are described as follows:

1. To understand the importance of the service innovation to the hotel industry, and to find how hotel industry integrate service innovation into the business activities.
2. To identifying the differences of service innovation between the various departments of international tourist hotel.
3. To use the concept of service innovation, choosing the international hotels to verify its feasibility and effectiveness.
4. To popularize service innovative activities in order to promote the development of international tourist hotel industry in Taiwan.

## Literature Review

### *The Definition of Service*

The term "services" means an economic unit change for the possessions or benefit in the consent of an individual economic entity (Hill,1977). It's means the work performed for someone else (Juran,1974). It can also mean to be sold or activities, interests and satisfaction which support to the product sales. Those activities, interests and satisfaction are mostly intangible (Buell,1984) Therefore, Kotler believes that "service" means an event or a performance, with one providing to the other. It could also be a non-material product which is physical intangible and does not result in ownership.

However, the major difference between the output forms of manufacturing and services is that the former separates the process of produce and sale, while the latter integrates. (Evangelista & Savona , 2000). Kotler (1994) defines services into four forms which are totally different from the characteristics of material product: (1) Intangible (2) Inseparability (3) Variability and (4) Perishability.

Bell and Kuznets (1972) also indicated "When the economy becomes more and more prosperous, perhaps people are gradually satisfied with the higher consumption of the product or the demand for material needs, and their living needs are more rich than ever, so people will gradually transfer the consumption target to services." Tax and Stuart (1997) proposed two definitions of new services: one is based on the scope of the change of existing system while the other is based on the process of operation and the change of the participants. The two methods are the ingredients in the concept of service and can be presented to customers and employees in order to know what are their expected blueprint

of receiving and providing. Under this definition, service is essentially an interaction between a series of the participants, processes and physical elements.

### *The Definition and Activities of Innovation*

The term “Innovation” depends on the point of view of the knowledge management. The life cycles of a single product continue to shorten, and there will be new competitors enter the market. The only way enterprise to remain competitive is continue to innovate, including to provide better solutions or develop more convenient products. Schiffman and Kanuk (1994) divided the definition of “innovation” into four: Product-Oriented Definition, Consumer-Oriented Definition, Market-Oriented Definition and Firm-Oriented Definition. Rogers (1995) generalized "the cognitive characteristics of innovation," into five types as follow:

(1) Relative Advantage: Innovation is considered better than the extent of previous concept, such as economic efficiency, convenience and so on. The more higher of the comparative advantage of innovative perception, the more individuals will adopt the innovation.

(2) Compatibility: Innovation was considered to a compatible extent of personal values, past experience and existing demand. The more higher of compatibility of innovative perception, the more individuals will adopt the innovation.

(3) Complexity: Innovation is considered to a extent that is difficult to use or understand. The more higher of complexity of innovative perception ,the more individuals will not adopt the innovation.



(4) Trialability: Innovation was considered to the extent of limited trial and experience. The more higher of trialability of innovative perception, the more potential customers will adopt the innovation.

(5) Observability: The extent that innovation itself or the result of adoption can be observed and discussed. The more higher of Observability of innovative perception , the more individuals will adopt the innovation.

From the definitions of those scholars, innovation can be new concept, new product service, new process, new equipment system or new technology either by the reform of internal or purchase from external. These projects are considered to an innovation for the enterprise as long as they have not possess it.

### *Service Innovation*

Service innovation is a process which contains new concepts and the production, development and implementation of behaviors. It is also a method, a change of respond to external environment or the first action of influence environment of the organizational transformation. (Daft, 1978) Moreover, it is found that there is a high degree of consumer involvement in the assessment phase of the product development process (Feldman and Page,1984). Sundbo (1997) explored if service will organize innovative activities. The results showed that the level and pattern of innovative activities are different, depending on the size of enterprise and the operating projects. Besides, the process of innovation is often a non-system search - and - learning process. However, innovation is totally different from organizational learning. Current academic research studies gradually turn the discussion of innovative process from production activities towards service activities. And the point of view of service innovation is majority from the technological innovation

of manufacturing. The fuzzy characteristics of service production are difficult to measure by traditional economic method of productivity indicator. (Gallouj & Weinstein,1997)

At present, the research on the innovative types of service mainly emphasize the product innovation vs. process innovation and management innovation vs. the distinction of technological innovation (Patrick,2004). Thus, Mamede (2002) believes that the most important feature of unique innovation is just like adaptive capacity. Kelly and Storey (2000) defined the new product of service-oriented enterprise as: (1)The core product is new or to the company or new to the world. (2)The core product can improve the existing product. (3)It is a service supplementary and value-added. In conclusion of above, this study defined the service innovation activities is through the closely encounter of service and customer and provide invisible service to acquire reasonable reward. It's a continuously behavior to create new service, idea or goal in order to satisfy the demand of consumer.

### Methodology

The main foci of this study is the innovation activities of international tourist hotel services and creating a explorative structure. Firstly, it explored in the international tourist hotel, the influence and solution way caused by the service characteristics, and apply the service characteristics into the awareness of innovation activities. Secondly, it explored the role the international tourist hotel played in the innovative activities. Finally, it compared the expected influence by the performance measurement of services innovation and develop the topic of this study. The structure of this study is as Figure 1:

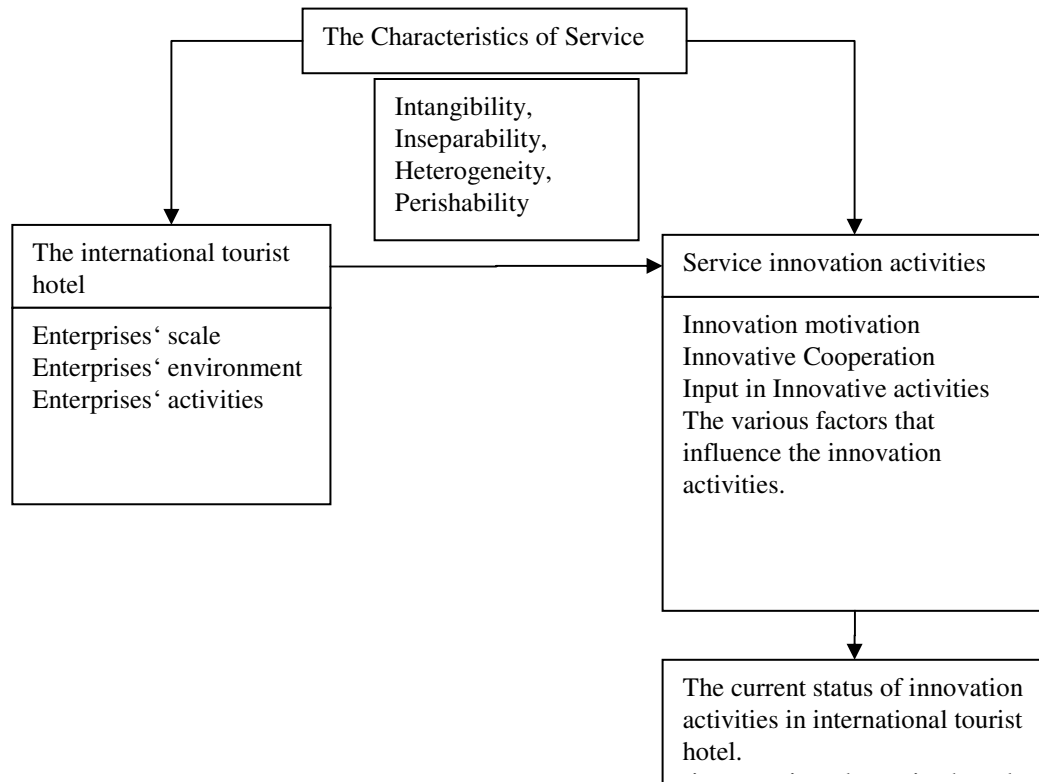


Figure1. Research Framework

This study investigates the service innovation activities of different tourist hotel and the respondents work. An important point of this study is to analyze if there is a significant discrepancy between innovation activities and innovation content in different scale of enterprise and feature of department by the result of questionnaires the respondents had provided. This study hypothesizes that the service innovation activities will have discrepancies in the innovation dynamic and that innovative inputs vary according to the tourist scale or feature of department.

#### *The Design of the Questionnaire*

This study obtained primary information through the use of questionnaires. Based on the relevant literature, we developed the questionnaire survey based on the “Investigation of service innovation of CIS of EU countries.”

### *Method of Data Analysis*

This study used SPSS 12 package version as a statistical analysis test tool, choosing the appropriate analysis according to the aforementioned purposes. The analyses are described as follow.

#### *Descriptive Statistics*

Using the frequency distribution and percentage to analyze the variable information of subject, in order to understand the distribution of each question of the structure.

#### *One-Way ANOVA*

The analysis of variance is used to verify if there is a significant discrepancy on three or more means of population sample. It means to distinguish the result of the experiment (response variables) which caused by the reasons of variation to the mutation caused by the experimental variables (caused by the known reasons) and mutation (commonly know as experimental error, for example: sampling and non-sampling errors) caused by the external interference variables (the factors outside the experimental elements). Then, make it to the variance with the degree of freedom of those two types and switch to the distribution, which is using to verify if there is a significant discrepancy on the variance and estimate if the reason of the variance is significant statistic methods.

### Data Analysis

Total numbers of 210 questionnaires were issued, 198 questionnaires were valid and the effective recovery is 94.2 percent. The official measurements consisted of "Descriptive statistics analysis", Multiple responses analysis and Analysis of Variance (ANOVA). Basic information of subjects included: department, seniority, the average

annual turnover, the total number of employees, the total number of rooms, the total number of restaurants and the average occupancy rates. The analysis results included the frequency distribution and percentage analysis.

#### *Analysis of Service Innovation Activities*

The study conducted data analysis by using descriptive statistics, multiple responses analysis and analysis of variance (ANOVA). The researcher use single-factor analysis to verify if there is a significant discrepancy between the profession of respondent samples and hostel internal characteristics, different functions, motive of service innovation and influence of positive and negative factors. Furthermore, the cross-table of descriptive statistics is also used for in-depth study. We also used multiple responses to analyze the discrepancy between related party and location of the innovation activities the hotel have cooperated with other organization. The cases were collated after the recovery of information and the results are shown in Tables 2 through Table 5.

Comparing the motives of service innovation and service department, it is partly significant under the 95% confidence level. For example: there is significant discrepancy on improving service delivery in order to reduce the response time for the customers, reducing the infect of service product in order to improve the quality of product, upgrading the operational efficiency in order to reduce the standard of per unit service products and attracting more customers or letting customers willing to return again which influence the motive of service innovation activities. But, no significant difference was existed in the setting up a service place more perfect and more comfortable and improving organization system of enterprise in order to increase employee's satisfaction in terms of service department. It is notable between the motive "Reduce the infect of

service product in order to improve the quality of product” of service innovation activities and service department.

Table 2. The Motive of Innovation Activities and Service Department Analyzed by ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Improve service delivery in order to reduce the response time for the customers	Between Groups	23.399	12	1.950	3.468	.000
	Within Groups	104.020	185	.562		
	Total	127.419	197			
Reduce the infect of service product in order to improve the quality of product	Between Groups	30.912	12	2.576	5.520	.000
	Within Groups	86.340	185	.467		
	Total	117.253	197			
Upgrade the operational efficiency in order to reduce the standard of per unit service products	Between Groups	20.740	12	1.728	1.855	.042
	Within Groups	172.351	185	.932		
	Total	193.091	197			
Set up a service place more perfect and more comfortable	Between Groups	5.442	12	.453	0.765	.686
	Within Groups	109.614	185	.593		
	Total	115.056	197			
Attract more customers or let customers willing to return again	Between Groups	12.332	12	1.028	1.812	.049
	Within Groups	104.920	185	.567		
	Total	117.253	197			
Improve organization system of enterprise on order to increase employee's satisfaction and improve operational performance	Between Groups	4.137	12	.345	0.732	.719
	Within Groups	87.116	185	.471		
	Total	91.253	197			

The influence of market and customer-oriented services, comparing with the positive influence of innovation activities and service department, is significant under the 95% confidence level. For example, there is significant discrepancy on increasing the items of service products or services range, entering new market or increase the market share, and increasing the quality of service products which influences the positive factors of innovation activities. From the cross-table analysis of descriptive analysis, we could

find that it is notable on influence of market and customer-oriented of positive factors influence of innovation activities, increasing the items of service products or services range and service department, especially there is a notable correlation between Customer Service Department and Food and Beverage Department.

Table 3. Market Affected by Positive Factors and Customer-Oriented and Service Department Analyzed by ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
The influence of market and customer-oriented in order to increase the items of service products or services range	Between Groups	8.508	12	.709	2.833	.001
	Within Groups	46.305	185	.250		
	Total	54.813	197			
The influence of market and customer-oriented in order to enter new market or increase the market share	Between Groups	7.005	12	.584	2.079	.020
	Within Groups	51.949	185	.281		
	Total	58.955	197			
The influence of market and customer-oriented in order to increase the quality of service products	Between Groups	7.830	12	.652	2.419	.006
	Within Groups	49.892	185	.270		
	Total	57.722	197			

From the cross-table analysis of descriptive analysis, we could find there is a notable correlation between the markets and customer-oriented of positive factors influence of innovation activities and increasing the items of service products or service department, especially there is a notable correlation between Customer Service Department and Food and Beverage Department. From the above analysis we could know the content of these two departments will encounter with customers at the first time in order to respond the customers-oriented. Thus, there is a notable correlation in the service innovation activities.

Table 4. Economic Factors Affected By Negative Factors And Service Department Analyzed By ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Economic factors, due to there is no relevant budget provided by the enterprise	Between Groups	5.370	12	.448	0.547	.882
	Within Groups	151.443	185	.819		
	Total	156.813	197			
Economic factors, due to the enterprises lack of sufficient financial resources	Between Groups	4.734	12	.395	0.510	.907
	Within Groups	143.245	185	.774		
	Total	147.980	197			
Economic factors, considered the innovative cost its too high	Between Groups	3.272	12	.273	0.427	.951
	Within Groups	118.046	185	.638		
	Total	121.318	197			

Comparing the economic factors of the negative impact level of service innovation activities and service department, there's no significant discrepancy under the 95% confidence level. For example: There is a little relation between economic factor and service department. According to the table above, no significant difference has been found in the enterprise didn't provide relevant budget, the enterprises lack of sufficient financial resources and the innovative cost is considered too high based on the service department.

Comparing the negative affected level of innovation activities of economic factors and average turnover, it's significant under the 95% confidence level. For example: There is a significant discrepancy in the enterprise didn't provide relevant budget, the enterprises lack of sufficient financial resources and the innovative cost is considered too high. Thus, it influences the negative factors of innovation activities.



Table 5. Economic Factors Affected by Negative Factors and Average Annual Turnover Analyzed by ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Economic factors, due to there is no relevant budget provided by the enterprise	Between Groups	33.957	3	11.319	17.874	.000
	Within Groups	122.856	194	.633		
	Total	156.813	197			
Economic factors, due to the enterprises lack of sufficient financial resources	Between Groups	57.507	3	19.169	41.104	.000
	Within Groups	90.473	194	.466		
	Total	147.980	197			
Economic factors, considered the innovative cost its too high	Between Groups	33.206	3	11.069	24.371	.000
	Within Groups	88.112	194	.454		
	Total	121.318	197			

Table 6. Economic Factors Affected by Negative Factors and Total Numbers of Employees Analyzed by ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Economic factors, due to there is no relevant budget provided by the enterprise	Between Groups	27.679	4	6.920	10.342	.000
	Within Groups	129.134	193	.669		
	Total	156.813	197			
Economic factors, due to the enterprises lack of sufficient financial resources	Between Groups	15.074	4	3.769	5.473	.000
	Within Groups	132.906	193	.689		
	Total	147.980	197			
Economic factors, considered the innovative cost its too high	Between Groups	14.504	4	3.626	6.552	.000
	Within Groups	106.814	193	.553		
	Total	121.318	197			

Comparing the negative affected level of innovation activities of economic factors and total numbers of employees, it's significant under the 95% confidence level. For example: There is a significant discrepancy in the enterprise didn't provide relevant budget, the enterprises lack of sufficient financial resources and the innovative cost is considered too high.

## Conclusions

Based on the analysis of the information from the questionnaires, this study acquired the results as follow.

1. Part of the motives of innovation activities will have discrepancy due to the internal characteristics of international tourist hotel or difference of business.

From the empirical studies by the research, we found the international tourist hotel often bring different motive of innovation activities due to the internal characteristics of international tourist hotel and different department activities. It shows that there is a direct and notable impact between different internal characteristics of international tourist hotel and different reason cause by the service department to the service innovation activities. It also shows that during the operation process of innovation activities of international tourist hotel, different department will bring different level of influences on service innovation activities due to the business function and have discrepancy between time and content of service innovation activities.

2. The positive factors influence of service innovation activities will have discrepancy due to the internal characteristics of international tourist hotel or difference of function.

From the empirical studies by the research, we found the positive factors of innovation activities which influence the international tourist hotel often bring different influence due to the internal characteristics of international tourist hotel and different department activities.

It shows that there is a direct and notable impact between different internal characteristics of international tourist hotel and different reason cause by the service department to the service innovation activities. It also shows that service innovation

activities of international tourist hotel will bring different level of influence to the innovation of service activities due to the different impact level, which is influenced by the market, customer, service orientation process and other factors.

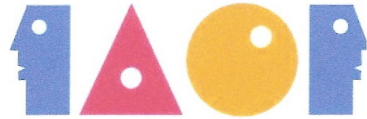
3. The negative factors influence of service innovation activities will have discrepancy due to the internal characteristics of international tourist hotel or difference of function.

From the empirical studies by the research, the negative factors which influence the service innovation activities of international tourist hotel often bring different influences due to the different internal characteristics of international tourist hotel and different department service. It shows that there is a direct and notable impact in negative factors from the influence to the service innovation activities, which is produced from different internal characteristics of international tourist hotel and department activities. It also shows that the service innovation activities of international tourist hotel will be affected by the factors such as economic, knowledge, market and no incentive for service, and it will bring different level of influences to the innovation of service activities due to the different impact level.

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## AIRLINE CODE-SHARING: A TRAP FOR TRAVELERS?

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### Abstract

This article examines the proposal that code-sharing agreement is a fraudulent practice that may hurt travelers. This article defines code-sharing, provides a brief history of the practice, examines current applicable law, and discusses the apparent benefits and drawbacks to both the airlines and travelers.

Keywords: Code-Sharing, Aviation, Travel, Tourist, Traveler, Airline, CRS

### Introduction

Over the past three decades, since deregulation of the airline industry, the practice of code-sharing has become widespread among both domestic and international carriers. Touted by the airlines as a tool that improves efficiency and benefits travelers through greater convenience and improved services, code-sharing is decried by many consumer advocates and others as inherently fraudulent. This article defines code-sharing, provides a brief history of the practice, examines current applicable law, and discusses the apparent benefits and drawbacks to both the airlines and consumers.

### *Defining Code-sharing*

Code-sharing is one of three major forms of cooperation and partnership between and among airline carriers that fall short of outright merger. The other forms are interline agreements and airline alliances. Interline agreements are relatively simple agreements related to cooperation on issues such as ticketing, connecting flights, and baggage transfers. Arising from code-sharing agreements, airline alliances involve much closer relationships in which a global network of carriers cooperate in cost reduction and revenue sharing short of mergers. Today's three major alliances (Star Alliance, SkyTeam, and OneWorld) include more than 40 of the largest airlines in the world and transport about 60% of air travelers globally (Grossman, 2007).

In its simplest form, code-sharing is a labeling practice and marketing strategy that allows the participating airline carriers to label and market a given flight as their own regardless of whether their plane, flight crew, and ground handling services are involved in the flight. Under such agreements, each of the carriers that are party to the agreement may place their own number or code on the flight and sell tickets to passengers even though the flight is operated by only one of the member carriers. For example, air travelers may see a list of three flights—AB123, CD 456, and EF789—as available for travel between cities X and Y departing at 8:00 a.m., and perhaps at different rates. Although travelers may purchase tickets for these flights from any of the three airlines (AB, CD, or EF), with a code-sharing agreement among the three, there is actually only one flight being flown from X to Y and only one of the airlines would actually supply the plane and operate the flight.

The “code” in code-sharing is a reference to the codes used to identify all commercial flights. Such codes are made up of two parts. The first of these is a two letter International Civil Aviation Organization (ICAO) designation established to identify the airline, and the second is the flight number assigned by the airline to identify the flight’s origin and destination (Hassin & Shy, 2004). Although code share agreements allow each participating carrier to sell tickets on flights operated by one of the other parties to the agreement, a common practice on domestic flights involves selling tickets for flights with one or more legs of the flight operated by regional commuter carriers under the code of a major airline.

#### *History of Code-sharing*

Although the first example of code-sharing agreement occurred in 1967 between what was then Allegheny Airlines (USAir) and a commuter airline (Sabar, 1998), the practice did not become prevalent until the mid-1980s following the 1978 deregulation of the domestic airline industry by the United States Congress (Bear, 2007; Hassin & Shy, 2004; Sabal 1998). The practice has grown dramatically in the decades since deregulation and includes both domestic and international flights.

Domestic agreements allow airlines to give the appearance of operating in markets where they have no actual physical presence by selling tickets under their codes in those markets without incurring the expense of additional aircraft and crews. Major airlines, for whom regional carriers have long served as passenger feeders, use code-sharing agreements with commuter carriers (perhaps several carriers) that serve in smaller markets to show flights from regional airports to the major airline hubs under the major airline’s code (Armantier & Richard, 2008). Similarly, international agreements

allow U.S. carriers to participate in markets to which they would otherwise have no access. To overcome the obstacles encountered as a result of “restrictions on entry in foreign markets (cabotage laws) [major U.S. airlines] have formed international alliances with foreign carriers that allow them to market flights within their partners’ domestic network” (Armantier & Richard, p. 876).

Low-cost carriers (LCCs) have also joined in the move toward participation in code-sharing agreements as competition increases and technology advances (Flottau, 2009; Ranson, 2006; Sobie, 2007). Long a role model for LCCs with their low cost business model, Southwest Airlines entered an agreement with ATA (no longer in business) in 2004 after decades of vowing it would never code-share (Flottau, 2009; Saber, 1998; Sobie, 2007) and is working toward more code-share agreements (Flottau, 2009).

### *Regulating Code-sharing*

Although code-sharing is legal in the United States following the 1978 federal deregulation of the airline industry, it would appear that regulation and enforcement has not kept pace with the dramatic growth and the variations in practices related to these agreements. A number of consumer advocates urge a more stringent regulatory system and regulations that address more specific aspects of code-sharing including those that involve liability issues.

Both the Department of Transportation and the Department of Justice play roles in regulating and monitoring code-sharing. The role of the Department of Transportation is largely related to issues of competition and that of the Department of Justice to anti-trust matters. There are also differences in oversight depending on whether the agreements are



international or domestic. Department of Transportation approval is required for code-share agreements with foreign carriers, but not for agreements that are wholly domestic unless it appears that the agreement is anti-competitive in nature (Bear, 2007).

Since 1989, the Antitrust Division of the U.S. Department of Justice has had the authority to review and “challenge in court if necessary, mergers, acquisitions, and intercarrier agreements concerning domestic air transportation (Bingaman, 1996). In a 1996 speech to the American Bar Association, Anne Bingaman, Assistant Attorney General with the Division, noted that although antitrust laws apply to all domestic code-sharing agreements, most existing agreements have not drawn objections from the Department of Justice because the agreements are “precompetitive and pro-consumer and do not violate U.S. antitrust laws”. Without “a grant of express statutory antitrust immunity by the Department of Transportation (Bingaman, 1996), the same antitrust laws also apply to international code-sharing agreements. However, determining how these international agreements effect competition requires consideration, as Bingaman subsequently noted, of the “sweeping antitrust immunity that has been granted to the International Air Transport Association (IATA) that permits otherwise competing airlines collectively to discuss and set passenger fares between the United States and foreign destinations.” Granting this antitrust immunity to the international airline partnerships has been the major response from regulatory authorities to airline consolidations and remains one of the most controversial issues in competition policy (Bilotkach, p. 428).

Antitrust issues may be influenced by the Supreme Court’s *Dagher* decision overturning a Ninth Circuit decision in regard to a Texaco-Shell pricing arrangement. Piraino notes that “The *Dagher* decision included broad dicta that may form the basis for

an entirely new way of analyzing the legality of joint ventures themselves and of the various types of competitive conduct pursued by joint ventures and their partners” (Piraino, p. 737). Essentially, the Court unanimously ruled that the partners were operating as a single entity and thus were not party to joint venture price-fixing. Justice Thomas wrote the Court’s decision concluding that it was not per se illegal for the Shell-Texaco joint venture to set the prices for its products... [and stating]:

that when ‘persons who would otherwise be competitors pool their capital and share the risks of loss as well as the opportunities for profit . . . such joint ventures [are] regarded as a single firm competing with other sellers in the market’. Thus, the alleged price fixing by Shell and Texaco was in fact ‘little more than price setting by a single entity . . . and not a pricing agreement between competing entities with respect to their competing products’. (Piraino, p.749-750)

Code-sharing law requires that consumers be clearly informed when they purchase, or consider purchasing, a ticket for a flight that involves a code-sharing agreement and that the identity of the carrier operating the flight be disclosed (14 CFR Part 257). Specifically, “the holding out or sale of scheduled passenger air transportation involving a code-sharing arrangement or long-term wet lease is prohibited as unfair and deceptive in violation of 49 U.S.C. 41712 unless, in conjunction with such holding out or sale, carriers and ticket agents follow the requirements of this part (14 CFR §257.4).

These requirements include, in part, notice on written or electronic schedules, oral notice to prospective customers, and notice on the itinerary. Printed advertisements, including internet advertisements require prominent disclosure that travel with another carrier may be involved along with identification of all potential carriers in the market area; however, broadcast advertisements require only a generic statement that other airlines may provide some of the advertised services (14 CFR §257.5).

In his comments in response to the Department of Transportation's proposal to amend the regulations in 14 CFR §257 to require lesser detail in advertisements (a proposed amendment in response to a petition by United Airlines), Edward Hasbrouck, a travel expert, consumer advocate, and author of *The Practical Nomad*, urged the DOT to withdraw their proposal and to issue new regulations that forbid code-sharing unless the flight is truly a joint operation (Hasbrouck, p. 2). He expressed the view that code-sharing is an inherently fraudulent labeling practice that requires more stringent regulation and contended that:

Code-sharing is purely a labeling practice, and should be regulated by the DOT as such. The function of a label, and particularly of a label on a consumer product or service, is to communicate, and specifically to communicate to consumers the nature of the product or service offered for sale. The questions for the DOT...are thus: 1) Whether the nature of the advertised or ticketed service...is accurately described by code-share labeling; 2) Whether any benefits accrue to consumers...(independent of the interline agreements which could, and in many cases do, exist without code-sharing); and 3) Whether code-share labeling misleads consumers. (Hasbrouck, p. 4)

#### *For Better or Worse?*

There seems to be little middle ground when it comes to points of view on code-sharing. Depending on your perspective, it is either a blessing that provides travelers with greater convenience and better service or a curse that is inherently fraudulent and misleading to the consumers it purports to benefit. There are, however, both benefits and drawbacks to code-sharing agreements that must be weighed in any evaluation of the practice and whether, in the final analysis, it is advantageous or detrimental to consumers, the airline industry, and the economy of tourism.

A variety of studies on these issues have produced variable and sometimes conflicting results in terms of the effect ticket prices and traveling experiences or

consumer welfare (Bilotkach, 2007; Armantier & Richard, 2008). Some variation is a result of factors including whether the agreement is domestic or international, the number of legs of the flight, whether flights are within complementary (overlapping partner networks) or parallel (no overlap) agreements (Bilotkach, 2007), the presence or absence of antitrust immunity, data collection and evaluation methods, specific features of individual agreements, and a number of consumer welfare perceptions related to characteristics of the flight experience (Armantier & Richard, 2008) such as flight duration, departure time, and time spent in intermediate airports. Such an extensive set of variable increases the challenge of developing and conducting scientifically valid studies that produce objective, comprehensive data and results that are reproducible and generalizable to markets and agreements beyond those included in the study. Armantier and Richard found that:

policy reviews of code-share agreements (i) should place a greater emphasis on changes in product attributes other than price, and (ii) should consider the impact of the alliances in markets other than those in which they will be implemented. [And that there are]...key distinctive features of ... [newer forms] of domestic code-share alliances, as compared to previous regional and international code-share alliances. The latter benefitted consumers by opening new markets and by eliminating the need [for] tickets purchased from different airlines... In contrast, [new domestic agreements] ...opened few new markets. p. 900

### *Benefits of Code-Sharing*

For the airlines, code-sharing would appear to be a win-win situation. These agreements allow airlines to give the appearance of serving a larger market, increase the visibility of their airline and promote brand loyalty by placing their name and logo on more flights, promote revenue increases without a corresponding increase in expense (selling tickets for flights they do not operate), and market their services as more

convenient and seamless. Due to the nature of computerized reservation systems (CRS), these agreements also benefit airlines by providing the opportunity for increased sales as a result of a higher position in the listing of available flights on the CRS used by many travel agents. These systems list single-ticket flights (even though code-sharing masks the true connecting nature of the flight in terms of CRS usage) in a higher position than connecting flights ticketed by more than one airline. Those searching the CRS for available flight may not continue to find the honestly listed connecting and often cheaper flights. This CRS bias is increased in some instances by duplicate listings in the CRS (one for each of the partner airlines using their code on the flight).

Not surprisingly, airline executives tout code-sharing as providing significant benefits to air travelers by serving to “improve coordination between connecting flights, streamline baggage transfers and offer the convenience of a single ticket for multiple flights [and often allow] passengers to collect frequent flier credits on one carrier and use them for...a partner” (Bear, 2007). Further, they believe consumers are benefited through the opening of new markets and improvements in service on existing flights.

#### *Drawbacks of Code-Sharing*

Consumer advocates and others often do not share the positive view the airlines project. They find the practice of code-sharing, particularly listing a flight under the code and name of an airline carrier that supplies neither the plane nor the crew and has no other level of participation in the operation of the flight, to be inherently fraudulent and unnecessarily misleading to consumers. Though one can certainly argue the benefits and convenience in the coordination of connecting flights and baggage transfer, travel expert and consumer advocate Edward Hasbrouck (Hasbrouck, 2006) argues that code-sharing

agreements are not necessary to accomplish either. He insists that interline agreements in effect even prior to the proliferation of code-sharing agreements allow airlines to accomplish both without misleading travelers with the impression that all legs of a flight are operated by a single carrier when that is not the case.

Despite claims by both the airlines and the Department of Justice that current regulations require sufficient and clear notification to consumers regarding the code-sharing nature of a flight and the true operator of a flight, travelers often remain confused and may have difficulty in determining the correct gate for boarding or locating the appropriate baggage claim area. As Hasbrouck points out, regardless of whether or not a traveler has an itinerary, a document on which notification is required:

tickets and boarding passes—the things travelers are required to have in hand while searching for a flight or gate...—do not. Indeed, IATA and airline rules provide no field on a ticket or boarding pass for the designation of the operating airline, and forbid the entry of other information in those fields. A travel agent who wants to indicate on a ticket which airline actually operates a code-share flight is forbidden from doing so by airline ticket issuance rules and procedures. (Hasbrouck, 2006, p. 5)

Additional problems with code-sharing include the aforementioned CRS bias, price deception including differences in cost for the same flight advertised by participating carriers, incomplete information for travelers in terms of available seats and other flights to the same destination, and more importantly, safety concerns and jurisdictional and liability confusion when things go wrong. Issues of price deception can be seen in a variety of circumstances and can also be related to the inability of consumers to get complete information from airline representatives. Two partners in a code-sharing agreement may list the same flight at different prices, although it would not be immediately obvious to the average traveler that the two flights were one and the same.

And despite claims by the airlines that code-sharing results in lower costs, even “figures from the Air Transport Association, the airlines’ own lobbying organization, show that the average revenue per passenger mile (i.e. the ticket price) for major USA-based airlines is substantially higher on their (protected) domestic routes within the USA than it is for those same airlines on international routes (where they might have to compete with foreign airlines) (Hasbrouck, 2006).” Further, and even though it doesn’t take an economist to surmise that the fewer the number of flights available for a particular destination the greater the likelihood of higher ticket prices, various studies within the US “have shown that airfares between any two cities since airline ‘deregulation’ in 1978 are an inverse function of the number of airlines offering service between those cities” (Hasbrouck, 2006).

Hasbrouck pointed out that although the best routes for a number of destinations may involve flights on more than one airline other than those partnered in a code-sharing agreement and marketing each others’ services, travelers will not learn of those routes from the airlines since they will only provide information about their own flights and those of their marketing partners. As an example, he used the flight of many teams on the popular television show, “The Amazing Race”, from Mexico City to London via Paris.

Unlikely to have been the route that ...

would get them to London the soonest...it’s the route that would have been suggested by the staff at Aeromexico, since Aeromexico is a partner in the Skyteam marketing alliance with Air France. This is exactly what airline alliances are designed to do for the airlines, and why they are bad for travelers. The racers were steered to the fastest route on a Skyteam marketing partner, rather than the fastest route on any airline. (Hasbrouck, 2006)

When things go wrong, who is responsible—the airline from which the ticket was purchased or the airline actually operating the flight? Where does liability fall for

delayed, lost, or damaged luggage? Or for injuries or deaths resulting from an airline crash? Even though luggage issues can be frustrating and inconvenient, issues of safety and well-being are obviously of much greater significance. Travelers may book a flight under the name of a major airline with which they are familiar and have trust in its solid safety record. But when the major airline has placed its name on a flight operated by a partner commuter airline, consumers may have no idea of the safety standards and record for the carrier actually operating the flight. It is typical for commuter airlines to employ pilots that are younger and less-experienced and to pay them a lower salary than those of the major airlines. The propeller planes used by most of these carriers are not only louder, slower, and more likely to be delayed or cancelled, but more prone to accidents than jets despite recently improved safety records (Sabar, 1998).

In the courtroom following the 1994 crash of an American Eagle flight that resulted in multiple fatalities, “American Airlines did all it could to distance itself [from] its commuter affiliate” (Sabar, 1998) and denied any responsibility as did the corporate entity, AMR Eagle, that oversees American Eagle flights. And the flight itself was actually operated by a small company called Flagship airlines—not American Airlines, AMR Eagle, or American Eagle. Similar issues came to the surface following a 2009 crash near Buffalo of Continental Connection Flight 3407 that resulted in 49 deaths. The National Transportation Safety Board (NTSB) cited pilot error as the cause of the crash. Their investigation resulted in 46 recommendations and plans to initiate further inquiry into code-sharing practices by holding a public symposium and by examining both government oversight and financial aspects of code-sharing relationships (Freeman, 2010).



In terms of solving baggage problems, the DOT's approval of international code-share agreements specify that the carrier issuing the ticket is responsible, but the issue is not regulated by the DOT on domestic agreements (Engle, 2004). Resolution on domestic flights may be based on contract law, details specified in the agreement between the carriers, and industry practice. A DOT spokesperson indicated that "the usual industry practice is to have the final carrier in the traveler's itinerary deal with" (Engle, 2004) delayed, lost, or damaged luggage, but there is no standard practice for addressing missed connections. The DOT does, however, prohibit domestic carriers from attempting to exclude themselves from responsibility for baggage and expensive items in checked baggage by publishing exclusionary tariff provisions. Samuel Podberesky, Assistant General Counsel for Aviation Enforcement and Proceedings in the DOT, informed carriers in a Federal Register notice that "the Aviation Enforcement Office will consider ... tariff provisions ... involving exclusionary baggage provisions to be of no effect and in violation of the Convention [Montreal Convention, Articles 17 and 19] and those involving code share relationships to be in violation of pertinent Department approvals of those codeshare services. The tariffs and their application, and similar practices, in the view of the Aviation Enforcement Office, also constitute unfair or deceptive business practices and unfair methods of competition in violation of 49 U.S.C. 41712" (Podberesky, 2009).

### Summary

Despite the many benefits code-sharing agreements provide for participating airlines, the potential for harm to consumers is undeniable. Even though there are at least some regulations requiring carriers to notify consumers of the nature of a code-share

flight, the average consumer can easily be misled as to which carrier is in fact operating the flight. This raises not only issues of deceptive advertising, but more important issues of passenger safety. Travelers who are unaware of the actual operating carrier are deprived of the choice of determining whether they sufficiently trust the carrier or to gather information regarding the carrier in order to make an informed decision.

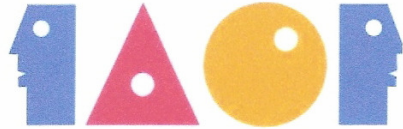
Since airlines could provide the same benefits they claim for passengers—improved coordination of connecting flights, streamlined baggage transfer—through existing interline agreements that do not involve code-sharing and its inherently misleading labeling practice, it could appear that the airlines knowingly subject consumers to deception in order to build their brand and give the impression that they serve a larger market than they actually do. Improved monitoring and enforcement of existing regulations by the DOT and the development of additional regulations in terms of carrier liability are essential to better serve air travelers if code-sharing agreements continue to be upheld as legal practices.

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STUDY ON THE IMPACTS OF EXPERIENTIAL MARKETING  
AND CUSTOMERS' SATISFACTION BASED ON  
RELATIONSHIP QUALITY

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Abstract

As the competition in the present marketing is hotter and hotter and purchasing power is gradually rising customers are not only satisfied with the perfect product provided by companies. One more significant thing for customers is the perfect consumer experience offered by companies (Turner, 2001).

This paper makes use of relationship quality as the disturbance variable and makes research on the impacts of experiential marketing on customers' satisfaction. The study object is customers of Costco Wholesale Corporation and the data collection method used here is questionnaire. (Questionnaires are recovered then used SPSS 14.0 to factor analysis, reliability & validity analysis, hierarchical regression analysis respectively).

Hoping the results and findings of the research will be helpful to companies in the application of experiential marketing.

Keywords: Experience marketing, Relationship quality, Customers' satisfaction.

## Introduction

As it is pointed by Pine & Gilmore (1999), economic development is entering into a new stage experience arena, which surpasses the traditional sales methods focusing on product sales and service offering. The new revised well-design stage experience shortens the distance between customers and products so that a close relationship is to be established and customers have a memorable impression. Traditionally, Market Share is the significant factor on the determination of success or failure of products. Nowadays, the determination factor highlights attitude-shown Mind Share, where the product must present. Mind Share rate gradually becomes not only the key determination point in product sales, but also the new direction which brand marketing should pay attention to (Liu Wei-gong, 2007). Mind Share is the support degree that the spiritual appeal gets from customers. Mind refers to the attitude towards products, living philosophy or value.

Experiential marketing is a kind of face-to-face communication method, which mainly raises customers' physical and emotional feelings (Urquhart Ross, 2002) so that customers expect to be relevant and interactive to some brands and to feel and experience wholehearted (Robin, 2001). The researches on TV ads and many marketing methods show that more and more ads no longer stress on product functions. Instead, ads stress on customers emotion experience, such as, the ads of National Electronics adopt comfortable marketing methods offering emotional experience to customers and action experience by way of installment. Ellwood points that the transfer of the present world economic model causes the great change in the content and level of customers' needs (Ellwood 2000). The traditional inner implicit rational needs become outer apparent emotional needs and sublimate to experience level now.

## Literature Review

The essay first researches the variable basic dimension include experiential marketing, brand equity, customers' satisfaction and so on. Secondly, the relationship among variables is discussed and then the research assumption of the essay is introduced.

### *Experiential Marketing*

Schmitt (1999) points that the experiential marketing architecture is divided into 2 parts: strategic experiential modules (SEMs). The five strategic experiential models proposed by Schmitt create different experiential forms for customers (Schmitt, 1999).

As the basis of the marketing, the details are as follow:

(1) Sensory experience: the sensory experience of customers towards experiential media includes visual, auditory, olfactory and tactile response results. (2) Emotional experience: the inner emotion and sense of customers raised by experience media. (3) Thinking experience: customers' thoughts on the surprise and enlightenment provoked by experience media. (4) Action experience: by experience media, customers are linked so that they can acquire social identity and belonging sense. (5) Related experience for customers through the experience of media production links, and to social recognition or a social belongs.

Experiential marketing is consisted of five strategic models which are sensory, emotion, thinking, action and relevance. The research is based on the evaluation items of experiential marketing and uses these five experiential models as variable evaluation dimensions.

### *Relationship Quality*

Relationship quality makes reference on Smith's method (1998), which is consisted of satisfaction, trust and commitment dimensions. The strong and weakness of relationship quality have influence on the attitude adopted by customers. If good relationship quality may reduce the uncertainty and have influence on the expectation of future lasting interaction (Crosby, Evans and cowls, 1990), thus, it is known that the strong and weakness of relationship quality will influence customers cognitive value. As relationship quality is the accumulation cognitive value towards every specific event, therefore, relationship quality will influence customer's satisfaction. Wray et al. (1994), Bejou et al. (1996) all agree that relationship quality is consisted of at least two dimensions, trust and satisfaction dimensions. Though Storbacka, Strandvid & Gronroos (1994) do not define relationship quality directly, their model proposes that relationship quality involves four factors which are customers' satisfaction, relationship strength, relationship lifespan and relationship acquire power. Besides, Kumar, Scheer, and Steenkamp (1995) hold that relationship quality among enterprises reflects that trust, commitment and conflicts expects on lasting and investment will. Roberts, Varki, and Brodie (2003) hold that relationship quality among service providers and in which should include trust, satisfaction and emotion commitment.

#### *Customers' Satisfaction*

Fornell points that customers' satisfaction is customers' overall evaluation towards the whole buying experience on products and service (Fornell, 1992). The overall purchasing experience is the measure and evaluation basis for customers' satisfaction. Hempel defines that customers' satisfaction depends on realization degree of expected product advantages. This reflects on the degree of consistency between



expectation and actual results (Hempel, 1997). Miller holds that satisfaction is caused by interaction between customers' expectation degree and recognition effects. He holds that expectation and ideal are both the standards for product performance and are used to evaluate the degree of product actual performance which leads to satisfaction and dissatisfaction (Miller, 1997). Oliver holds that satisfaction is an emotional statement, which is the response towards products and service (Oliver, 1981). Lai Rong-zong holds that four variables are used for evaluate customer's satisfaction evaluation, product quality, staff quality, service content and real entity so that one can know customers' satisfaction (Lai Rong-zong, 2000). The essay also uses these four variables as evaluation items to customers' satisfaction evaluation dimensions.

#### *Relationship Between Experiential Marketing and Customers' Satisfaction*

In 2003, Yuan Yi-hua (2003) discusses that the research on experiential marketing, experiential value and customers' satisfaction is made on the study of three companies which are Eslite Bookstore, Starbucks Coffee and IKEA, where experiential marketing works well. The research results show that these three companies use emotion value by the method of emotion sensation to influence customers' satisfaction, service quality by the method of emotion value to influence customers' satisfaction, service quality by the method of function value to influence customers' satisfaction as well as by emotion function and function value to influence customers' satisfaction. In Fan Wen-jia's (2003) paper "Study on the Relationship between Customer participation, Emotion experience and Customer Satisfaction - Case Study on Starbucks Coffee", the essay makes research on the trilateral relationship among customers' involvement, emotion experience and customers' satisfaction (Fan Wen-jia, 2003). One of the research results is

that there is positive relationship between emotion experience and customers' satisfaction. Thus, the experience on experiential marketing does improve customers' satisfaction on consumption. Thus, with the combination of the above, the research gets the following assumption:

*Hypothesis 1(H1) : Experiential marketing has significantly positive effect on customers' satisfaction.*

#### *Relationship Between Relationship Quality and Experimental Marketing*

Aaker and Joachimsthaler (2000) consider that relationship quality is helpful for creation and enhancement of experiential marketing. Petromilli and Michalczyk (1999) hold that by way of different kinds of behavioral interaction, every customer forges experiential marketing. Meanwhile, relationship quality will enhance experiential marketing. Gao Ming-yi (2004) discusses the relationship between experiential marketing and relationship quality. The results show that there is obvious positive relationship between experiential marketing dimensions (which are sensory, emotion, thinking, action and relevance) and relationship quality. Wang Fang-cen (2003) finds out that sensory experience positively relates to trust of customers. Ho Yung-ching, etc. (2004) hold that sensory experience, emotion experience, thinking experience, action experience, relevance experience and customer trust, emotion commitment are positively related. Thus, with the combination of the above, the research gets the following assumption:

*Hypothesis 2 (H2) : Relationship quality has significantly positive effect on experiential marketing.*

#### *Relationship between Relationship Quality and Customers' Satisfaction*

Crosby et al. (1990) point out relationship quality has obvious influence on future interaction expectation in article “Relationship Quality in Services Selling: An Interpersonal Influence Perspective”. Kumar et al. (1995) said that relationship quality is a kind of high level concept. This concept implies that good relationship quality may reduce conflict between customers and enterprises, improve customers’ trust and commitment on the enterprises and boost willingness on continuous trade and investment. On the satisfaction dimension of customers, the so-called continuing trade is a kind of action satisfaction. Besides in, in his article “Research on Relationship between Relationship quality and Loyalty - Case Study on ADSL Customers of Chung hwa Telecom”, Chen Kang-zhuang (2003) made research on ADSL Customers of Chung hwa Telecom and adopts four dimensions, including professional knowledge, relationship sales behavior, net quality and service recovery as influence factors of relationship quality. The essay further discusses the influence of relationship quality on satisfaction of customers. The research results show that relationship quality is apparently positively related to satisfaction of customers. Thus, with the combination of the above, the research gets the following assumption:

*Hypothesis 3 (H3) : Relationship quality has significantly positive effect on customers’ satisfaction.*

*Whether Relationship Quality Has Apparent Interferences On Experiential Marketing On Satisfaction Of Customers.*

The purpose of the research is to study experiential influences on customers’ satisfaction, and whether relationship quality is the cause. Thus, the assumption of the research is as followings:

*Hypothesis 4 (H4) : Relationship quality has a moderation effect on the experiential marketing effects to the satisfaction of customers.*

Methodology

*Research Frame*

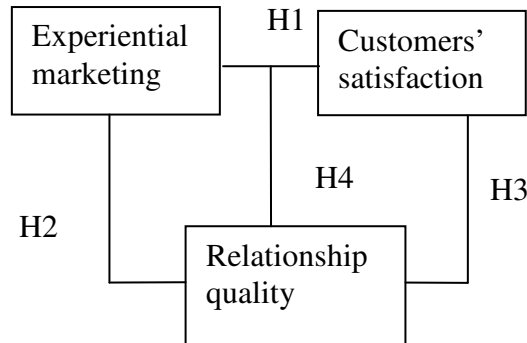


Figure 1. Research Design

(1). Research sample

By the method of random selection of samples, the research makes uses of on-spot distribution and collection of questionnaires. The sample focuses on Kobayashi Optical city authority, service industry personnel and customers. Totally 500 pieces of questionnaires have been distributed focusing on 100 companies. After elimination the repeat-counting, closed and relocated companies, there are totally 285 pieces of responsive questionnaires, among which 30 pieces are not fully completed. Thus, there are 255 pieces of valid questionnaires, valid responsive rate is 51%, who will fill in the experiential marketing questionnaires.

Each piece of fill-in questionnaire represents valid samples of agreed experiential marketing, which is consisted of Kobayashi Optical city authority, service industry personnel and customers. Thus, it is in line with the research, whose study purpose is to

discuss experiential marketing influence on customers' satisfaction based on relationship quality.

## (2). Development of Research Tools

This research uses questionnaire method. Questionnaire make as a research tool to be collect data. Questionnaires source from reference information are revised as fitting this one. The contents are made up for five parts, assessed by a 6-point Likert scale and it is anonymous. The interviewees choose from 'strongly agree', 'agree', 'agree somewhat', 'disagree somewhat', 'disagree' and 'strongly disagree'. In the six items, the scores are 6 points for 'strongly agree' and 1 point for 'strongly disagree', and so forth.

## 3. Experiential Marketing Scale

The scale is proposed based on the dimensions and questionnaires put forward by Zhao Bi-xiao. After analysis on factors, question entities are made up of five dimensions .Individual dimensions' Cronbach  $\alpha$  reliability is: 0.88 (sensory), 0.82 (emotion), 0.84 (thinking), 0.78 (action), and 0.76 (relevance).The research uses answers of sample questionnaires as the main factors, which are to be analyzed as main factors. After oblique rotation, 90% amount of explainable variability is to be released. The factors analysis is shown in Table 3-1.

## 4. Relationship Quality Scale

The scale mainly focuses on five-question entities. These five questions are mainly based on related questionnaires proposed by Tung in 1982. From the analysis on factors, this measure table gets the result that the amount of explainable variance is 88%, the reliability coefficient Cronbach  $\alpha$  is 0.80.

Table 3-1. Experiential Marketing Scale

Question items	Factor loadings	Eigen value	Explained variance %	Accumulate variance %	Cronbach $\alpha$
Experience provider	0.902	3.541	33.842	33.842	0.88
Reaction results	0.886				
Individual intrinsic	0.833				
Media touch	0.802				
Stimulate trigger	0.886	2.314	22.468	56.31	0.82
Edification thinking	0.861				
Surprise message	0.842				
Body Action	0.811				
Lifestyle	0.834	1.861	15.438	71.748	0.84
Personal life	0.816				
Style changes	0.791				
Affected individuals	0.773				
Create link	0.875	1.164	10.667	82.415	0.78
Social Recognition	0.802				
Sense of belonging	0.766				
Individual touch	0.783	0.982	8.120	90.535	0.76
Affection & emotion	0.753				
Intrinsic emotion	0.722				

Table 3-2. Relationship Quality Scale

	Average	Standard deviation	Analysis each number
Expected sustain interaction	3.62	1.264	742
Affect perceived customer value	3.78	1.259	742
Cumulative particular event perceived value	3.70	1.261	742
Maintaining expectations of trust, commitment & conflict	3.66	1.259	742
Trust, satisfaction & affective commitment	3.74	1.246	742
Total average	3.70		
Total explained variation	88%		
Cronbach $\alpha$	80%		

## 5. Customers' Satisfaction Scale

The scale is divided into product quality, staff qualities, service content, entities present, which mainly based on relationship dimensions and questionnaires proposed by Li Min-Jae in 1993. From the analysis on factors, this measure table gets the result that the amount of explainable variability is 78%, the reliability coefficient Cronbach  $\alpha$  is 0.86.

## Conclusion and Hypothesis Test

### *1. Hypothesis 1: Positive Relates between Experiential Marketing and Customers Satisfaction.*

As is shown in Table 4-1, the five dimensions of experiential marketing is positive related to the four factor dimensions of customers' satisfaction. Thus, H1 assumption is supported.

After the discussion on the reference and with the empirical study by way of questionnaire, the relevance among experiential marketing dimension, relationship

quality dimension, customers' satisfaction dimension is known. The research result shows that experiential marketing emotion has positive relevance with four dimensions, customers' satisfaction on products, staff quality, service content and entities present ( 0.175\* 、 0.182\*\* 、 0.188\*\* 、 0.164\* ) (\* behind numbers means obvious relevance, the more \*, the more obvious).The sensory of experiential marketing has positive relevance with the four dimensions of customers' satisfaction which are products quality, staff quality, service content and entities present ( 0.136\* 、 0.125\* 、 0.144\*\* 、 0.129\* ). The thinking of experiential marketing has positive relevance with the four dimensions of customers' satisfaction which are product quality, staff quality, service content and entities present ( 0.222\*\* 、 0.174\* 、 0.233\*\* 、 0.216\*\* ) . The action of experiential marketing has positive relevance with the four dimensions of customers' satisfaction which are product quality, staff quality, service content and entities present ( 0.211\*\* 、 0.213\*\* 、 0.199\*\* 、 0.204\*\* ) .The sensory of experiential marketing has positive relevance with the four dimensions of customers' satisfaction which are product quality, staff quality, service content and entities present ( 0.183\*\* 、 0.192\*\* 、 0.186\*\* 、 0.201\*\* ) . Thus, experiential marketing has positive relevance influence on satisfaction of customers. The point is that products and service can create the whole experience, by the method of senses and influential, creative relevance experience. And the consumption process has influence on satisfaction of customers. Therefore, experiential marketing has positive relevance on satisfaction of customers.



*Hypothesis 2: Positive Relevance between Relationship Quality and Experiential Marketing*

As is shown in Table 4-1, Relationship quality is positive related to the five dimensions of experiential marketing(0.188\*\*、0.152\*、0.226\*\*、0.202\*\*、0.177\*). Thus, H2 assumption is supported.

On the relationship quality and experiential marketing perspectives, relationship quality has positive relevance with five dimensions which include emotion, sensory, thinking, action and relevance (0.188\*\*、0.152\*、0.226\*\*、0.202\*\*、0.177\*). Each customer forges experiential marketing by way of different kinds of action experience so that customers have the sense of relationship quality and loyalty. Therefore, relationship quality will enhance experiential marketing. Thus, relationship quality is positive related to experiential marketing.

*Hypothesis 3: Positive Relevance between Relationship Quality and Customers' Satisfaction*

Relationship quality is positive related to customers' satisfaction (0.303\*\*、0.312\*\*、0.306\*\*、0.316\*\*). Thus, H3 assumption is supported.

On the relationship quality and customers' satisfaction perspectives, relationship quality has apparently positive relevance with the four dimensions of customers' satisfaction which include staff quality, service content and entity present (0.303\*\*、0.312\*\*、0.306\*\*、0.316\*\*). Relationship quality is a high-level concept, which implies that better relationship quality may reduce the conflicts between costumers and enterprises, improve customers trust and commitment on emprises and enhance the will of lasting trade and investment. Assuming that customers have low quality

recognition towards a specific event, but customers may have comparatively high relationship quality. This is because that the satisfaction in the relationship is accumulated satisfaction on many specific events and the dissatisfaction on one specific things will not cut down the relationship. Hypothesis 4: The Compromise Effects of Relationship Quality on Experiential Marketing and Customers' Satisfaction

*H4.a: Relationship quality will enhance emotion dimension, which has positive relevance respectively with product quality, staff quality, service contents and entities present.*

In all the samples forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is (3.529 、 4.587 、 3.221 、 2.983). In the satisfaction forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 2.438 、 3.426 、 3.581 、 2.119). In the trust forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 1.324 、 2.283 、 1.756 、 1.447 ) . In the commitment forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 2.416 、 2.732 、 1.192 、 1.233 ) . Thus, in the satisfaction model, t values of emotion dimension and service contents are higher than the whole samples t value. Therefore, the assumption of H4.a is partly supported.

*H4.b: Relationship quality will enhance sensory dimension and has positive relevance respectively with product quality, staff quality, service content and entities present.*

In all the samples forms, t value which sensory dimension has respectively on product quality, staff quality, service content and entities present is

Table 4-1. Pearson's Correlation Analysis of Variables

	Emotion	Sensory	Thinking	Action	Relevance	Relationship quality
Emotion dimension	1	0.196**	-0.022	-0.123*	0.018	0.188**
P value		0.000	0.334	0.014	0.582	0.000
Sample amount	255	255	255	255	255	255
Sensory dimension	0.152*	1	-0.036	-0.106*	-0.033	0.152*
P value	0.000		0.028	0.000	0.185	0.002
Sample amount	255	255	255	255	255	255
Thinking dimension	-0.016	-0.017	1	-0.038	0.033	0.226**
P value	0.134	0.055		0.325	0.284	0.000
Sample amount	255	255	255	255	255	255
Action dimension	-0.022	-0.264**	0.42	1	0.036	0.202**
P value	0.002	0.000	0.224		0.622	0.000
Sample amount	255	255	255	255	255	255
Relevance dimension	0.028	-0.042	0.072	0.002	1	0.177*
P value	0.122	0.076	0.014	0.486		0.001
Sample amount	255	255	255	255	255	255
Relationship quality	0.188**	0.152*	0.226**	0.202**	0.177*	1
P value	0.000	0.002	0.000	0.000	0.001	
Sample amount	255	255	255	255	255	255
Product quality	0.175*	0.136*	0.222**	0.211**	0.183**	0.303**
P value	0.012	0.044	0.000	0.000	0.000	0.000
Sample amount	255	255	255	255	255	255
Staff qualities	0.182**	0.125*	0.174*	0.213**	0.192**	0.312**
P value	0.000	0.038	0.018	0.000	0.000	0.000
Sample amount	255	255	255	255	255	255
Staff qualities	0.188**	0.144*	0.233**	0.199**	0.186**	0.306**
P value	0.000	0.033	0.000	0.000	0.000	0.000
Sample amount	255	255	255	255	255	255
Entities present	0.164*	0.129*	0.216**	0.204**	0.201**	0.316**
P value	0.022	0.042	0.000	0.000	0.000	0.000
Sample amount	255	255	255	255	255	255

( 2.733 、 3.334 、 3.529 、 2.638 ) . In the satisfaction forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 1.694 、 1.362 、 2.112 、 1.360 ) . In the trust forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 1.283 、 1.425 、 2.037 、 1.627 ) . In the commitment forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 1.114 、 1.329 、 1.5289 、 1.073 ) . Thus, It is seen that in forms of satisfaction, trust, commitment and management training, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is lower than the whole samples t value. Therefore, the assumption of H4.b is not supported.

*H4.c: Relationship quality will enhance thinking dimension and has positive relevance respectively with product quality, staff quality, service content and entities present.*

In all the samples forms, t value which thinking dimension has respectively on product quality, staff quality, service content and entities present is ( 1.628 、 2.042 、 1.533 、 1.729 ) . In the satisfaction forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 0.981 、 1.028 、 0.267 、 0.314 ) . In the trust forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 0.762 、 0.991 、 0.138 、 0.306 ) . In the commitment forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 0.866 、 1.035 、 0.522 、 0.537 ) . Thus, It is seen that in forms of

satisfaction, trust, commitment and management training, t value which thinking dimension has respectively on product quality, staff quality, service content and entities present is lower than the whole samples t value. Therefore, the assumption of H4.c is not supported.

*H4.d: Relationship quality will enhance action dimension and has positive relevance respectively with product quality, staff quality, service content and entities present.*

In all the samples forms, t value which action dimension has respectively on product quality, staff quality, service content and entities present is ( 10.683 、 11.446 、 10.469 、 12.383 ) . In the satisfaction forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 8.468 、 7.339 、 8.615 、 9.423 ) . In the trust forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 6.642 、 7.351 、 6.823 、 6.992 ) . In the commitment forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 7.353 、 8.426 、 7.571 、 7.534 ) . Thus, It is seen that in forms of satisfaction, trust, commitment and management training, t value which action dimension has respectively on product quality, staff quality, service content and entities present is lower than the whole samples t value. Therefore, the assumption of H4.d is not supported.

*H4.e: Relationship quality will enhance relevance dimension and has positive relevance respectively with product quality, staff quality, service content and entities present.*

In all the samples forms, t value which relevance dimension has respectively on product quality, staff quality, service content and entities present is ( 5.733 、 6.429 、 6.732 、 7.446 ) . In the satisfaction forms, t value which emotion

dimension has respectively on product quality, staff quality, service content and entities present is ( 3.323 、 2.549 、 3.018 、 2.507 ) . In the trust forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 3.420 、 3.008 、 2.182 、 3.407 ) . In the commitment forms, t value which emotion dimension has respectively on product quality, staff quality, service content and entities present is ( 2.883 、 2.963 、 2.877 、 2.915 ) . Thus, It is seen that in forms of satisfaction, trust, commitment and management training, t value which relevance dimension has respectively on product quality, staff quality, service content and entities present is lower than the whole samples t value. Therefore, the assumption of H4.e is not supported.

Among H4 assumptions, the research discusses on the whole samples are different with satisfaction, trust, commitment, and training management, especially on the multiple regression analysis. The results show that in the satisfaction form, apart from the enhancement on the positive relevance between emotion dimension of experiential marketing and service contents of customers' satisfaction (the original value is 3.221 and it is 3.581 in satisfaction form). The other four experiential marketing dimensions which are sensory, thinking, action and relevance are not influenced by satisfaction, trust and commitment. The reason may be that these four dimensions are over highly positive related with the four dimensions of customers' satisfaction, which are product quality, staff quality, service content and entities present.

#### Suggestions

Based on the above analysis results of the research, in order to fuse the findings of the research and the practice, the research extends several strategic meanings and

practical suggestions from the research findings. Hoping these research results may offer reference on practice and academy.

#### (1) Design of Expedient Marketing

The strong relevance between product brands and certain culture or image can be forged so that customers have the right recognition on the brand and think about the brand at anytime. Thus, enterprise should think about people, ethnics, culture of the target customers and how to make customers identify these ethnics or whether cultural groups should promote the establishment of brand groups. Besides, by the method of establishment of brand society or hold activities related with the brand image, the links between customers and brands can be effectively enhanced.

#### (2) Strategies of Experiential Marketing Implement

Experiential marketing do improve customers' loyalty. In the implement of experiential marketing strategies, it is necessary to think about whether the method can effectively improve customers' experiential value at the same time. Thus, it is can be used as the index for enterprises to introduce experiential marketing. Based on the research, customers have obvious value on sensory, emotion, thinking, action and relevance experience. Therefore, enterprises can more provoke customers' positive emotion feeling experience when making marketing plan.

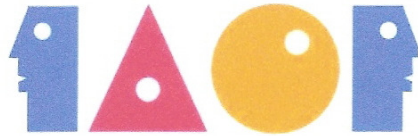
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## THE DETERMINANT FACTORS OF CHINA'S TRUCK PRODUCTION

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### Abstract

Since the announcement of the Chinese Government's "Automotive Industry Development Policy" in 1994, China's automobile market has become recognised as the fastest growing market with substantial global significance. In the year 2003, automobile production in China ranked number four in the world with production totalling 4.5 million vehicles and an annual growth rate of 34%. China's truck production, in particular, increased from 764,000 vehicles in the year 2000 to more than 1 million in 2002. This study proceeded the assumption that China's truck production is under the influence of both a "Planning Economy" and "Market Economy" and thus explores the factors influencing China's truck production for the period commencing in 1971 to 2001. The results indicate the existence of significant positive correlations between truck production in China and both its current GNP growth rate and time trend. Furthermore, the results reveal a significant negative correlation between truck production in China and the two variables: 'current average automobile price' and 'current number of automobile manufacturers'. Additionally, this paper discusses relevant industrial development policies and management strategies of manufacturers.

Keywords: China, Development Policy, Truck Production, Automotive Industry

### Introduction

Newly developing countries often nurture the automotive industry as a path to technological and economic development, because the automotive industry is capital-intensive, and has significant effects on related industries (Veloso & Soto, 2001). Capable

of creating numerous employment opportunities and increasing per capita GDP, the automotive industry has been called the industrial locomotive or engine. Among Asian countries, Taiwan and South Korea have been actively developing their automotive industries over the last 50 years approximately. China and Malaysia have also begun developing their own industries in recent decades (Hsiao, 1997; 2004). The Chinese government, from “self-development, self-reliance” in the period of planned economy to “introducing foreign capital, cooperative development” in the period of market-based economy, gave exclusive priority to the development of automobile industry, in particular, as one of the pillar industries in the so-called “Seventh Five-year plan” (1986-1990).

The Chinese government’s announcement of the “Automotive Industry Development Policy” in 1994, effectively categorized the automotive industry as a priority in relation to development at a national level. The aims of this policy mainly focused on the problems, so-called “*scattered about, mess, slowness, and poor*”, resulting from the laissez faire policy in 1980s. Moreover, this policy regulated foreign investment, tariff, and import. The impact of this policy was observable as early as 2003, where the total automobile production in China was 4.5 million vehicles, making it the fourth largest automobile producer, immediately behind the USA, Japan and Germany (IEK, 2004). Moreover, its growth rate was 34.2%, a figure ranking it the top in the world. Consequently, relevant studies on China’s automotive industry have gained increasing popularity. See for Hawit (1995), Rao et al (1999), Yeung and Chan (1999), Lewis (2003), Eun and Lee (2002), Wilson and Brennan (2003), Francois and Spinanger (2004), David (2006), Lee (2007), Stalley (2007). The strong emphasis the Chinese government

has placed on its automotive industry is further evidenced by the revision of the “Automotive Industry Development Policy” in 2004. Yet, this policy concerned on the internationalization of automotive industry, its local content technology, and a comprehensive consumption and recovery system, which effectively created a blueprint to transform China’s domestic automotive industry into a world-class automotive manufacturing base. As relevant studies focus on, for example, industrial environment and policy, competition, and market analysis using SWOT, case study or quantitative methods, there is little literature on factors identification for automotive production, in particular, truck production.

During the year 2000, China’s total automobile production amounted to 20.7 million vehicles, with a growth rate of 12.9%. Given China’s economic development, the truck production industry has become one of the essential drivers of economic growth. In the year 2000, truck production alone accounted for 764,000 vehicles, which constituted 36.9% of the total automobile production. Since then, China’s truck production has only continued to grow, exceeding 1 million vehicles in 2002. Due to its outstanding performance, China has occupied an instrumental role in terms of propelling development in the automobile industry on an international scale. Moreover, whilst China’s government is implementing its “Macroeconomic Control Policy”, including expanding national infrastructure, developing the western regions of China, and increasing domestic demand; truck manufacturing has emerged as a fast growing market (NIC, 2003). In particular, while the Chinese government focused on the development of heavily industry, the policy of automotive industry receives priority in developing trucks. The significance can be seen by a high production ratio of truck to car, 3.6:1.5 in 1992 (China automotive

industry yearbook, 2000).

Nevertheless, under the framework of the revised “Centralized Planning Economy” in China, truck production is heavily influenced by the forecast of market demand. In other words, the government considers both the automobile sales figures one or two years into the future; in conjunction with the current state of economic development to formulate a plan regarding truck manufacturing (CATRC, 2003). Therefore, the policy making and implementing, in particular in the automotive industry, the government plays a key role to plan automotive production and sales. This is obviously different from the principle of resources distribution in the basis of market economy. In addition, the Chinese government implements a so-called “instructing price”, delivering offerings at a price point to enable consumption. As the development of the automobile industry is strongly related to long-term national economic development, cross-sectional time series data must be considered in order to gain a better understanding of the long-term trend of truck production.

As China’s economy evolves towards operating as an open market, the central government’s focus will inevitably be on the impact of market mechanisms upon the development of China’s automotive industry (Harwit, 2001). Therefore, we believe that economic variables have critical influence on the progression of the automotive industry. In this study, cross-sectional time series data is used to observe fluctuations in China’s truck production. Specifically, this study gathers historical data spanning a period of more than 30 years. For this evaluation, the use of time series data from 1971 to 2001 is of crucial importance in ultimately constructing a model to identify factors which influence truck production in China.

The remaining sections are organized as follows: Section 2 describes the general characteristics of the automotive industry, while section 3 describes the development of China's automotive industry. Section 4 outlines the 'Centralized Planning Economic Theory' and the construction of a multiple regression model. Section 5 presents the results and finally section 6 presents a discussion of findings and conclusions.

### Characteristics of the Automotive Industry

The issue for concern is the potential influence economic variables have on truck production. Given that, in formulating possible explanatory variables, we have focused on characteristics distinctive to the automotive industry. The automotive industry has several unique features including demanding high-precision products and being both technologically-intensive and inextricably integrated. The study conducted by Jan and Hsiao (2004) suggests four general characteristics of the automotive industry: significance of economies of scale, high capital and technological entry barriers, strong inter-industry effects, and considerable contributions to the size of the labor market. Upon this foundation, this study endeavors to add two additional characteristics, which include high demand for product reliability and specialized division of industry. The six general characteristics are described as follows.

#### *Economies of Scale*

The automobile industry is associated with high fixed production costs, for example, building a factory and developing molds involves incurring high costs. Consequently, a small production scale results in extremely high average costs and thus average price. As the production scale increases, firms can take advantage of greater economies of scale. Therefore, the benefits derived from economies of scale can only be

realized when a firm is sufficiently large (Chen, 2000). The minimum requirement for achieving economies of scale for the national automobile industry is the production of 2 million vehicles. The economic scale for passenger cars is 250~300 thousand vehicles (IER & CAEA, 2008). Hsiao (1997) noted in his research, that in order to realize the minimum economies of scale, the production of a single model of truck needed to reach at least 100,000 vehicles.

For decades, the Chinese government implemented industry policies in association with market mechanisms. Thus, through centralized control, jointly reforming enterprises, strengthening industry concentration, developing capacity scale and nurturing key groups, three major automobile groups have emerged: China FAW Group Corp., SAIC Group and Dongfeng Motor Corp., as well as to another thirteen key automobile groups (Shia, 2002).

#### *High Capital and Technological Entry Barriers*

The automotive industry is both capital and technologically-intensive and therefore high fixed cost. Additionally, the automotive industry requires the manufacture of high precision, specialized products which utilize a diverse range of technologies. Therefore, continuous long-term study and development is necessary in order to accumulate the latest design and technology and thus carry out functions such as upgrading production capability or creating a new car model (Velooso & Soto, 2001). In regards to marketing, it is crucial to invest in numerous promotional activities, show rooms and maintenance sites. Due to the demanding nature of the automotive industry, requirements such as exorbitant amounts of capital expenditure and advanced technology combine to represent a considerable barrier to market entry.

### *Strong Inter-industry Effects*

Jan and Hsiao (2004) indicated that the automotive industry has strong inter-industry effects. The industries associated with the automobile industry include product and technology R&D, parts purchasing, car manufacturing, sales and service. These involve at least 100 industries. Studies indicate that for manufacturing one automobile the industry association coefficient is 2.67. In particular, the fluctuations in the automotive industry can motivate the upgrade of related industries, such as steel and mechanical industries. In China, the marginal output value for the upstream and downstream industries associated with the automobile industry is 2.64 (IER & CAEA, 2008). Thus it has a great influence on the economy as a whole.

In addition, the production value of the automotive industry itself is substantial. As an illustration, the total production value of the automotive industry alone was \$60 billion (USD) in the year 2001 (IEK, 2004). This significantly contributes to GDP and economic growth.

### *Significant Contributions to the Labor Market*

Since the automobile industry has a very large industrial scale and drives both its upstream and downstream industries, it not only provides significant direct job opportunities but also drives the creation of indirect job opportunities. Therefore, the automotive industry comprises a sizeable proportion of the labor market. In the major automobile production countries in the world, such as US, Japan and Germany, the number of jobs provided by the automobile industry and the associated industries accounts for 20% of the total labor market. The fact that China's automotive industry had accumulated 2,041 factories; employing 1.5 million people by the end of 2001



exemplifies this point. Furthermore, the above figures are not accounting for sales and after-sales maintenance personnel. In 2006, amongst China's working population, approximately one out six people was engaged in automobile related work (IER & CAEA, 2008)). Therefore, the automotive industry contributes significantly towards employment figures.

### *Specialised Division of Industry*

The automotive industry has an obvious need for specialization. The manufacture of a vehicle involves over 30,000 parts and 34 related industries due to the distinctive requirements of specialized labor combined with cost factors; most of the components for assembly are supplied by satellite factories. Consequently, a so-called "centre-satellite" system comprising of one factory at the centre and several component factories is formed (Dyer, 1994, 1996). For instance, the China Automobile Corporation has 73 component satellite factories. In a way, the automobile industry is an indicator of the manufacturing and science and technology level for a country. Furthermore, its development is closely related to the technology level for the associated industries.

### *High Demand for Product Reliability*

The nature of automobile use, that is to transport people at relatively high speeds, means a high level of safety and reliability is demanded of automobile manufacturers. This means that firms must continually invest in R&D. Therefore, consideration must be given to user safety and product reliability. Moreover, as the product has a life cycle of several years, there is a high demand for reliability of the product itself. As a result, many countries have a system mandating a certain standard of quality for automobile products, such as Ford's Q1 system in the USA and the JIS accreditation system in Japan. The

Chinese government in recent years implemented some strategies, for example, 'innovation and development of key technologies and new path of industrialization', aimed at bringing together the upgrade of automotive industry and therefore other industries. In 2004, the investment of R&D reached 2440 billions (RMB), with a growth rate of 26.13%, compared to the 380 billions in 1998.

### *The Growth of China's Automotive Industry*

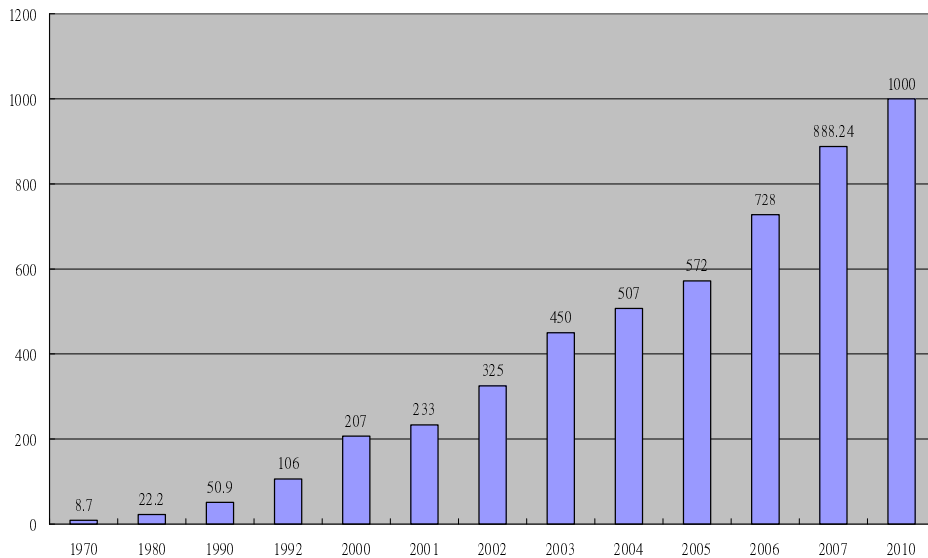
A common feature in developing countries, in the early stages, the government often plays a key role and establishes policies to nurture and protect the industry. Nevertheless, in addition to the roles of the government and the private sector in the industry, many other roles are also significant. For example, to some extent, the local automobile market influences the industry. There are restrictions on independent design and development due to Chinese market requirement and therefore innovation is limited to marketing and customization of vehicles (Munir & Hu, 2006). In addition, reduction in ownership price for customers sounds for Chinese customers. Automobile production in China has grown exponentially. The First Automobile Corporation was established in 1947, and in 2004, China entered its 55<sup>th</sup> year of automobile development. However, it was only a little over a decade ago, that it experienced an astonishing upward trend in its market scale and growth rate. In 1971, a record production of 100,000 vehicles was reached; and in 1980, the production exceeded 200,000 vehicles. Since the announcement of the "Automotive Industry Development Policy" in 1994, automobile production has multiplied in terms of growth, with production exceeding 2 million vehicles in 2000, and 2.34 million vehicles in 2001 respectively.

Since China's entrance into the WTO at the end of 2001, the scale for automobile

industry has rapidly increased. In 2003, the vehicle production reached a new record of 4.5 million vehicles and a growth rate of 34.2% (Figure 1). The dramatic growth in 2002 and 2003 reflected some important factors, including increasing per capita income, greater availability of up-to-date products, and the evolution of consumer buying patterns to include automobiles. The growth rate in 2004 slowed to more normal and substantial levels, and industry volume increased by 15% from 2003. Towards the end of China's transitional phase of entering the WTO in 2006, the golden period of development was able to push China's automobile output to 7.27 million

Figure 1.

Production of China's Automotive Industry  
(1970~2010)



- a. Unit=x10, 000 cars. The value for 2010 is a projected value.
- b. Source : IER & CAEA (2008)

vehicles in 2006 within a time span of five years. Consequently, exceeding German and becoming the world's third largest automobile production country, right next to US and Japan. In 2007, continuing the growth trend from the golden period of development, the

total automobile output reached 8.88 million vehicles (IER & CAEA, 2008). Given this sustained growth, holding other factors constant, it is further estimated that by 2010, China's total automobile production will exceed 10 million vehicles, and by 2015, China will surpass Japan and US as the world's first largest automobile producer (IEK, 2004).

On the other hand, China's domestic demand for automobiles is also growing at an increasing rate. Since entering WTO in 2001, industrial competition and lower tariffs has led China's automobile industry to continually reduce prices, which in no doubt has stimulated rapid growth in market demand. With expanding production scale, the purchasing of parts and assemblies becomes globalized on an increasingly large scale. The production cost is going down. There is more room for the producers to reduce the price, which further stimulates consumer spending (Francois & Spinanger, 2004).

In 2003, the sales volume reached 4.51 million vehicles ranking China the world's third largest consumer of automobiles, surpassed only by the USA and Japan. In 2006, the sales volume reached a new record of 7.21 million vehicles and a growth rate of 25%. China has become the world's second largest consumer of automobiles (IEK, 2004). In 2007, continuing the trend, the sales of automobiles reached 8.79 million vehicles (IER & CAEA, 2008). In addition, with its rapid economic growth, China's purchasing power has experienced a corresponding increase, which has not only contributed to the exponential growth of automobile production, but simultaneously transformed the automotive industry into a strong catalyst for motivating the economy on a macro scale. In fact, between 1990 and 2006, the output value by the automobile industry has continuously showed an increasing trend in GDP,

from 0.65% in 1990 to 1.59% in 2006. It is estimated that by 2012, the automotive industry will constitute 5% of China's GDP (IEK, 2004).

## Modeling

### *Centralization Planning Economic Theory*

Generally speaking, product price varies negatively with product demand, whilst varying positively with product supply. The combined influence of supply and demand ultimately determines both the volume of production and price. This is known as the “*price mechanism*”, a rationing device or signaling device in the essence of economics (Kreps, 1990). This free price mechanism contrasts with a controlled or fixed price system where prices are set by government, within a controlled market or planned economy. Through the controlled price system, the government plans and regulates goods production and resources distribution. To demonstrate this point, if a certain price range is set by the government, the market must adjust accordingly through production.

China and the former USSR were countries that ordinarily abided by “The Planned Economy Theory”, and it is only recently that they have made the adjustment to adopting the ‘Open Market Economic Policy’ (Chen et al, 1988). Despite such a change, many large government-owned enterprises (such as the automotive group) still follow the ‘Central Policy Planning’ in principle. Alternatively expressed, the production target of this term is set by reference to past figures based on changes in the macro-economy and the relevant industry (i.e. volume of trade and production); and the movements in production during a particular term. This is the major means for maintaining market price stability. However, since China has adopted an ‘Open Market

Economy Policy' for many years already, there is uncertainty as to whether or not price will have a significant influence on production.

Since China entered the WTO at the end of 2001, the automobile industry has moved to a strategic and structural adjustment phase, and transformed into a dual-rail development trend of "market pull type" and "innovation self-push type". For the types of vehicles produced by China's automobile industry, the ratio of truck vehicles to passenger vehicles had always been high. This study will proceed upon the assumption that China's truck production is under the influence of both a "Planned Economy" and "Market Economy". Furthermore, we also assume that financial variables on the demand side influence the market for truck production. Based on these assumptions, the focal point of this study is to examine which macro-economic factors will influence China's truck production. This study also examines whether there is an effect resulting from time difference and whether or not the current price has any influence on the current production.

#### *Data Collection*

Data collection in this study is notoriously challenging. Since, we are concerned with economic variables potentially influencing China's truck market, this study mainly refers to studies done by China's "National Information Centre" and "National Industry Development Commission" in 2001 and 2003, and takes into account variables that may potentially influence China's truck market to formulate possible explanatory variables or in the alternative derive a regression model through trials. In particular, we also collect data from China Automobile Market Outlook, China's Auto Market Almanac, and China Economic Information Network. They also contain data on macro-economic

and automotive industrial aspects, for example, GNP, automotive industry production value, fixed asset value and employment population, etc. The data (15 variables) collected in this study include: production of loaded automobiles, number of automobile manufacturers, year-end automotive employment population, total automotive industry production value, original fixed asset value, net fixed asset value, year-end total population, population growth rate, real GNP, real GNP growth rate, employment population, growth rate for employment population, average GNP per person, automobile popularity rate, average truck price. In addition, the influence of “Popularity Rate for Automobiles” is taken into consideration in order to examine the saturation effect on China’s automobile market. The rate is calculated: the total automobile product divided by total population. When the market becomes saturated, the “Popularity Rate for Automobiles” and the production will move in two different directions; if saturation is yet to arise, the “Popularity Rate for Automobiles” and the production should move in the same direction. The sample’s observation period spans from 1971 to 2001 and in total there are 31 units of annual data on automobile and economic variables.

Given the existence of a time difference,  $X_iL_j$  indicates that the  $i^{\text{th}}$  variable has  $j$  period time difference; for example,  $X_4L_1$  indicates that  $X_4$  has one period of time difference, meaning that the variable,  $X_4$  of 1 period earlier, would influence the current sales production.

#### *The Regression Model*

Assume that  $Y$  represents China’s annual production, known as the “dependant variable” and  $X$  is the “explanatory variable”. The explanatory variable is related to

economic variable that influences truck production, while  $\varepsilon$  represents the residual variable with mean zero and normal distribution. The basic set of assumptions that underlie the regression model are as follows: homoscedasticity, non-autocorrelation, uncorrelatedness of regressor and disturbance. A linear multiple-regression model is presented below:

$$Y = \beta_0 + X_1\beta_1 + X_2\beta_2 + \dots + X_p\beta_p + \varepsilon$$

Such a multiple linear regression model is amenable to estimation by the use of ordinary least squares techniques. The actual data which can be used to conduct the regression analysis are the 31 units collected for the period commencing 1971 to 2001. The annual data is used as an observation sample. Basically, the establishment of the regression model is based on various economic variables from the past, to explore the fluctuations of China's truck production market. Accounting for the possible time-lag effect on economic variables and the compatibility of the statistic model, this study includes the production of the previous  $n$  period as an explanatory variable to emphasize that the current market production is under the influence of the production of the previous  $n$  period. The economic variable amongst the explanatory variables also considers the time-lag effect of single or multiple periods. Additionally, it can be expected, as shown in Figure 1, that China's truck production may be influenced by the time trend factor. Therefore, this study will also include the "time trend" variable for testing. This variable makes allowances for a certain increase in truck production that occurs every year. The economic variable that influences the production may reveal the existence of a relationship with the exponential model (Chen et al, 1988; Aigner et al, 1977; Battese & Coelli, 1995). Taking the log value from related variables is common



practice when testing the compatibility of the regression model; as an alternate method for estimating the level of elasticity (Lau & Brada, 1990; Jefferson et al, 1996; Varian, 1984).

### The Results

Based on a consideration of the economic aspects, this study incorporates the stepwise regression analysis in order to develop a model of market fit. Table 1 shows the result of the regression analysis. This study follows a standard method i.e. repeated testing and adjustments including testing explanatory variables over different time periods, to construct a time series model. It is advantageous as it allows the errors of the final regression model to be matched to the independent assumption as closely as possible (Durbin-Watson D: 2.17, 1<sup>st</sup> Order Autocorrelation: -0.12), so that the related statistics inference can proceed and the test results are both accurate and relevant.

Regarding whether the residual variable follows a normal distribution, the *p*-value of Shapiro-Wilk is 0.57 ( $p > 0.1$ ). This value indicates that there is insufficient evidence to overthrow the assumption that the residual variable follows a normal distribution.

In addition, the value of adjusted  $R^2$  is relatively high at 0.99, which indicates that this regression model has good explanatory capability. Moreover, the final value of adjusted  $R^2$  obtained by the stepwise regression procedure indicates that there is no obvious linear relationship among the independent variables i.e. the multicollinearity problem.

The F value is 740.22, which is significant at the level of 0.01. The above statistical values shown in Table 1, reveals that the regression model fits well (Green, 1991; Neter et al, 1999). To sum up, the overall explanatory capability of this regression model has a significantly high level of confidence (Goldberger, 1998).

Table 1.  
Results of the Regression Analysis of China's Truck Production

Variable	df	Parameter Estimate	Standard Error	t Value	Pr >  t
Intercept	1	-98.14549	7.65989	-12.81	<.0001
YEAR	1	0.05350	0.00414	12.91	<.0001
GNP growth rate	1	0.74369	0.10714	6.94	<.0001
The number of LOG factories	1	-0.81079	0.19230	-4.22	0.0003
Average real price	1	-0.01768	0.00522	-3.39	0.0023

$R^2$  : 0.9913     $\text{adj } R^2$  : 0.9900     $F$  : 740.22     $P\_value$  <.0001  
 Durbin-Watson  $D$  : 2.171     $1^{st}$  Order Autocorrelation : -0.121  
 Shapiro-Wilk  $W$  0.971843     $Pr < W$  0.5711

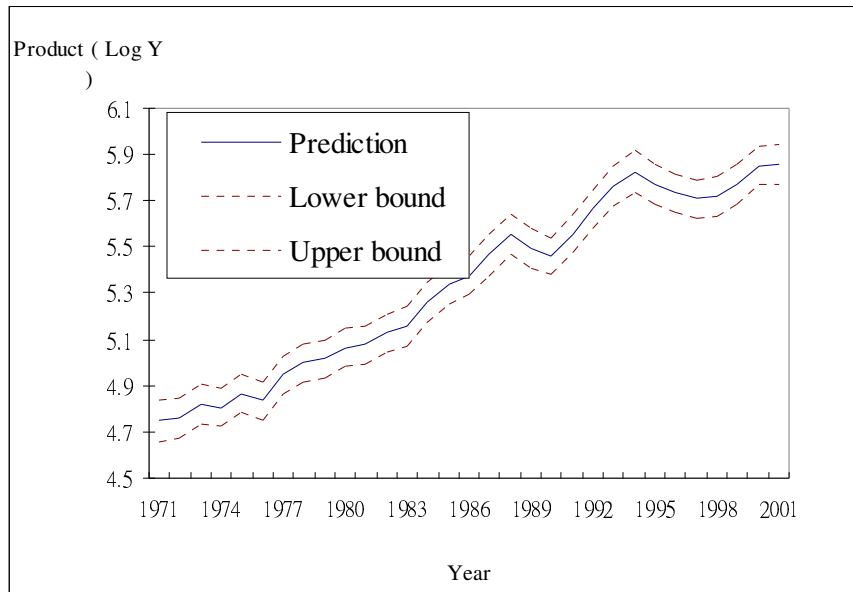
With all the explanatory variables, China's truck production is significantly influenced by the time trend (YEAR); the value of the coefficient being 0.05350, which indicates that the truck production will increase by 0.0535 units for every year during the period of observation. The  $t$ -value is 12.91, significant at the 1% level. The second explanatory variable is the current GNP growth rate, which has a regression coefficient of 0.74369, indicating that the truck production will increase by 0.74369 units with every increased unit in the current GNP growth rate; the  $t$ -value is 6.94, significant at the 1% level. The third explanatory variable is the log value of the 'number of current automobile manufacturers', which has a regression coefficient of -0.81079, indicating that the truck production will decrease by 0.81079 units for every 1% increase in the 'number of current automobile manufacturers'; the  $t$ -value is -4.22, significant at the 1% level. The results demonstrate that with increasing automobile manufacturers in the market, economies of scale have decreasing utility. This corresponds with many previous studies whereby the automobile industry has possessed

the phenomenon of economies of scale. The last explanatory variable is the average real price of the automotive industry, which has a regression coefficient of -0.01768, indicating that the truck production will decrease by 0.01768 units for every increased unit in the 'current average real price' in the automotive industry; the  $t$ -value is -3.39, significant at the 1% level. Figure 2 shows the prediction of the model. In conclusion, the model overall has good explanatory capability and high goodness-of-fit.

### Discussion

According to traditional economic theory, production is normally influenced by fixed assets and labor forces (Battese & Coelli, 1995; Varian, 1984). The model used in this study incorporates these two variables. However, findings reveal that neither of these variables is statistically significant. In other words, the current information lacks the evidence to confirm that China's truck production is influenced by fixed assets and labors. This implies that under the planned economy and market economy, there are other factors to be considered as suggested in this study. In addition, this study also examines other economic variables, whilst also measuring whether or not time difference has any impact. The result of the regression analysis, however, reveals that reliance on the above two variables alone is insufficient. In this way, we recommend that the fixed assets and labor of China's truck manufacturers need to be further improved. While this analysis is only suggestive, it does provide support for more detailed investigation by manufacturers when considering production for which this analysis is a closer approximation. In sum, China's truck production, as shown in the results (Table 1), is significantly influenced by

Figure 2.  
Projected values of production in China's truck production



time trend, the current GNP growth rate, the ‘number of current automobile manufacturers’, and the ‘average real price’ in the automotive industry. The first two variables show a significant positive relationship, and the latter two variables show a significant negative relationship. We suggest that the result is significantly in relation to the China’s automotive industry policy underlying the concept of central planned economy.

Without a doubt, the automobile industry plays a very important role in the modernization process. Major industrialized countries usually have more than one large-scale automobile plant that makes significant contribution to economic development, for examples, refer to the automobile industries in US, Japan, Germany, France and Italy. Japan, in particular has properly implemented industrial strategies, which has resulted in its automobile industry exceeded that of the USA and Germany.

In contrast to neoclassical economics, here emphasis is on the existence of a free market and opposition to interference. The view is to open the market and follow free market principles. Under the principle of comparative advantage, resources are allocated in the most effective way without much emphasis on government interference (Wade, 1990). However, market economy mainly relies on price mechanisms to effectively allocate resources. In fact, usually due to externalities, public goods, monopolies and incomplete information, the market does not allocate resources in the most effective way. As a consequence, social costs and social benefits are not reflected by market price mechanisms and market failure occurs. In this situation, the government should make necessary interference with the market (Atkinson & Stiglitz, 1980). Chiang (1996) indicated that in the past, the major industrialized countries in the world have implemented different industrial policies to cope with market failure. The objective is to remedy the deficiency in market mechanisms and assure smooth operation of the market economy. It is a creative and effective system for a developing country to adopt a selective industrial policy to replace market mechanisms that still remains in development. Therefore, the government's timely interference is necessary and its objective is to expand the market (Chang, 1994; Hirschman, 1958; Shin, 1996; Masahiko et al, 1996). China's automobile industry is developing on the dual-principle of planned economy and market economy.

Before reforms and China's economy opening up, China had always adopted the notion of a planned economy without the inclusion of the market economy concept. There was nothing about industrial policy. After reforms and China's economy opening up, new vitality has been injected into China's automobile industry, which then started

moving to an adjustment and rapid development stage. In the early 80's, not only was the volume of output from China's automobile industry unable to satisfy the demand but the industrial structure was also based on truck production. Under the concept of central planned economy, the focus is on developing heavy industry, expanding national infrastructure, and developing the western regions of China, thus the first priority is on trucks. Besides, for mainland China, the automobile industrial policy set in 1994 was the most important industrial policy in the automobile sector during the 90's. The emphasis was to resolve the issues associated with scattering, disorder, low and slowness in the automobile industry. Mainland China was seeking to integrate and reform all the automobile plants scattering over the country and achieve conglomeration and economies of scale for the automobile industry. Towards the end of 2003, China's automobile industry comprised of basically three main groups, China FAW Group Corp., SAIC Group and Dongfeng Motor Corp., in addition to another thirteen key automobile groups (Beijing Automobile Works, Tianjin Automobile Industrial (group) Co., Ltd., China National Heavy Duty Truck Group Co., Yuejin Motor Group, Jiangling Motors Co., Ltd., Qingling Motors (Group) Co., Anhui Jianghuai Automobile Co., Ltd., Chang An Group, , Harbin Hafei Automobile Industry Group Co., Ltd., Chang He Automobile Co., Ltd., Dragon Hill Wuling Automobile Holdings Limited, ShenYang Brilliance JINBEI Automotive Co., Ltd., and Guangzhou Automobile Industry Group Co., Ltd.). Basically, the industrial consolidation has significantly increased.

As a result, the Chinese government is actively encouraging the merger of automobile manufacturers to reap the benefits of economies of scale, reduce costs and increase the production. Moreover, the reduction in truck prices is also beneficial to the

increase in truck production that has been observed. Supporting evidence is obviously in the earlier discussion. The Chinese government's decision to implement policy on relieving the price mechanism is further supported by the results. To sum up, relieving the price mechanism involves consolidating the automobile industry, reducing the number of automobile manufacturers, increasing the production capacity and further reducing the price. This corresponds to our result in which the production of trucks, the number of automobile manufacturers and the average real price shows a significant negative relationship.

In addition, the view based on the development of the world's automobile industry indicates that the need for automobiles (i.e. number of vehicles owned per person) and the growth in the automobile industry are closely related to the economic development for the country, i.e. there is a high level of correlation between automobile industrial development and the economic development at each stage. For example, during the early stages of economic development, the number of cars per capita is relatively low, and the elastic coefficient regarding the demand for cars relative to economic growth is slightly higher than 1, and the primary demand for automobiles is for trucks (Annual Report on Automotive Industry in China, 2007). After a certain period of development, the income per capita has reached a certain level, and the number of cars per capita increases rapidly. GDP is very often used as an indicator for a country's economy. Since the development of China's automobile industry is consistent with others. In particular, there is a strong similarity with Asian countries like Japan, Korea and Taiwan. Moreover, under a planned economy, production also follows a time trend. Therefore, this study suggests that truck production is positively and significantly

influenced by time trend and GDP growth rate, is self-evident.

On the other hand, the estimate regarding the impact of China's macro-economy on truck production in relation to the Chinese government and manufacturers was also influenced by the current GNP growth rate, as confirmed by the results. Alternatively expressed, China's current business cycles will significantly influence truck production. Consequently, an optimistic forecast can be made in respect of China's truck production mainly due to a corresponding optimistic forecast on China's future economic growth, which permits these estimations being drawn from the results (Lu, 2000).

Through the passage of time, China's truck production undoubtedly follows a pattern of apparent growth. Intuitively, this suggests that automobile manufacturers must make advanced plans to invest in China's truck production in order to cope with the market development trends. This should be an important consideration for both the domestic and international automobile manufacturers in formulating global development strategies.

### Conclusion

As China's economy continues to develop, truck production has become a main force in driving economic growth as a whole. In 2002, China's truck production exceeded 1 million vehicles; notably the market opportunity contributed to China's economy as a whole. In this study, the multiple regression analysis was implemented to observe the change in truck production data in China from 1971 to 2001 and to construct the regression model for truck production in China. The results indicate that there is a significant positive correlation between truck production and both China's current GNP growth rate and time trend. There is also a significant negative correlation



between truck production and the following two variables: 'current automobile average real price' and 'current number of automobile manufacturers'. The adjusted  $R^2$  of the model is 0.99, indicating that the model has considerable explanatory capability.

In this study, time series data is drawn from over 30 years and utilized to construct a regression model for truck production in China. Furthermore, a noteworthy point is that similar studies investigating this particular issue have yet to be published. The impact of the 'Cultural Revolution' has led to difficulty in collecting China's macro statistical data, which in turn rendered the task of collecting a complete set of economic variables for time series data in the cross-section which spans several decades, a fundamental challenge in this study (Wang & Meng, 2001).

China's ascension to the World Trade Organization (WTO) occurred in November 2001. It is worthwhile noting that future research exploring the significance of this event on the future of China's truck production would provide further valuable insight into China's truck production industry. Woodall (2004) indicated that rapid growth in China's economy particularly in the automotive, oil and energy industries is foreseeable. Therefore, related studies on supply and demand in the truck market in China still remains of considerable importance. Based on the same reasoning, studies focusing on China's sedan automobile market and automobile production as a whole also represent areas of interest for researchers and academics.

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## THE CONNECTION BETWEEN PATENT LITIGATION AND PATENT PORTFOLIO

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### Abstract

Patentees employ the patent portfolio to protect their innovative achievements in the intellectual property community. Furthermore, patent litigation is a final resort against infringement. The patent portfolio, therefore, has legal and management purposes. Based on previous research studies, the purpose of this article is to explore the correlation between patent portfolio and patent infringement litigation. Our study examines material from the patent portfolios of defendants and plaintiffs of patent infringement suits in the US semiconductor industry. Our results will show that some characteristics of patentees' patent portfolios will influence the competence of their patent lawsuits against their competitors.

*Key Words:* Patent Litigation, Patent Portfolio, Patent Infringement, 4-digit IPC, Technology Stake

### Introduction and Purpose

Based upon a review of the management and economic literature with regard to empirical research of patent litigations, this paper used two approaches. First, to explore from a cost perspective, for example, the effect of news releases on patent litigations that cause indirect cost increase to defendants. Second, to research the potential risk of

bankruptcy (Bhagat, S., et. al. 1994) . Small companies with weak financial capability facing lawsuits with a high burden of costs, will avoid patent lawsuits, while major companies with strong financial capability and a low cost burden in lawsuits, will avoid applying the patent in the same technical field (Lerner, J. 1995) . Such litigation costs will affect the intention of those small companies to apply for the patent right to defend their intellectual property rights (Lanjouw, J. O. and Lerner, J., 1996) . Due to the impact of litigation costs, U.S. patentees are more inclined than non-U.S. patentees to file lawsuits in the U.S. Federal Patent Court. Moreover, those patentees with a high worthy patent have stronger intentions to file lawsuits to defend their intellectual property rights. Comparing the financial capability of the plaintiff and defendant in patent litigation, the plaintiff with stronger financial capability comparatively tends to introduce more aggressive legal procedures than the defendant with weaker financial capability. An example would be pursuing a preliminary injunction that would cause further financial pressure on the defendant (Lanjouw, J. O. and Lerner, J. 2001) . Patents which have been infringed and are backed by a valid verdict through patent litigation are more valuable than those patents that do not have a litigation verdict or verifications (Sherry, E. F. and Teece, D. J. 2004) . From an innovative technology perspective, the number of the patent's 4-digit IPC codes shows a positive connection with the number of patentee's patent litigations (Lerner J. 1994) . Furthermore, the number of patent litigations shows a positive connection with some characteristics of the plaintiff and defendant themselves and all their patents (Lanjouw, J. O. and Shankerman, M. 2001a) . The latter compares the strength of the plaintiff's technology stakes on patent litigation, which is correlated to its reconciliation intention or no reconciliation strategy (Somaya, D. 2003) .

The above-mentioned research explains which company will expose itself to the risk of patent litigation from various perspectives, and from the technology perspective in particular. In their research on “Infringement Suits” and “Invalidity Suits,” Lanjouw and Schankerman found that most Patent Infringement Suits’ defendants will file invalidity suits. They also researched the correlation between the number of litigations and patents’ characteristics, nationality, corporation or personal identity, etc. Somaya (Somaya, D. 2003) has discussed reconciliation and non-reconciliation strategies plaintiffs take in patent litigations due to the level of strength of their technology stakes. The previous three research studies mostly explained the relation between the percentage of becoming involved in litigations and the plaintiffs’ patent characteristics from a plaintiff’s position; however, in the filing stage of patent litigation, the defendant will suffer financial crisis and limitation on continuous production and sales as well as financial loss from the patent litigation trial. Why, then, do some of the defendants still choose to file a lawsuit despite overwhelming pressure, instead of agreeing to a settlement? By observing the opposite position, the profound impact of losing a lawsuit, once the plaintiffs have filed it, will lead to the further filing of lawsuits, which has yet to be explained. Besides, the research studies by Lanjouw & Schankerman, and Somaya focused on the characteristics of all the patents owned by the plaintiffs and the number of citations, i.e. the correlation between comprehensive technology stakes and percentage of litigation involvement. However, in addition to the patent characteristics, the aforementioned research also emphasizes that bulky litigation costs will accompany patent litigations and waste a company’s various resources. In other words, both the plaintiff and defendant in a patent litigation case have to consider this scenario in deciding whether to go through a complete trial process and



final adjudication by a court. Litigants have to evaluate the gap in technology between themselves and their competitors, as shown by former research that focused on the level of litigation costs and relative strength of financial capability etc. (Lerner, J. 1995) . Which technology fields require a company's full resources to vigorously fight against competitors in court, and why do those defendant companies choose to file lawsuits to the end, and even risk losing the lawsuit and indemnification? The patent litigation insurance market is eager to know the answer to these questions. In considering the answers the gap in technology stakes for specific technology fields must be taken into account.

This research is dedicated to exploring the elements that make plaintiffs and defendants pursue patent litigation lawsuits to the end. Besides, there is a continuity of previous study on asymmetric stakes' research (Siegelman, P. and Waldfogel, J. 1999) that holds different viewpoints of asymmetric stakes; for example, to regard asymmetric stakes as strategic asymmetric technology stakes while conducting patent litigations (Somaya, D. 2003) . As both the plaintiff and defendant insist on filing a lawsuit, they must have stake factors that are equivalent to each other to be able to contend with each other. This research by Lanjouw & Schankerman (Lanjouw, J. O. and Shankerman, M. 2001a) and Somaya (Somaya, D. 2003) has further segmented asymmetric technology stakes into comprehensive technology stakes asymmetry and specific technology stakes asymmetry; specific technology stakes asymmetry represents both parties' technology stakes in certain technology fields, rather than compare the comprehensive technology stakes between the two parties. Part of the research studies have regarded patents as a separation mechanism to prevent rivals from duplicating a company's unique intellectual property rights and affect its competitive advantages (Lippman, s. A. and Rumelt, R. P.

1984) . It is critical that both the plaintiff and the defendant consider the extent to which the patent is regarded as a separation mechanism, the degree of interference in the specific technology fields, and the actual strength level of the patent portfolio in the technology field (Granstrand, O. 1999) , before pursuing a lawsuit to the end. It still has to be verified further as to whether it is a factor that influences the probability of a patentee's patent litigation. Moreover, Lerner (Lerner J. 1994) , Lanjouw and Schankerman (Lanjouw, J. O. and Shankerman, M. 2001a) , and Somaya (Somaya, D. 2003) have introduced a number of 4-digit IPC subclasses as independent variables to discuss the correlation between patentees' number of 4-digit IPC subclasses and the number of patent litigations they have been involved in. However, the 4-digit IPC subclasses under patent litigation within the scope of patent technology classification is what patent litigation competitions really are. Therefore, this research tries to understand the 4-digit IPC subclasses of patent litigation within the scope of this patent technology classification, and compare the content of patent portfolios of the same involved 4-digit IPC subclasses between the plaintiff and the defendant, i.e. the difference on technology stakes in particular technology fields between the plaintiff and the defendant, and the impact on both the plaintiff and the defendant in pursuing a lawsuit to the end. The focus of previous research on patent litigation has been on comprehensive technology stakes asymmetry, while this research is to extends the subject to specific technology stakes asymmetry. This research introduces measurement indicators for specific technology stakes to measure and explain the percentage of patentees that pursue lawsuits on patent litigation to the end.

The contribution of this research is to further verify patentees' technology stake factor in certain fields, and explain the percentage of patent litigation involvement for patentees in more detail, especially with regard to the percentage of plaintiffs and defendants who insist on patent litigation. While previous research on patent litigation focused on the plaintiff's position, this research has added the defendant's perspective. Also, by comparing the measurement indicators on comprehensive technology stakes introduced by the previous research with the measurement indicators on specific technology stakes, we will be able to further measure and explain the percentage of patent litigation and the percentage of patentees who pursue lawsuits to the end.

Furthermore, to measure the percentage of plaintiffs and defendants who litigate over patents, this research claims that besides technology stakes factors, a measurement on patent portfolio in a specific technology between plaintiffs and defendants is also necessary by observing the characteristics of various technology stakes of patentees; for example, the characteristics of the patent portfolio of the relevant technology fields. After all, two parties with strong comprehensive technology stakes does not mean they perform better specific technology stakes than their competitors.

#### Theoretical Framework

As for the patent litigation process, the previous research studies were divided into five stages: first, the stage of deciding whether to file a lawsuit; second, declaration of lawsuit stage; third, the court hearing stage; fourth, the court trial stage; and fifth, the court verdict stage (Lanjouw, J. O. and Shankerman, M. 2001a) . In fact, the number of patent-litigation cases that proceed to the district court verdict stage is relatively low. Among the reasons are that the granting of intellectual property rights does not bring full

protection or excludes patent infringement (Shapiro, C. 2007) . Furthermore, company executives facing severe litigation pressure are risk averse and have a cost-saving perspective, so will consider out of court reconciliation to avoid litigation costs and the possibility of paying compensation (Fournier, G. M. and Zuehlke, T. W. 1989) . Another decisive factor that determines out of court reconciliation, where the position of both parties in a patent lawsuit is symmetrical, is that some defendants will want to avoid public attention and tend to reach a reconciliation (Cooter, R. D. and Rubinfeld, D. L. 1989) despite a high probability of winning. Some characteristics of the aforementioned patentees may explain that some litigation cases were recalled or reached reconciliation at stage 1, 2, or 3, but it does not satisfactorily explain those litigation cases that disregarded litigation costs and litigation compensation and proceeded to stages 4 and 5. However, the “loss of patent invalid verdict” and “compensation for patent infringement,” have a severe impact on either litigating party, and mean far more than reconciliation means, a factor which both parties need to consider and one which the patent insurance supplier needs to acknowledge desperately. Therefore this research aims to focus on the cases through court verdict instead of other revoked cases via reconciliation.

This research focused on those cases in which there was no intention to settle and where the litigants pursued a lawsuit to the end through a district court verdict. Current research on whether litigants decide to reach reconciliation or pursue a lawsuit to the end can be divided into three research directions: divergent expectation (DE) , asymmetry information (AI) , and asymmetry stakes (AS), in which DE believes that those who adopt reconciliation or non-reconciliation will subject themselves to various and rational expected litigation outcomes (Priest, G. and Klein, B. 1984) . The reason why cases fail

to reach reconciliation and litigation is pursued to the end is affected by selfish deviation between two parties, and leads to expected litigation outcomes by plaintiffs and underestimated and expected litigation outcomes by defendants. AI considers that those who adopt reconciliation or litigation policies will be subject to asymmetry information (Bebchuk, L. A. 1984) . Both plaintiffs and defendants in a lawsuit tend to introduce incomplete information to proceed with reconciliation or litigation decisions (Schweizer, U. 1989) . From Meurer's perspective (Meurer, M. J. 1989) , AS is that the expected proportion of the profits of overall industry between two parties, will affect their countermeasures to litigation, which is a decision that determines no lawsuit, reconciliation, or pursuing litigation to the end. Lanjouw and Lerner (Lanjouw, J. O. and Lerner, J. 1997) proposed that in the case of two firms in a lump-sum transfer model, where the patentee decides on a monopoly market price and where the non-patent competitor cannot afford to pay for a loyalty fee under the market price, whether this would lead to patent infringement and non-reconciliation circumstances. Under simple probit regression empirical analysis, those companies with strategic technology stakes in the computer and pharmaceutical industries will affect decisions on whether to reach reconciliation in a patent lawsuit (Somaya, D. 2003) .

#### *Asymmetry Of Comprehensive / Specific Technology Stakes*

However, the impact of DE and AI is only limited to stage 1, 2, and 3, while AS will affect stage 4 and 5 with a resolution to file a lawsuit (Somaya, D. 2003) . In intellectual property rights litigation, according to real and simulated statistics, AS continues to have a considerable influence in determining patent litigations (Siegelman, P. and Waldfoegel, J. 1999) . The level of asymmetrical stakes and number of patent

litigations between two parties in a lawsuit are in direct ratio (Waldfogel, J. 1995) . How that is associated with litigation cost will affect the reconciliation terms that the plaintiffs will accept in patent litigation cases (Waldfogel, J. 1998) . This research aims to focus on patent litigation cases in stage 4 and 5 and proposes that AS is limited to “asymmetry of comprehensive technology stakes” compared to previous research studies. However, from the implementation and resources perspectives of intellectual property rights, this research further elaborates on “asymmetry of specific technology stakes.” The aforesaid research studies that focused on AS have also elaborated on various aspects, such as the financial aspects of patent litigations without reconciliation, in which the patent infringers failed to compensate patentees with a fixed amount, and in surviving in the market under price monopoly at the same time, such a fixed compensation is the negotiated surplus by two parties and is regarded as AS (Lanjouw, J. O. and Lerner, J. 1997) . Meurer (Meurer, M. J. 1989) indicated that AS is the expected profits of the overall market between two parties in a lawsuit, which is, however, strategic technology stakes according to Somaya (Somaya, D. 2003) . We examine how many technology stakes in specific technology fields these parties have for patent litigation procedures and stick to the final trial stage.

#### *Patentees' Patent Portfolio Of Involving 4-Digit IPC Subclasses*

Those comprehensive technology stake indicators between two parties introduced by previous research studies, such as number of patents, number of forward citations, number of backward citations, number of mutual citations, and the number of claims between two parties involved were regarded as variables of “asymmetry of technology stakes” to explain the possibility of a company becoming involved in litigation. However, patent litigation cases do not focus on the whole patent between two parties; various

technology fields in the semiconductor industry change with each passing day. Furthermore, each single technology field of the two parties involved does not have “asymmetry of technology stakes” status; the contents of many patent strategies among intellectual property right communities are out of legal, managerial consideration (Anawalt, H. C. 2004) . Patentees’ behaviors and strategies are connected with the R&D strategy of their rivals [14,28]; inventors will use various types of patent portfolio strategies to protect their inventions (Granstrand, O. 1999) and for other reasons. Therefore, this research aims to focus on the content difference of patent portfolios in specific technology fields between two parties. As these involve patent portfolios of those technology fields have to be attended to in the first place, as has been emphasized in previous research studies, infringed patents that have the stamp of a court verdict are more valuable (Sherry, E. F. and Teece, D. J. 2004) . We suppose that patentees would construct a specific technology portfolio in each 4-digit IPC subclass in which they may be involved. Hence, patentees’ patent portfolio of involving 4-digit IPC subclasses is where the IP arena is really competing.

This research has explained the possibility of a company’s involvement in patent infringement litigation through verdict by a U.S. federal court in terms of the differences of patent portfolios as per technology field of each relevant patent between two parties. If one party outperforms the other in terms of patent portfolio involving the technology field, it might have more competence to stick to the last trial stage of patent litigation procedure and compete against the other party in the involved technology field. To sum up the foresaid inference, the following hypotheses are proposed in this research:

*H<sub>1</sub>: In patent litigation cases, the stronger the technology stakes in the relevant technology fields, the more capable the defendant is of taking on a patent infringement lawsuit filed by plaintiffs and fighting to the trial stage.*

*H<sub>2</sub>: In patent litigation cases, the higher the defendant's patent portfolio in the technology field is than the plaintiff's, the more capable the defendant is of fighting against a patent infringement lawsuit filed by the plaintiff and insisting on going to the trial stage.*

*H<sub>3</sub>: In patent litigation cases, the stronger the plaintiff's technology stakes are in the relevant technology field, the more capable the plaintiff is of coping with defendant's infringement behavior and fighting against the trial stage.*

*H<sub>4</sub>: In patent litigation cases, the stronger a plaintiff's patent portfolio is in the relevant technology field than the defendant's, the more capable the plaintiff is of protecting its intellectual property right and suing at the trial stage.*

Table 1. Number of Involved 4-digit IPC Subclasses (  $\geq 10$  times)

4-digit IPC	Number of litigations	Percentage	Cumulative percentage
H01L	200	16.49%	16.49%
G06F	153	12.61%	29.10%
H03K	112	9.23%	38.33%
G11C	108	8.90%	47.24%
H04B	56	4.62%	51.85%
H04L	45	3.71%	55.56%
H05K	30	2.47%	58.04%
H04Q	26	2.14%	60.18%
H02M	26	2.14%	62.32%
H01R	25	2.06%	64.39%
H04M	23	1.90%	66.28%
H03M	23	1.90%	68.18%
G02B	23	1.90%	70.07%
H05F	20	1.65%	71.72%
G11B	19	1.57%	73.29%
H04N	19	1.57%	74.86%
G05F	18	1.48%	76.34%
C23C	15	1.24%	77.58%
H05B	13	1.07%	78.65%
H04J	13	1.07%	79.72%
C30B	13	1.07%	80.79%

Source : consolidated by this research



## Data and Models

### *Data Sources: From Three Databases.*

This research intends to explain both plaintiff's and defendant's probabilities of asserting their IP rights. According to the full and short names of 176 semiconductor companies<sup>1</sup> listed in Compustat, we searched for samples that had at least a plaintiff or a defendant record ruled by a U.S. federal court in patent infringement litigations from the Westlaw database. There were 42 plaintiffs and 60 defendants in 215 patent infringement cases<sup>2</sup>, which were collected. Among the two parties judged in those 215 cases, there were another 45 plaintiff companies and 20 defendant companies that did not belong to the semiconductor companies listed in Compustat. Those were non-listed and non-OTC domestic companies in the U.S., overseas companies, and unclassified companies across various industries. In order to completely include the research data into the semiconductor company samples, we compiled our data from 80 defendant companies and 87 plaintiff companies in total. According to the relevant patent number recorded in verdicts and adjudications in federal courts, we focused on the technology stakes of relevant 4-digit IPC subclasses that referred to the relevant patents of plaintiffs or defendants in patent infringements. We argue that the content of the relevant 4-digit IPC subclasses is the actual IP arena of the semiconductor industry, and the relevant 4-digit IPC subclasses are our specific technology fields. Then we used the Derwent Innovations Index to collect patent data of comprehensive (all) and specific (involved) technology fields for the year in which verdicts were reached in the cases of the 80 defendants and 87 plaintiffs<sup>3</sup>.

### *Measurements On Involvement Of Patent Infringement*

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<sup>1</sup> Compustat personal computer version in May 2007

<sup>2</sup> Search duration : from earliest cases to Nov., 2008 in [www.westlaw.com](http://www.westlaw.com)

<sup>3</sup> Search duration : from earliest cases to Nov., 2008 in Derwent Innovations Index

### *Number of patent litigations.*

According to related research papers, a measurement on probability of litigations is by number of litigations; however, most of these litigation cases, in fact, are solved through out of court reconciliation, from the filing of a lawsuit to the stage just before judgment by district court. Just a small proportion goes to final judgment by the court. Moreover, this part of case has yet to be studied. This research introduces an empirical study of patent infringement litigations in the semiconductor industry that have gone through a district court judgment; furthermore the research discriminates between the number of those semiconductor companies which act as plaintiffs and defendants individually, which helps to illuminate the probability of litigation and explore how these companies became plaintiffs and defendants.

### *Number of involved patents.*

According to verdicts and judgments over the years researched and consolidated by this study, only 1~2 patents were argued between two parties in previous infringement litigation cases, recently, where the plaintiff declared that the defendant had infringed more than one of the plaintiff's patents and even more than 10 patents. This phenomenon contains two meanings: 1. A change in intellectual property right protection pattern through patent portfolio application that semiconductor companies tend to use. 2. The patentee gets to know how to use the various patterns of patent portfolios to protect his intellectual property rights, and to be able to deal with infringers and competitors in a more deliberate manner (Granstrand, O. 1999) . Past research has shown that if more than 10 patents are involved in one lawsuit it will impose far greater pressure on the defendant than if one single patent is involved; this shows the plaintiff has a comparative advantage

if he files one lawsuit covering more than 10 patents at the same time in his patent portfolio with a technology classification.

*Number of involved IPC subclasses.*

A patent examiner will give each patent a technology classification before it is issued, with one or more 9-digit IPC codes. Previous studies indicate that in a patent infringement litigation case, even one single patent infringement will involve various technology classifications (Lerner J. 1994) that use 4-digit IPC subclasses as a classification standard for the technology field to avoid complex problems which are easy to observe. This study sustains the method introduced previously, to firstly observe the quantity of 4-digit IPC subclasses that refer to the involved patents. Our sample also indicates that irrespective of whether one or more patents are involved in patent litigations filed by plaintiffs, they also belong to one or more 4-digit IPC subclasses separately, and the meanings behind them also signify the strengths and weaknesses of plaintiffs and defendants in these technology field classifications and lead to the possibility of infringement litigations.

*Measuring the Strength of Patent Portfolios.*

In examining the measurement of various patent indicators in technology stakes between two parties, there are a few more points that can be discussed further: 1. The total number of patents and the total number of citations of sample companies introduced by previous studies to evaluate the strength of the company's technology stakes and to further speculate on the possibility of litigation of plaintiffs. However, not all the technological development of each 4-digit IPC subclasses within the company outperforms rivals and competitors. 2. Even the total number of patents and the total

number of citations in some major companies outperform those of competitors, who still became defendants due to patent infringement litigation filed by competitors. Therefore, in order to further investigate that these semiconductor companies have a potential to be plaintiffs or defendants in patent infringement cases, however, due to the different content of the technology portfolio involving patents between two parties, we suppose the patentees would have a specific technology portfolio in each 4-digit IPC subclass with which they are concerned. This research will focus on the specific technology fields that involve patents belonging to, i.e., one or more 4-digit IPC subclasses that belong to the involved patents respectively, in which the content of the patent portfolio of involved 4-digit IPC subclasses requires observation and comparison. The research introduces the following methods to measure the strength and weakness of patent portfolios among these 4-digit IPC subclasses involved in litigation between two parties, to further infer the correlation between these differences of patent portfolio and the possible level of litigation the company might be involved in.

*Density of patent portfolio.*

According to our research, sometimes the number of patents of some defendants is far greater than that of the plaintiffs, and it is taken for granted that those competitors with more patents represent companies with advantaged technology stakes. The aforesaid status has not been explained satisfactorily, which can also infer that the patent portfolios of defendants were asymmetrically developed due to the various technology fields in which they were superior to their competitors for the patent portfolios in some technology fields, while they were inferior to the plaintiffs in some technology fields. Therefore, according to a comparison of all patents that belong to involved 4-digit IPC

subclasses between two parties, this research regarded the number of patents categorized as involved 4-digit IPC subclasses as the density of specific patent portfolio.

*Depth of patent portfolio.*

Sometimes defendants have a lot more citations than plaintiffs. If competitors have patents with a greater number of citations, it means the patentees have more critical technology stakes rationally; the aforesaid status cannot be explained easily, and it can also be inferred that the number of citations of those defendant's total patents may be unequally affirmed by peers, in which some patents are recognized by competitors, while some are yet to be attended. Therefore, according to the comparison between the number of citations cited by itself, the number of citations cited by litigant competitors, and the number of citations cited by others competitors with the relevant 4-digit IPC subclasses between two parties in this research, this research regarded the number of citations cited by itself, litigant competitors, and other competitors categorized as being involved in 4-digit IPC subclasses as the depth of a specific patent portfolio.

*Width of patent portfolio.*

We sort and calculate the number of identical 9-digit IPC subclasses of involved 4-digit IPC subclasses that have been developed among the relevant patents between two parties of patent infringement cases in our samples. The number of identical 9-digit IPC subclasses of involved 4-digit IPC subclasses can be regarded as subordinate technologies under the same technology categories that have been developed for the specific technology, and can be explained as the width of this patent portfolio under the same technology field (Klemperer, P. 1990) ; besides, calculating the quantity of non-identical 9-digit IPC of involved 4-digit IPC subclasses that have been developed among

the involved patents between two parties, which can be regarded as other subordinate technologies under non-involved categories have been developed for the specific technology, and can be explained as the width of this patent portfolio under the different technology field.

### *Empirical Model*

#### *Defendant's measurements.*

The following four linear regression equations are used to observe the probability of each single semiconductor company that becomes a defendant, by analyzing the correlation between three measurements on involvement of patent infringement (TLD<sub>n</sub>, TNPLD<sub>n</sub>, and TNILD<sub>n</sub> with two kinds of technology stake indicators (see Table 2) . We also compared the explanatory abilities of comprehensive technology stakes indicators ( DWPD<sub>n</sub>, LCWPD<sub>n</sub>, OCWPD<sub>n</sub>, SCWPD<sub>n</sub>, IPC4WPD<sub>n</sub>, and IPC9WPD<sub>n</sub>) and specific technology stakes indicators ( DSPD<sub>n</sub>, LCSPD<sub>n</sub>, OCSPD<sub>n</sub>, SCSPD<sub>n</sub>, IPC9SPD<sub>n</sub>, and IPC9NSPD<sub>n</sub>) with three measurements on involvement of patent infringement.

Furthermore, we deploy two dummy variables that represent the difference indicators of comprehensive technology stakes between two parties ( DVD<sub>1n</sub>, DVD<sub>2n</sub>, DVD<sub>3n</sub>, DVD<sub>4n</sub>, DVD<sub>5n</sub>, and DVD<sub>6n</sub>) and the difference indicators of specific technology stakes between two parties ( dvd<sub>1n</sub>, dvd<sub>2n</sub>, dvd<sub>3n</sub>, dvd<sub>4n</sub>, dvd<sub>5n</sub>, and dvd<sub>6n</sub>) , and examine the connection between the disparities of technology stakes with three measurements on involvement of patent infringement, in which the difference of patent portfolio content will affect the percentage of becoming a defendant.

$$Y_{dn} = a_0 + a_1 X_n \quad (1_D)$$

$$Y_{dn} = a_0 + a_1 X_n + a_2 D_{in} + a_3 d_{in} \quad (2_D)$$

$$Y_{dn} = b_0 + b_1 x_n \quad (3_D)$$

$$Y_{dn} = b_0 + b_1 x_n + b_2 D_{in} + b_3 d_{in} \quad (4_D)$$

$$Y_d = TLD_n, TNPLD_n, TNILD_n$$

$$X_n = DWPD_n, LCWPD_n, OCWPD_n, SCWPD_n, IPC4WPD_n, IPC9WPD_n$$

$$x_n = DSPD_n, LCSPD_n, OCSPD_n, SCSPD_n, IPC9SPD_n, IPC9NSPD_n$$

$$D_{in} = DVD_{1n}, DVD_{2n}, DVD_{3n}, DVD_{4n}, DVD_{5n}, DVD_{6n}$$

$$d_{in} = dvd_{1n}, dvd_{2n}, dvd_{3n}, dvd_{4n}, dvd_{5n}, dvd_{6n}$$

$$n = 1 \dots 80 \quad i = 1 \dots 6$$

*Plaintiff's measurements.*

The following four linear regression equations are used to observe the probability of each single semiconductor company that becomes a plaintiff, by analyzing the correlation between three measurements on involvement of patent infringement (TLP<sub>m</sub>, TNPLP<sub>m</sub>, and TNILP<sub>m</sub>) with two kinds of technology stake indicators. We also compared the explanatory abilities of comprehensive technology stakes indicators (DWPP<sub>m</sub>, LCWPP<sub>m</sub>, OCWPP<sub>m</sub>, SCWPP<sub>m</sub>, IPC4WPP<sub>m</sub>, and IPC9WPP<sub>m</sub>) and specific technology stakes indicators (DSPP<sub>m</sub>, LCSPP<sub>m</sub>, OCSPP<sub>m</sub>, SCSPP<sub>m</sub>, IPC9SPP<sub>m</sub>, and IPC9NSPP<sub>m</sub>) upon three measurements on involvement of patent infringement.

Furthermore, we deploy two dummy variables that represent the difference indicators of comprehensive technology stakes between two parties (DVP<sub>1m</sub>, DVP<sub>2m</sub>, DVP<sub>3m</sub>, DVP<sub>4m</sub>, DVP<sub>5m</sub>, and DVP<sub>6m</sub>) and the difference indicators of specific technology stakes between two parties (dvp<sub>1m</sub>, dvp<sub>2m</sub>, dvp<sub>3m</sub>, dvp<sub>4m</sub>, dvp<sub>5m</sub>, and dvp<sub>6m</sub>), and examine the connection between the disparities of technology stakes with three measurements on involvement of

patent infringement, in which the difference of patent portfolio content will affect the percentage of becoming a plaintiff.

$$Y_{pm} = a_0 + a_1 X_m \quad (1_p)$$

$$Y_{pm} = a_0 + a_1 X_m + a_2 D_{jm} + a_3 d_{jm} \quad (2_p)$$

$$Y_{pm} = b_0 + b_1 x_m \quad (3_p)$$

$$Y_{pm} = b_0 + b_1 x_m + b_2 D_{jm} + b_3 d_{jm} \quad (4_p)$$

$$Y_p = TLP_m, TNPLP_m, TNILP_m$$

$$X_m = DWPP_m, LCWPP_m, OCWPP_m, SCWPP_m, IPC4WPP_m, IPC9WPP_m$$

$$x_m = DSPP_m, LCSPP_m, OCSPP_m, SCSPP_m, IPC9SPP_m, IPC9NSPP_m$$

$$D_{jm} = DVP_{1m}, DVP_{2m}, DVP_{3m}, DVP_{4m}, DVP_{5m}, DVP_{6m}$$

$$d_{jm} = dvp_{1m}, dvp_{2m}, dvp_{3m}, dvp_{4m}, dvp_{5m}, dvp_{6m}$$

$$m = 1 \dots 87 \quad j = 1 \dots 6$$

Table 2. List of Variables Used

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Explainable variables:	
TLD <sub>n</sub> :	the times of being a defendant
TNPLD <sub>n</sub> :	the number of involved patents when being a defendant
TNILD <sub>n</sub> :	the number of involved 4 IPC items when being a defendant
TLP <sub>m</sub> :	the times of being a plaintiff
TNPLP <sub>m</sub> :	the number of involved patents when being a plaintiff
TNILP <sub>m</sub> :	the number of involved 4 IPC items when being a plaintiff
Explanatory variables:	
1. Indicators of comprehensive technology stakes from defendants:	
DWPD:	The sum of all patents of defendant
OCWPD:	The sum of citations from other competitors to all patents of defendant
LCWPD:	The sum of citations from litigant competitors to all patents of defendant
SCWPD:	The sum of self citations to all patents of defendant
IPC4WPD:	The sum of 4 IPC items from all patents of defendant
IPC9WPD:	The sum of 9 IPC items from all patents of defendant
2. Dummy variable of comprehensive technology stakes from defendants:	
DVD <sub>1</sub>	= 1 if the sum of all patents of defendant is bigger than plaintiff
DVD <sub>2</sub>	= 1 if the sum of citations from other competitors to all patents of defendant is bigger than plaintiff
DVD <sub>3</sub>	= 1 if the sum of citations from litigant competitors to all patents of defendant is bigger than plaintiff
DVD <sub>4</sub>	= 1 if the sum of self citations to all patents of defendant is bigger than plaintiff
DVD <sub>5</sub>	= 1 if the sum of 4 IPC items from all patents of defendant is bigger than plaintiff



$DVD_6$  = 1 if the sum of 9 IPC items from all patents of defendant is bigger than plaintiff

3. Indicators of specific technology stakes from defendants:

DSPD: The sum of patents categorized as involved 4 IPC item of defendant

OCSPD: The sum of citations from other competitors to the patents categorized as involved 4 IPC of defendant

LCSPD: The sum of citations from litigant competitors to the patents categorized as involved 4 IPC of defendant

SCSPD: The sum of self citations to the patents categorized as involved 4 IPC of defendant

IPC9SPD: The sum of identical 9 IPC items categorized as involved 4 IPC item of defendant

IPC9NSPD: The sum of non-identical 9 IPC items categorized as involved 4 IPC item of defendant

4. Dummy variable of specific technology stakes from defendants:

$dvd_1$  = 1 if the sum of patents categorized as involved 4 IPC of defendant is bigger than plaintiff

$dvd_2$  = 1 if the sum of citations from other competitors to those patents categorized as involved 4 IPC of defendant is bigger than plaintiff

$dvd_3$  = 1 if the sum of citations from litigant competitors to those patents categorized as involved 4 IPC of defendant is bigger than plaintiff  
( litigant competitors )

$dvd_4$  = 1 if the sum of self citations to those patents categorized as involved 4 IPC of defendant is bigger than plaintiff

$dvd_5$  = 1 if the sum of identical 9 IPC items categorized as involved 4 IPC of defendant is bigger than plaintiff

$dvd_6$  = 1 if the sum of non-identical 9 IPC items categorized as involved 4 IPC of defendant is bigger than plaintiff

5. Indicators of comprehensive technology stakes from plaintiffs:

DWPP: The sum of all patents of plaintiff

OCWPP: The sum of citations from other competitors to all patents of plaintiff

LCWPP: The sum of citations from litigant competitors to all patents of plaintiff

SCWPP: The sum of self citations to all patents of plaintiff

IPC4WPP: The sum of 4 IPC items from all patents of plaintiff

IPC9WPP: The sum of 9 IPC items from all patents of plaintiff

6. Dummy variable of comprehensive technology stakes from plaintiff

$DVP_1$  = 1 if the sum of all patents of plaintiff is bigger than defendant

$DVP_2$  = 1 if the sum of citations from other competitors to all patents of plaintiff is bigger than defendant

$DVP_3$  = 1 if the sum of citations from litigant competitors to all patents of plaintiff is bigger than defendant

$DVP_4$  = 1 if the sum of self citations to all patents of plaintiff is bigger than defendant

$DVP_5$  = 1 if the sum of 4 IPC items from all patents of plaintiff is bigger than defendant

$DVP_6$  = 1 if the sum of 9 IPC items from all patents of plaintiff is bigger than defendant

7. Indicators of specific technology stakes from plaintiffs:

DSPP: The sum of patents categorized as involved 4 IPC item of plaintiff

OCSPP: The sum of citations from other competitors to the patents categorized as involved 4 IPC of plaintiff

LCSP: The sum of citations from litigant competitors to the patents categorized as involved 4 IPC of plaintiff

SCSPP: The sum of self citations to the patents categorized as involved 4 IPC of plaintiff

IPC9SPP: The sum of identical 9 IPC items categorized as involved 4 IPC item of plaintiff

IPC9NSPP: The sum of non-identical 9 IPC items categorized as involved 4 IPC item of plaintiff

8. Dummy variable of specific technology stakes from plaintiffs:

$dvp_1$  = 1 if the sum of patents categorized as involved 4 IPC item of plaintiff is bigger than defendant

$dvp_2$  = 1 if the sum of citations from other competitors to those patents categorized as involved 4 IPC of plaintiff is bigger than defendant

$dvp_3$  = 1 if the sum of citations from litigant competitors to those patents categorized as involved 4 IPC of plaintiff is bigger than defendant  
( litigant competitors )

$dvp_4$  = 1 if the sum of self citations to those patents categorized as involved 4 IPC of plaintiff is bigger than defendant

$dvp_5$  = 1 if the sum of identical 9 IPC items categorized as involved 4 IPC of plaintiff is bigger than defendant

$dvp_6$  = 1 if the sum of non-identical 9 IPC items categorized as involved 4 IPC of plaintiff is bigger than defendant

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Source : consolidated by this research

## Empirical Findings

### *Defendant's Part*

#### *Findings.*

Table 3 indicates that the explained variable is  $TLD_n$  being the number of defendants in semiconductor companies, and the P-value of comprehensive technology stakes indicators  $OCWPD_n$ ,  $LCWPD_n$ ,  $SCWPD_n$ , and  $IPC9WPD_n$  have achieved a level of significance while  $DWPD_n$  and  $IPC4WPD_n$  have failed to achieve a level of significance; however, the P-value of the involved technology stakes indicators  $DSPD_n$ ,  $OCSPD_n$ ,  $LCSPD_n$ ,  $SCSPD_n$ ,  $IPC9SPD_n$ , and  $IPC9NSPD_n$  have all achieved a level of significance. Comparing the determined coefficient between the two, the  $R^2$  value of  $DWPD_n$ ,  $OCWPD_n$ ,  $SCWPD_n$ ,  $IPC4WPD_n$ ,  $IPC9WPD_n$  to  $TLD_n$  except  $LCWPD_n$  are lower than the  $R^2$  value of the specific technology stakes indicators  $DSPD_n$ ,  $OCSPD_n$ ,  $SCSPD_n$ ,  $IPC9SPD_n$ ,  $IPC9NSPD_n$  to  $TLD_n$ . Adding on two-set dummy variables, the defendant's comprehensive technology stakes indicators and specific technology stakes indicators have nearly the same P-value significance level as  $TLD_n$  and similar strength level of explanation capability on the  $R^2$  value. The P-value of  $DVD_{2n}$  and  $dvd_{2n}$  have achieved a level of significance as to  $TLD_n$ , and the P-value of  $DVD_{1n}$ ,  $DVD_{5n}$ , and  $DVD_{6n}$  have also achieved a level of significance too.

Table 4 indicates that the explained variable is  $TNPLD_n$  the involved patents the defendant might be accused of using in semiconductor companies, and the P-value of comprehensive technology stakes indicators  $LCWPD_n$  and  $SCWPD_n$  have achieved a level of significance, while  $DWPD_n$ ,  $OCWPD_n$ ,  $IPC4WPD_n$  and  $IPC9WPD_n$  failed to achieve a level of significance; however, the P-value of the involved technology stakes indicators  $DSPD_n$ ,  $LCSPD_n$ ,  $OCSPD_n$ ,  $SCSPD_n$ ,  $IPC9SPD_n$ , and  $IPC9NSPD_n$  have all achieved a level of significance. Comparing the determined coefficient between the two, the  $R^2$  values of  $DWPD_n$ ,  $OCWPD_n$ ,  $SCWPD_n$ ,  $IPC4WPD_n$ ,  $IPC9WPD_n$  to  $TNPLD_n$ ,

except LCWPD<sub>n</sub>, are lower than the R<sup>2</sup> value of the specific technology stakes indicators DSPD<sub>n</sub>, OCSPD<sub>n</sub>, SCSPD<sub>n</sub>, IPC9SPD<sub>n</sub>, IPC9NSPD<sub>n</sub> to TNPLD<sub>n</sub>. Adding on two-set dummy variables, the defendant's comprehensive technology stakes indicators and specific technology stakes indicators have nearly the same P-value significance level as TNPLD<sub>n</sub> and a similar strength level of explanation capability on the R<sup>2</sup> value, in which the P-value of DVD<sub>2n</sub> and dvd<sub>2n</sub> have achieved a level of significance as to TNPLD<sub>n</sub>.

Table 3. TLD<sub>n</sub> with Comprehensive Technology Stakes & Specific Technology Stakes

	equation ( 1 <sub>D</sub> )		equation ( 2 <sub>D</sub> )			
	TLD <sub>n</sub>		TLD <sub>n</sub>			
	0.0129		0.0783			
DWPD	( 0.0001)		( 0.0001)	DVD <sub>1</sub> ( 0.4352)		dvd <sub>1</sub> ( 0.4691)
	0.3185		0.7442	0.0566 *		0.8768
	0.0389		0.1618			
OCWPD	( 0.0001)		( 0.0001)	DVD <sub>2</sub> ( 0.4258)		dvd <sub>2</sub> ( 0.4945)
	0.0813 *		0.2323	0.0014 **		0.0681 *
	0.1381		0.1690			
LCWPD	( 0.0011)		( 0.0011)	DVD <sub>3</sub> ( 0.3515)		dvd <sub>3</sub> ( 0.4553)
	0.0007 ***		0.0022 ***	0.1795		0.6442
	0.2603		0.2773			
SCWPD	( 0.0001)		( 0.0001)	DVD <sub>4</sub> ( 0.3628)		dvd <sub>4</sub> ( 0.4402)
	0.0001 ***		0.0001 ***	0.1884		0.4802
	0.0264		0.0731			
IPC4WPD	( 0.0056)		( 0.0063)	DVD <sub>5</sub> ( 0.4189)		dvd <sub>5</sub> ( 0.4617)
	0.1520		0.6855	0.0865 *		0.8696
	0.0676		0.1401			
IPC9WPD	( 0.0001)		( 0.0001)	DVD <sub>6</sub> ( 0.3911)		dvd <sub>6</sub> ( 0.4538)
	0.0206 **		0.2047	0.0597 *		0.6142
	equation ( 3 <sub>D</sub> )		equation ( 4 <sub>D</sub> )			
	TLD <sub>n</sub>		TLD <sub>n</sub>			
	0.2164		0.2309			
DSPD	( 0.0001)		( 0.0001)	DVD <sub>1</sub> ( 0.4065)		dvd <sub>1</sub> ( 0.4251)
	0.0001 ***		0.0001 ***	0.2501		0.6401
	0.2974		0.3708			
OCSPD	( 0.0001)		( 0.0001)	DVD <sub>2</sub> ( 0.3735)		dvd <sub>2</sub> ( 0.4189)
	0.0001 ***		0.0001 ***	0.0048 ***		0.0280 **
	0.0890		0.1219			
LCSPD	( 0.0020)		( 0.0020)	DVD <sub>3</sub> ( 0.3599)		dvd <sub>3</sub> ( 0.4733)
	0.0075 ***		0.0217 **	0.1364		0.8319
	0.5137		0.5305			
SCSPD	( 0.0001)		( 0.0001)	DVD <sub>4</sub> ( 0.2917)		dvd <sub>4</sub> ( 0.3472)
	0.0001 ***		0.0001 ***	0.1279		0.1997

	0.4486		0.4492			
IPC9SPD	( 0.0001)		( 0.0001)	DVD <sub>5</sub>	( 0.3056)	dvd <sub>5</sub> ( 0.3547)
	0.0001	***	0.0001	***	0.8815	0.8647
	0.0761		0.1496			
IPC9NSPD <sub>n</sub>	( 0.0001)		( 0.0001)	DVD <sub>6</sub>	( 0.3898)	dvd <sub>6</sub> ( 0.4420)
	0.0138	**	0.1187		0.0678	* 0.5647

upper: R<sup>2</sup>, middle: standard deviation in parentheses, lower: significance level \*p ≤ 0.1, \*\*p ≤ 0.05, \*\*\*p ≤ 0.01, one tail test

Table 4. TNPLD<sub>n</sub> with Comprehensive Technology Stakes & Specific Technology Stakes

	equation ( 1 <sub>D</sub> )		equation( 2 <sub>D</sub> )			
	TNPLD <sub>n</sub>		TNPLD <sub>n</sub>			
	0.0081		0.0139			
DWPD	( 0.0001)		( 0.0001)	DVD <sub>1</sub>	( 6.3937)	dvd <sub>1</sub> ( 1.6104)
	0.4298		0.5685		0.7322	0.5869
	0.0140		0.1139			
OCWPD	( 0.0001)		( 0.0001)	DVD <sub>2</sub>	( 1.8111)	dvd <sub>2</sub> ( 2.1029)
	0.2975		0.4915		0.0048	*** 0.0606
	0.1363		0.1690			
LCWPD	( 0.0049)		( 0.0049)	DVD <sub>3</sub>	( 1.4539)	dvd <sub>3</sub> ( 1.8830)
	0.0008	***	0.0024	***	0.1615	0.6573
	0.1985		0.2144			
SCWPD	( 0.0002)		( 0.0003)	DVD <sub>4</sub>	( 1.5645)	dvd <sub>4</sub> ( 1.8982)
	0.0001	***	0.0003	***	0.2252	0.4580
	0.0083		0.0634			
IPC4WPD	( 0.0237)		( 0.0265)	DVD <sub>5</sub>	( 1.7417)	dvd <sub>5</sub> ( 1.9196)
	0.4224		0.8983		0.1257	0.4620
	0.0292		0.0776			
IPC9WPD	( 0.0002)		( 0.0002)	DVD <sub>6</sub>	( 1.6755)	dvd <sub>6</sub> ( 1.9440)
	0.1317		0.4932		0.1224	0.7538
	equation ( 3 <sub>D</sub> )		equation ( 4 <sub>D</sub> )			
	TNPLD <sub>n</sub>		TNPLD <sub>n</sub>			
	0.1950		0.1980			
DSPD	( 0.0001)		( 0.0001)	DVD <sub>1</sub>	( 5.7673)	dvd <sub>1</sub> ( 1.4533)
	0.0001	***	0.0001	***	0.7816	0.6391
	0.1611		0.2304			
OCSPD	( 0.0001)		( 0.0001)	DVD <sub>2</sub>	( 1.7086)	dvd <sub>2</sub> ( 1.9160)
	0.0002	***	0.0009	***	0.0157	** 0.0332
	0.1154		0.1471			
LCSPD	( 0.0082)		( 0.0084)	DVD <sub>3</sub>	( 1.4670)	dvd <sub>3</sub> ( 1.9294)
	0.0021	***	0.0070	***	0.1293	0.8922
	0.4690		0.4871			
SCSPD	( 0.0003)		( 0.0004)	DVD <sub>4</sub>	( 1.2610)	dvd <sub>4</sub> ( 1.5013)
	0.0001	***	0.0001	***	0.1782	0.1437
	0.3807		0.3878			
IPC9SPD	( 0.0022)		( 0.0024)	DVD <sub>5</sub>	( 1.3326)	dvd <sub>5</sub> ( 1.5468)
	0.0001	***	0.0001	***	0.8114	0.3553
	0.0943		0.1258			
IPC9NSPD <sub>n</sub>	( 0.0004)		( 0.0004)	DVD <sub>6</sub>	( 1.6348)	dvd <sub>6</sub> ( 1.8537)
	0.0058	***	0.0344	**	0.1781	0.9083

upper: R<sup>2</sup>, middle: standard deviation in parentheses, lower: significance level \*p ≤ 0.1, \*\*p ≤ 0.05, \*\*\*p ≤ 0.01, one tail test

Table 5 indicates that the explained variable is  $TNILD_n$  the number of involved 4-digit IPC subclasses the defendant might be accused of using in semiconductor companies, and the P-value of comprehensive technology stakes indicators  $DWPD_n$ ,  $OCWPD_n$ ,  $LCWPD_n$ ,  $SCWPD_n$ , and  $IPC9WPD_n$  have achieved a level of significance, while  $IPC4WPD_n$  has failed to achieve a level of significance; however, the P-value of the involved technology stakes indicators  $DSPD_n$ ,  $LCSPD_n$ ,  $OCSPD_n$ ,  $SCSPD_n$ ,  $IPC9SPD_n$ , and  $IPC9NSPD_n$  have all achieved a level of significance. Comparing the determined coefficient between the two, the  $R^2$  values of  $DWPD_n$ ,  $OCWPD_n$ ,  $LCWPD_n$ ,  $SCWPD_n$ ,  $IPC4WPD_n$  and  $IPC9WPD_n$  to  $TNILD_n$  are all lower than the  $R^2$  values of the specific technology stakes indicators  $DSPD_n$ ,  $OCSPD_n$ ,  $SCSPD_n$ ,  $IPC9SPD_n$  and  $IPC9NSPD_n$  to  $TNILD_n$ . Adding on two-set dummy variables, the defendant's comprehensive technology stakes indicators and specific technology stakes indicators have nearly the same P-value significance level as  $TNILD_n$  and a similar strength level of explanation capability on the  $R^2$  value, in which the P-values of  $DVD_{2n}$  and  $dvd_{2n}$  have achieved a level of significance as to  $TNILD_n$ , and the P-values of  $DVD_{3n}$ ,  $DVD_{4n}$ ,  $DVD_{5n}$ ,  $DVD_{6n}$ ,  $dvd_{1n}$ ,  $dvd_{2n}$ , and  $dvd_{5n}$  have also achieved a level of significance too.

#### *Analyses*

Firstly, it does not matter that the explained variables  $TLD_n$ ,  $TNPLD_n$ , and  $TNILD_n$  are measured, our findings show that the defendants' comprehensive technology stakes indicators have a significant connection with three measurements on involvement of patent infringement. Hence, our sample has similar results to previous studies i.e., the P-value of  $DWPD_n$  (Lanjouw, J. O. and Shankerman, M. 2001a) , and the P-value of  $OCWPD_n$ ,  $LCWPD_n$ , and  $SCWPD_n$  (Somaya, D. 2003) attained a level of significance,

and uphold opinions about the relationship between comprehensive AS and the probabilities of patent litigation. However, the P-value of specific technology stakes indicators DSPD<sub>n</sub>, LCSPD<sub>n</sub>, OCSPD<sub>n</sub>, SCSPD<sub>n</sub>, IPC9SPD<sub>n</sub>, and IPC9NSPD<sub>n</sub> of the

Table 5. TNILD<sub>n</sub> with Comprehensive Technology Stakes & Specific Technology Stakes

	equation (1 <sub>D</sub> ) .		equation (2 <sub>D</sub> ) .			
	TNILD <sub>n</sub>		TNPID <sub>n</sub>			
	0.0404		0.0549			
DWPD	( 0.0001)		( 0.0001)		DVD <sub>1</sub> ( 3.2753)	dvd <sub>1</sub> ( 0.8250)
	0.0753 *		0.0612 *		0.4077	0.4691
	0.1251		0.2479			
OCWPD	( 0.0001)		( 0.0001)		DVD <sub>2</sub> ( 0.8731)	dvd <sub>2</sub> ( 1.0137)
	0.0013 ***		0.0008 ***		0.0031 ***	0.0019 ***
	0.0565		0.1064			
LCWPD	( 0.0026)		( 0.0026)		DVD <sub>3</sub> ( 0.7889)	dvd <sub>3</sub> ( 1.0217)
	0.0348 **		0.0803 *		0.0860 *	0.6672
	0.1593		0.1893			
SCWPD	( 0.0001)		( 0.0001)		DVD <sub>4</sub> ( 0.8316)	dvd <sub>4</sub> ( 1.0090)
	0.0002 ***		0.0032 ***		0.1091	0.6344
	0.0081		0.1390			
IPC4WPD	( 0.0124)		( 0.0133)		DVD <sub>5</sub> ( 0.8737)	dvd <sub>5</sub> ( 0.9630)
	0.4288		0.5255		0.0019 ***	0.0347 **
	0.1152		0.1495			
IPC9WPD	( 0.0001)		( 0.0001)		DVD <sub>6</sub> ( 0.8418)	dvd <sub>6</sub> ( 0.9767)
	0.0022 ***		0.0068 ***		0.0925 *	0.2642
	equation (3 <sub>D</sub> ) .		equation (4 <sub>D</sub> ) .			
	TNILD <sub>n</sub>		TNILD <sub>n</sub>			
	0.2812		0.3206			
DSPD	( 0.0001)		( 0.0001)		DVD <sub>1</sub> ( 2.7775)	dvd <sub>1</sub> ( 0.6999)
	0.0001 ***		0.0001 ***		0.3942	0.0543 *
	0.4625		0.5515			
OCSPD	( 0.0001)		( 0.0001)		DVD <sub>2</sub> ( 0.6824)	dvd <sub>2</sub> ( 0.7653)
	0.0001 ***		0.0001 ***		0.0068 ***	0.0002 ***
	0.0630		0.1096			
LCSPD	( 0.0044)		( 0.0045)		DVD <sub>3</sub> ( 0.7843)	dvd <sub>3</sub> ( 1.0315)
	0.0255 **		0.0685 *		0.0768 *	0.8297
	0.2612		0.2893			
SCSPD	( 0.0002)		( 0.0002)		DVD <sub>4</sub> ( 0.7767)	dvd <sub>4</sub> ( 0.9247)
	0.0001 ***		0.0001 ***		0.0931 *	0.5128
	0.6443		0.6953			
IPC9SPD	( 0.0008)		( 0.0008)		DVD <sub>5</sub> ( 0.4919)	dvd <sub>5</sub> ( 0.5709)
	0.0001 ***		0.0001 ***		0.2661	0.0006 ***
	0.2860		0.3120			
IPC9NSPD <sub>n</sub>	( 0.0002)		( 0.0002)		DVD <sub>6</sub> ( 0.7589)	dvd <sub>6</sub> ( 0.8605)
	0.0001 ***		0.0001 ***		0.1368	0.1627

upper: R<sup>2</sup>, middle: standard deviation in parentheses, lower: significance level \*p ≤ 0.1, \*\*p ≤ 0.05, \*\*\*p ≤ 0.01, one tail test

defendants all attained a level of significance, in which, our specific AS has a more striking correlation with the probabilities of patent litigation than comprehensive AS. Then, comparing the explanatory capabilities of two kinds of technology stakes indicators with three measurements on involvement of patent infringement  $TLD_n$ ,  $TNPLD_n$ , and  $TNILD_n$ , the  $R^2$  value of the specific technology stakes indicators  $DSPD_n$ ,  $OCSPD_n$ ,  $SCSPD_n$ ,  $IPC9SPD_n$ , and  $IPC9NSPD_n$  is larger than all the technology stakes indicators  $DWPD_n$ ,  $LCWPD_n$ ,  $OCWPD_n$ ,  $SCWPD_n$ ,  $IPC4WPD_n$ , and  $IPC9WPD_n$ . And, according to the results, after adding two-set dummy variables, the former is still better than the latter; therefore this research claims that to measure the probability of lawsuits which defendants pursue to the end, defendants' specific technology stakes indicators are better than defendants' comprehensive technology stakes indicators. This finding supports  $H_1$ .

In the empirical results of the defendants' part listed in tables 3, 4, and 5, we could further observe explanatory capabilities of two kinds of defendants' technology stakes indicators upon three measurements on involvement of patent infringement. As we and the plaintiffs are eager to gauge the competence of defendants to fight against lawsuits to the end, it does not matter that the explained variables are measured by  $TLD_n$ ,  $TNPLD_n$ , and  $TNILD_n$ . Among the comprehensive technology stakes indicators, the  $R^2$  value of technology stakes depth indicators  $LCWPD_n$ ,  $OCWPD_n$ , and  $SCWPD_n$  reported the utmost level of significance, followed by the technology stakes width indicators  $IPC4WPD_n$  and  $IPC9WPD_n$  and the technology stakes density indicator  $DWPD_n$ . Among the specific technology stakes, the  $R^2$  value of technology stakes depth indicators  $LCSPD_n$ ,  $OCSPD_n$ , and  $SCSPD_n$  reported the utmost level of significance, followed by the technology stakes width indicators  $IPC9SPD_n$  and  $IPC9NSPD_n$  and the technology

stakes density indicator  $DSPD_n$ . The  $R^2$  value of two kinds of defendants' technology stakes indicators reveal that the technology stakes depth indicators will mostly affect defendants who pursue lawsuits to the end. In other words, the depth of defendants' patent portfolio in the involved technology fields has the most significant connection with the capability and intention of defendants to pursue patent lawsuits to the end. This is followed by the technology stakes width indicators, and, finally, the technology stakes density indicators.

Secondly, we must add on a linear regression equation with two-set dummy variables to analyze the differences of comprehensive technology stakes and the differences of specific technology stakes between plaintiffs and defendants, and to evaluate the correlation between the two dummy variables and the probability of defendants' insistence on filing a lawsuit. Among the comprehensive technology stakes difference indicators, the P-value of technology stakes depth difference indicators  $DVD_{2n}$ ,  $DVD_{3n}$ , and  $DVD_{4n}$  reported the utmost level of significance, followed by technology stakes width difference indicators  $DVD_{5n}$ ,  $DVD_{6n}$ , and technology stakes density difference indicator  $DVD_{1n}$ . Among the specific technology stakes, the P-value of technology stakes depth difference indicators,  $dvd_{2n}$ , reported the utmost level of significance, followed by technology stakes width difference indicator  $dvd_{5n}$  and technology stakes density difference indicator  $dvd_{1n}$ . This research claims that the attributes that drive defendants to file lawsuits to the end in patent litigations is normally subject to the difference in depth of technology stakes between plaintiffs and defendants and the difference of forward citation numbers from other competitors on defendants' patents, except the plaintiffs of  $DVD_{2n}$  and  $dvd_{2n}$  in particular. In other words, technology



stakes depth difference between plaintiffs and defendants and a gap in other competitors' recognition and acknowledgement, will affect the defendants more in filing lawsuits to the end. However, the width difference of technology stakes between plaintiffs and defendants, will possibly affect whether the defendant files a patent lawsuit to the end, especially when defendants' patent infringement cases are more involved with 4-digit IPC subclasses and will be subject to the influence of width difference of technology stakes between two parties, i.e., it will be subject to the impact of width difference of the technology portfolio. The density difference of technology stakes between two parties has a low correlation among the three measurements on involvement of patent infringement and signifies that the defendant is likely to pursue a lawsuit to the end. The technology stakes differences of patent portfolio can also be regarded as defendants' determinants of sticking with the patent lawsuit to the end, in which are technology stakes density, depth, and width difference of patent portfolio between plaintiffs and defendants. The density difference of technology stakes between two parties, i.e. the difference in the number of patents between two parties, does not represent a real gap in technology stakes between plaintiffs and defendants, but technology stakes depth and width difference affect the capability and intention of defendants to pursue patent lawsuit to the end. Although the number of some defendants' patents was far lower than that of plaintiffs, the defendants still pursued patent lawsuits to the end. This finding also supports H<sub>2</sub>.

We further explain the results of the P-value of the density difference indicators in specific patent portfolio  $dvp_{1m}$ , the depth difference indicators in specific patent portfolios  $dvp_{2m}$ ,  $dvp_{3m}$ , and  $dvp_{4m}$ , and the width difference indicators in specific patent portfolios  $dvp_{5m}$  and  $dvp_{6m}$ . When the explained variable is  $TLD_n$  in Table 3, in which the

depth difference of a specific patent portfolio of a defendant is higher than that of a plaintiff, the more competent the defendant is to fight against a patent infringement lawsuit to the end. When the explained variable is  $TNPLD_n$  in Table 4, in which the depth difference of a specific patent portfolio of a defendant is higher than that of the plaintiff, the more competent the defendant is to fight against a patent infringement lawsuit to the end. Plaintiffs even accuse defendants of infringing too many patents in patent infringement cases. This means that the higher the depth difference of a specific patent portfolio is between a defendant and a plaintiff, the more competent the defendant will be to cope with the multi-patents infringement lawsuit strategies of the plaintiff. When the explained variable is  $TNILD_n$  in Table 5, in which the higher the depth difference and width difference of a specific patent portfolio between a defendant and a plaintiff is, the more competent the defendant will be to fight against a patent infringement lawsuit to the end, even if the plaintiff accuses the defendant of overstepping more 4-digit IPC subclasses in patent infringement cases. This means that the higher the depth difference and width difference of a defendant's and plaintiff's specific patent portfolio is, the more competent the defendant will be to cope with the plaintiff's multi 4-digit IPC subclasses infringement lawsuit strategy.

#### *Plaintiff Part*

##### *Findings.*

Table 6 indicates that the explained variable is  $TLP_m$  being the number of plaintiffs in semiconductor companies, and the P-value of comprehensive technology stakes indicators  $LCWPP_m$  have achieved a level of significance while  $DWPP_m$ ,  $OCWPP_m$ ,  $SCWPP_m$ ,  $IPC4WPP_m$ , and  $IPC9WPP_m$  failed to achieve a level of

significance. However, the P-values of the involved technology stakes indicators  $DSPP_m$ ,  $LCSP_m$ ,  $OCSPP_m$ ,  $SCSP_m$ ,  $IPC9SPP_m$ , and  $IPC9NSPP_m$  have all achieved a level of significance. Comparing the determined coefficient between the two, the  $R^2$  values of  $DWPP_m$ ,  $OCWPP_m$ ,  $SCWPP_m$ ,  $IPC4WPP_m$ , and  $IPC9WPP_m$  (except  $LCWPP_m$ ) are lower than the  $R^2$  value of the specific technology stakes indicators  $DSPP_m$ ,  $OCSPP_m$ ,  $SCSP_m$ ,  $IPC9SPP_m$ ,  $IPC9NSPP_m$  to  $TLP_m$ . Adding on two-set dummy variables, the plaintiff's comprehensive technology stakes indicators and specific technology stakes indicators have nearly the same P-value significance level as  $TLP_m$  and similar strength level of explanation capability on the  $R^2$  value. The P-value of  $DVP_{1m}$ ,  $dvp_{1m}$ ,  $DVP_{5m}$ ,  $dvp_{5m}$ ,  $DVP_{6m}$ , and  $dvp_{6m}$  have also achieved a level of significance.

Table 7 indicates that the explained variable is  $TNPLP_m$ , the involved patents the plaintiffs might accuse the defendant of using in semiconductor companies, and the P-value of indicators  $DSPP_m$ ,  $LCSP_m$ ,  $OCSPP_m$ ,  $SCSP_m$ ,  $IPC9SPP_m$ ,  $IPC9NSPP_m$  to  $TNPLP_m$ . Adding on two-set dummy variables, the plaintiff's comprehensive technology stakes indicators and specific technology stakes indicators have nearly the same P-value significance level as  $TNPLP_m$  and a similar strength level of explanation capability on the  $R^2$  value. The P-value of  $DVP_{1m}$ ,  $dvp_{1m}$ ,  $dvp_{2m}$ ,  $dvp_{3m}$ ,  $DVP_{5m}$ ,  $dvp_{5m}$ , and  $dvp_{6m}$  have achieved a level of significance as to  $TNPLP_m$ .

Comprehensive technology stakes indicators  $LCWPP_m$  has achieved a level of significance, while  $DWPP_m$ ,  $OCWPP_m$ ,  $SCWPP_m$ ,  $IPC4WPP_m$ , and  $IPC9WPP_m$  have failed to achieve a level of significance. However, the P-value of the involved technology stakes indicators  $DSPP_m$ ,  $LCSP_m$ ,  $OCSPP_m$ ,  $SCSP_m$ ,  $IPC9SPP_m$ , and  $IPC9NSPP_m$  have all achieved a level of significance. Comparing the determined coefficient between the

Table 6.  $TLP_m$  with Comprehensive Technology Stakes & Specific Technology Stakes

	equation( 1p)		equation ( 2p)			
	TLP <sub>m</sub>		TLP <sub>m</sub>			
DWPP	0.0012		0.1178			
	( 0.0001)		( 0.0001)		DVP <sub>1</sub> ( 0.3770)	dvp <sub>1</sub> ( 0.3568)
	0.7463		0.7249		0.0249 **	0.0014 ***
OCWPP	0.0049		0.0446			
	( 0.0001)		( 0.0001)		DVP <sub>2</sub> ( 0.3952)	dvp <sub>2</sub> ( 0.3715)
	0.5179		0.9813		0.9032	0.1290
LCWPP	0.1331		0.1736			
	( 0.0001)		( 0.0001)		DVP <sub>3</sub> ( 0.3017)	dvp <sub>3</sub> ( 0.3134)
	0.0005 ***		0.0018 ***		0.1675	0.6478
SCWPP	0.0211		0.0429			
	( 0.0001)		( 0.0001)		DVP <sub>4</sub> ( 0.1098)	dvp <sub>4</sub> ( 0.3394)
	0.1818		0.5730		0.7755	0.3237
IPC4WPP	0.0005		0.1158			
	( 0.0023)		( 0.0023)		DVP <sub>5</sub> ( 0.3000)	dvp <sub>5</sub> ( 0.3261)
	0.8270		0.6850		0.0289 **	0.0024 ***
IPC9WPP	0.0005		0.0790			
	( 0.0001)		( 0.0001)		DVP <sub>6</sub> ( 0.3548)	dvp <sub>6</sub> ( 0.3469)
	0.8341		0.7533		0.0729 *	0.0113 **
	equation( 3p)		equation ( 4p)			
	TLP <sub>m</sub>		TLP <sub>m</sub>			
DSPP	0.0624		0.1759			
	( 0.0001)		( 0.0001)		DVP <sub>1</sub> ( 0.3550)	dvp <sub>1</sub> ( 0.3467)
	0.0202 **		0.0171 **		0.0035 ***	0.0026 ***
OCSPP	0.1545		0.1781			
	( 8.6270)		( 9.2800)		DVP <sub>2</sub> ( 0.3488)	dvp <sub>2</sub> ( 0.3448)
	0.0001 ***		0.0004 ***		0.2771	0.1311
LCSPP	0.1138		0.1571			
	( 0.0007)		( 0.0006)		DVP <sub>3</sub> ( 0.4271)	dvp <sub>3</sub> ( 0.1580)
	0.0014 ***		0.0045 ***		0.1647	0.6187
SCSPP	0.1255		0.1378			
	( 0.0001)		( 0.0001)		DVP <sub>4</sub> ( 0.3449)	dvp <sub>4</sub> ( 0.3242)
	0.0008 ***		0.0029 ***		0.7148	0.2988
IPC9SPP	0.3375		0.3935			
	( 0.0004)		( 0.0004)		DVP <sub>5</sub> ( 0.2436)	dvp <sub>5</sub> ( 0.2826)
	0.0001 ***		0.0001 ***		0.0076 ***	0.0032 ***
IPC9NSPP	0.0657		0.1376			
	( 0.0001)		( 0.0001)		DVP <sub>6</sub> ( 0.3318)	dvp <sub>6</sub> ( 0.3412)
	0.0171 **		0.0194 **		0.0153 **	0.0438 **

upper: R<sup>2</sup>, middle : standard deviation in parentheses, lower: significance level \*p ≤ 0.1, \*\*p ≤ 0.05, \*\*\*p ≤ 0.01, one tail test

two, the R<sup>2</sup> value of DWPP<sub>m</sub>, OCWPP<sub>m</sub>, SCWPP<sub>m</sub>, IPC4WPP<sub>m</sub>, IPC9WPP<sub>m</sub> to TNPLP<sub>m</sub> (but not LCWPP<sub>m</sub>) are lower than the R<sup>2</sup> value of the specific technology stakes Table 8 indicates that the explained variable is TNILP<sub>m</sub>, the number of involved 4-digit IPC subclasses that the plaintiff might accuse the defendant of using in semiconductor

companies, and the P-value of comprehensive technology stakes indicator  $LCWPP_m$  has achieved a level of significance, while  $DWPP_m$ ,  $OCWPP_m$ ,  $SCWPP_m$ ,  $IPC4WPP_m$ , and  $IPC9WPP_m$  have failed to achieve a level of significance; however, the P-value of the involved technology stakes indicators  $DSPP_m$ ,  $LCSPP_m$ ,  $OCSPP_m$ ,  $SCSPP_m$ ,  $IPC9SPP_m$ , and  $IPC9NSPP_m$  have all achieved a level of significance. Comparing the determined coefficient between the two, the  $R^2$  value of  $DWPP_m$ ,  $OCWPP_m$ ,  $SCWPP_m$ ,  $IPC4WPP_m$ , and  $IPC9WPP_m$  to  $TNPLP_m$  (except  $LCWPP_m$ ) are all lower than the  $R^2$  value of the specific technology stakes indicators  $DSPP_m$ ,  $OCSPP_m$ ,  $SCSPP_m$ ,  $IPC9SPP_m$ , and  $IPC9NSPP_m$  to  $TNPLP_m$ . Adding on two-set dummy variables, the plaintiff's comprehensive technology stakes indicators and specific technology stakes indicators have nearly the same P-value significance level as  $TNPLP_m$  and a similar strength level of explanation capability on the  $R^2$  value in which the P-values of  $DVP_{1m}$ ,  $dvp_{1m}$ ,  $DVP_{2m}$ ,  $dvp_{2m}$ ,  $DVP_{5m}$ ,  $dvp_{5m}$ ,

Table 7.  $TNPLP_m$  with Comprehensive Technology Stakes & Specific Technology Stakes

	equation ( 1 <sub>p</sub> )		equation ( 2 <sub>p</sub> )		
	$TNPLP_m$	$TNPLP_m$			
	0.0018				
DWPP	( 0.0001)	( 0.0001)	$DVP_1$ ( 1.8033)	$dvp_1$ ( 1.7070)	
	0.6923	0.6291	0.1726	0.0296	**
	0.0001	0.0362			
OCWPP	( 0.0001)	( 0.0001)	$DVP_2$ ( 1.8376)	$dvp_2$ ( 1.7275)	
	0.9952	0.7876	0.5199	0.095	*
	0.0633	0.1041			
LCWPP	( 0.0008)	( 0.0008)	$DVP_3$ ( 1.5105)	$dvp_3$ ( 1.4545)	
	0.0193	0.0267	0.2973	0.0568	*
	0.0105	0.0164			
SCWPP	( 0.0002)	( 0.0002)	$DVP_4$ ( 1.8028)	$dvp_4$ ( 1.6048)	
	0.3458	0.5201	0.8594	0.5064	
	0.0011	0.1038			
IPC4WPP	( 0.0106)	( 0.0108)	$DVP_5$ ( 1.3985)	$dvp_5$ ( 1.5199)	
	0.7579	0.6942	0.0256	0.0056	***
	0.0031	0.0417			
IPC9WPP	( 0.0001)	( 0.0001)	$DVP_6$ ( 1.6756)	$dvp_6$ ( 1.6384)	
	0.6095	0.4762	0.3445	0.0726	*

	equation ( 3 <sub>p</sub> )		equation ( 4 <sub>p</sub> )			
	TNILP <sub>m</sub>		TNILP <sub>m</sub>			
	0.0340	0.0865				
DSPP	( 0.0001)	( 0.0001)	DVP <sub>1</sub>	( 1.7306)	dvp <sub>1</sub>	( 1.6901)
	0.0891 *	0.0988 *		0.0603 *		0.0454 **
	0.0552	0.0878				
OCSP	( 0.0001)	( 0.0001)	DVP <sub>2</sub>	( 1.7014)	dvp <sub>2</sub>	( 1.6815)
	0.0293 **	0.0326 **		0.1685		0.1016 *
	0.0402	0.0825				
LCSP	( 0.0010)	( 0.0010)	DVP <sub>3</sub>	( 1.5279)	dvp <sub>3</sub>	( 1.4718)
	0.0639 *	0.0851 *		0.3364		0.0556 *
	0.0865	0.0939				
SCSP	( 0.0003)	( 0.0003)	DVP <sub>4</sub>	( 1.6371)	dvp <sub>4</sub>	( 1.5386)
	0.0059 ***	0.0076 ***		0.4605		0.4850
	0.2971	0.3558				
IPC9SPP	( 0.0022)	( 0.0023)	DVP <sub>5</sub>	( 1.1622)	dvp <sub>5</sub>	( 1.3484)
	0.0001 ***	0.0001 ***		0.0076 ***		0.0258 **
	0.0465	0.0776				
IPC9NSPP	( 0.0004)	( 0.0004)	DVP <sub>6</sub>	( 1.5886)	dvp <sub>6</sub>	( 1.6340)
	0.0461 **	0.0572 **		0.1172		0.2024

upper: R<sup>2</sup>, middle: standard deviation in parentheses, lower: significance level \*p ≤ 0.1, \*\*p ≤ 0.05, \*\*\*p ≤ 0.01, one tail test

DVP<sub>6m</sub>, and dvp<sub>6m</sub> have achieved a level of significance as to TNILP<sub>m</sub>, and the P-value of dvp<sub>4m</sub> has also achieved.

Table 8. TNILP<sub>m</sub> with Comprehensive Technology Stakes & Specific Technology Stakes

	Equation (1 <sub>p</sub> )		Equation (2 <sub>p</sub> )			
	TNILP <sub>m</sub>		TNILP <sub>m</sub>			
	0.0026	0.0811				
DWPP	( 0.0001)	( 0.0001)	DVP <sub>1</sub>	( 0.9889)	dvp <sub>1</sub>	( 0.9360)
	0.6399	0.7650		0.1029 *		0.0097 ***
	0.0218	0.0765				
OCWPP	( 0.00001)	( 0.00001)	DVP <sub>2</sub>	( 0.9986)	dvp <sub>2</sub>	( 0.9388)
	0.1748	0.2703		0.2167		0.0304 **
	0.3411	0.3615				
LCWPP	( 0.0003)	( 0.0003)	DVP <sub>3</sub>	( 0.7080)	dvp <sub>3</sub>	( 0.6817)
	0.000001 ***	0.000001 ***		0.5113		0.1141
	0.0115	0.0717				
SCWPP	( 0.0001)	( 0.0001)	DVP <sub>4</sub>	( 0.9723)	dvp <sub>4</sub>	( 0.8655)
	0.3252	0.6258		0.4302		0.0263 **
	0.0002	0.0831				
IPC4WPP	( 0.0059)	( 0.0060)	DVP <sub>5</sub>	( 0.7853)	dvp <sub>5</sub>	( 0.8535)
	0.8757	0.9626		0.0832 *		0.0099 ***
	0.0056	0.0925				
IPC9WPP						

	( 0.00007)	( 0.00008)	DVP <sub>6</sub> ( 0.9052)	dvp <sub>6</sub> ( 0.8851)
	0.4902	0.4027	0.0195 ***	0.0140 ***
	equation ( 3 <sub>p</sub> ) .		equation ( 4 <sub>p</sub> ) .	
	TNILP <sub>m</sub>	TNILP <sub>m</sub>		
	0.0804	0.1490		
DSPP	( 0.00005)	( 0.00005)	DVP <sub>1</sub> ( 0.9273)	dvp <sub>1</sub> ( 0.9056)
	0.0081 ***	0.0117 **	0.0334 **	0.0159 **
	0.1145	0.1663		
OCSPP	( 0.00002)	( 0.00002)	DVP <sub>2</sub> ( 0.9030)	dvp <sub>2</sub> ( 0.8925)
	0.0014 ***	0.0019 ***	0.0865 *	0.0293 **
	0.2795	0.3019		
LCSPP	( 0.0004)	( 0.0005)	DVP <sub>3</sub> ( 0.7399)	dvp <sub>3</sub> ( 0.7127)
	0.000001 ***	0.000001 ***	0.5967	0.1188
	0.0377	0.0968		
SCSPP	( 0.0001)	( 0.0002)	DVP <sub>4</sub> ( 0.9074)	dvp <sub>4</sub> ( 0.8528)
	0.0731 *	0.1162	0.2669	0.0237 **
	0.5833	0.6189		
IPC9SPP	( 0.0009)	( 0.0010)	DVP <sub>5</sub> ( 0.4962)	dvp <sub>5</sub> ( 0.5758)
	0.000001 ***	0.000001 ***	0.0107 ***	0.0521 *
	0.1811	0.2770		
IPC9NSPP	( 0.0002)	( 0.0002)	DVP <sub>6</sub> ( 0.7808)	dvp <sub>6</sub> ( 0.8031)
	0.00004 ***	0.00001 ***	0.0014 ***	0.0695 *

upper: R<sup>2</sup>, middle: standard deviation in parentheses, lower: significance level \*p ≤ 0.1, \*\*p ≤ 0.05, \*\*\*p ≤ 0.01, one tail test

### Analyses.

Firstly, it does not matter that the explained variables measured are TLP<sub>m</sub>, TNPLP<sub>m</sub>, and TNILP<sub>m</sub>, our findings manifest that plaintiffs' comprehensive technology stakes indicators have a significant connection with three measurements involving patent infringement. Hence, our sample has a similar result to previous studies i.e., the P-value of LCWPP<sub>m</sub> [9,10] attained a level of significance, and upholds their opinions about the relationship between comprehensive AS and the probabilities of patent litigation. However, the P-value of the specific technology stakes indicators DSPP<sub>m</sub>, LCSPP<sub>m</sub>, OCSPP<sub>m</sub>, SCSPP<sub>m</sub>, IPC9SPP<sub>m</sub>, and IPC9NSPP<sub>m</sub> of the plaintiffs all attained a level of significance, in which our specific AS has a more striking correlation with the probabilities of patent litigation than comprehensive AS. Then, comparing the explanatory capabilities of two kinds of technology stakes indicators upon three

measurements on patent infringement,  $TLP_m$ ,  $TNPLP_m$ , and  $TNILP_m$ , the  $R^2$  value of the specific technology stakes indicators  $DSPP_m$ ,  $OCSPP_m$ ,  $SCSPP_m$ ,  $IPC9SPP_m$ , and  $IPC9NSPP_m$  is larger than the comprehensive technology stakes indicators  $DWPP_m$ ,  $OCWPP_m$ ,  $SCWPP_m$ ,  $IPC4WPP_m$ , and  $IPC9WPP_m$ . And, according to the result after adding two-set dummy variables, the former is still better than the latter, therefore this research claims that it is better to measure the probability of lawsuits that plaintiffs pursue to the end with plaintiffs' specific technology stakes indicators rather than with plaintiffs' comprehensive technology stakes indicators. This finding supports  $H_3$ .

In the empirical results of the plaintiff part listed in tables 6, 7, and 8, we can further observe the explanatory capabilities of two kinds of plaintiffs' technology stakes indicators upon three measurements involving patent infringement. Just as we or defendants are eager to gauge the competence of plaintiffs in pursuing their lawsuits to the end, it does not matter that the explained variables are measured by  $TLP_m$ ,  $TNPLP_m$ , and  $TNILP_m$ . Among the comprehensive technology stakes indicators, the  $R^2$  value of technology stakes depth indicators  $LCWPP_m$ ,  $OCWPP_m$ , and  $SCWPP_m$  reported the utmost level of significance, followed by technology stakes width indicators  $IPC4WPP_m$  and  $IPC9WPP_m$  and technology stakes density indicator  $DWPP_m$ . However, the five indicators for comprehensive technology stakes have not attained a level of significance, except for  $LCWPP_m$ . Among the specific technology stakes, the  $R^2$  value of technology stakes width indicators  $IPC9SPP_m$  and  $IPC9NSPP_m$  reported the utmost level of significance, followed by technology stakes depth indicators  $LCSPP_m$ ,  $OCSPP_m$ , and  $SCSPP_m$ , and technology stakes density indicator  $DSPP_m$ . The  $R^2$  value of two kinds of plaintiffs' technology stakes indicators reveal that the technology stakes width indicators



will affect the plaintiffs mostly on pursuing lawsuits to the end. In other words, the width of plaintiffs' patent portfolio in the involved technology fields has the most significant connection with the capability and intention of plaintiffs to file patent lawsuits to the end, followed by the technology stakes depth indicators, and, finally, the technology stakes density indicators.

Second, the linear regression equation with the two-set dummy variables must be added to analyze the differences of comprehensive technology stakes and the differences of specific technology stakes between plaintiff and defendant, to evaluate the correlation between the two technology stakes difference indicators with the probability of plaintiff's insistence on pursuing a lawsuit among the three indicators in patent litigations. Among the comprehensive technology stakes difference indicators, the P-value of technology stakes width difference indicators  $DVP_{5m}$  and  $DVP_{6m}$  reported the utmost level of significance, followed by the technology stakes density difference indicators  $DVP_{1m}$ , and the technology stakes depth difference indicators  $DVP_{2m}$ ,  $DVP_{3m}$ , and  $DVP_{4m}$ . Among the specific technology stakes difference indicators, the P-value of the technology stakes density difference indicator  $dvp_{1m}$  reported the utmost level of significance, followed by the technology stakes width difference indicators  $dvp_{5m}$  and  $dvp_{6m}$  and technology stakes depth difference indicators  $dvp_{2m}$ ,  $dvp_{3m}$  and  $dvp_{4m}$  at the end. However, the six indicators for specific technology stakes differences have all attained a level of significance, but not all of the comprehensive technology stakes difference indicators. According to the above result, this research claims that the reason why plaintiffs pursue lawsuits to the end in patent litigations is different to those defendants consider – the depth difference of the technology stakes between the two parties – and whether the plaintiff has

comprehensively looked at every aspect in evaluating the pursuit of a lawsuit to its conclusion, in which the density, depth, and width differences of the technology stakes between the plaintiff and defendant has to be considered. Especially, the density difference of technology stakes in specific technology fields between the  $dvp_{1m}$  of plaintiff and defendant. The greater the number of patents involved in patent infringement cases, where the plaintiff decides to pursue a lawsuit to the end, will also be subject to the impact of the depth difference of technology stakes between the two parties, i.e. it will be subject to the impact of difference in the number of citations involving the technology portfolio between plaintiffs and defendants. This finding also supports  $H_4$ .

We further explain plaintiffs' P-value of the density difference indicators in the specific patent portfolio  $dvp_{1m}$ , the depth difference indicators in the specific patent portfolio  $dvp_{2m}$ ,  $dvp_{3m}$ , and  $dvp_{4m}$ , and the width difference indicators in the specific patent portfolio  $dvp_{5m}$  and  $dvp_{6m}$ . When the explained variable is  $TLP_m$  in Table 6, in which the density difference and width difference of the specific patent portfolio of the plaintiffs is higher than those of the defendants, the more competent plaintiffs will be to pursue a patent infringement lawsuit to the end. When the explained variables are  $TNPLP_m$  and  $TNILP_m$  in tables 7 and 8, in which the density difference, depth difference, and width difference of the specific patent portfolio of the plaintiffs are higher than those of the defendants, the more competent the plaintiffs will be to pursue a patent infringement lawsuit to the end. Furthermore, plaintiffs will accuse defendants of overstepping more patents or more 4-digit IPC subclasses in patent infringement cases. This means that when the density difference, depth difference, and width difference of a

specific patent portfolio of plaintiffs are higher than those of defendants, the more probable plaintiffs are to use a multi-patents or multi-4-digit IPC subclasses infringement lawsuit strategy.

The below two-set virtual variables are to measure the correlation among the three quantity indicators that plaintiffs and defendants are prone to file lawsuits to the end, in which the defendant reported different empirical results from the plaintiff. This could be explained by the fact that the plaintiff, as the one who initiates the litigation procedure in patent litigation, will carefully consider the intensity, depth, and width differences of technology stakes between the plaintiffs and defendants when evaluating the necessity of pursuing a lawsuit to the end. The samples of this research indicated a dissimilar impact on the competence and will of defendants to fight against litigation lawsuits to the end.

#### Conclusion

This research examined previous studies with three quantity indicators that have been applied to U.S. federal district court trials: the number of involved litigations, the number of involved patents, and the number of involved 4-digit IPC subclasses among the patent infringement litigations. These were regarded as explained variables that plaintiffs and defendants were prone to go to district court trial to file a lawsuit in patent litigation, and to compare the comprehensive technology stakes indicators of defendants and plaintiffs introduced by the previous Literature and specific technology stakes indicators adopted by this research. Comparing the correlation between the two kinds of independent variables and explained variables, the empirical results indicated that the latter reported a better explanatory capability and a significance level more striking than the independent variables. To elaborate further, this research regarded the specific

technology stakes indicators of involved patents as more useful technology strength indicators of patent portfolios of defendants and plaintiffs when facing several inevitable lawsuit decisions. This research has discovered that irrespective of the observations on the defendants or plaintiffs, when evaluating whether the plaintiff or defendant will pursue a patent litigation lawsuit to the end in a district court trial, scrutinizing the two parties' specific technology stakes indicators of patent portfolio will be more appropriate than gauging the comprehensive technology stakes indicators adopted previously.

It further observes the difference of patent portfolios in specific technology fields between plaintiffs and defendants, i.e. a comparison of the density, depth, and width differences etc. of patent portfolios in specific technology fields between the two parties. Whether there is any correlation with the possibility of filing patent litigation lawsuits to the end for plaintiffs and defendants in a district court trial, this research found there are different empirical results between plaintiffs and defendants. As the plaintiff is the one who launches the litigation procedure, it will certainly have a more comprehensive consideration as to the density, depth, and width differences of patent portfolios of plaintiffs and defendants in evaluating whether there is a necessity to pursue a lawsuit to the end. Conversely, what makes the defendant as the reactive party go on fighting against plaintiffs in a patent litigation is the depth difference of technology stakes between the two parties, in which the plaintiff is hard to control within a short time. As to density and width differences of technology stakes between plaintiffs and defendants, this research sample indicated less impact on the competence and will of the defendant in filing a lawsuit to the end.

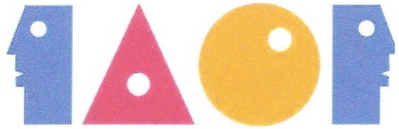
This article aimed to explore the correlation among the three characteristics of patent portfolios and the possibilities of patent litigation. However, the research is limited by the difficulty in defining the various patent portfolio methods adopted among current technology competitors such as “Ad hoc blocking,” “Strategic patent searching,” “Blanketing,” “Fencing,” “Surrounding,” and “Combination” types etc. (Granstrand, O. 1999) . If we are simply using the database adopted by this research, it seems hard to clearly define a complex portfolio structure of patent portfolios between the plaintiff and defendant, to further define which patent portfolio method Granstrand proposed between the plaintiff and defendant, or to analyze and compare whether there is a correlation in terms of the possibility of filing lawsuits of patent litigation between the plaintiff and defendant for each patent portfolio mentioned above. However, we expect that later research will resolve these limitations on the research to unveil the mystery of various patent portfolios among technology competitors through case studies or field interviews.

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TALENT MANAGEMENT:  
QUANTITATIVE AND QUALITATIVE STUDIES OF HR  
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Abstract

This study (1) investigated Thai human resource (HR) practitioners' perspectives on talent management in terms of their definition and understanding; and (2) proposed key factors that influence effective talent management in Thailand and other countries. To determine this, four hundred structured questionnaires were disseminated and forty HR practitioners were interviewed. The study discovered that talent management is still a new and challenging HR issue in which the succession planning was recognized and utilized as the foundation of talent management in both public and private organizations. The majority of in-depth interview participants suggested that they wished to manage individual talent as such encouraging and unleashing employees' potential, but they did not know how and where to begin the process. These problems significantly discouraged HR practitioners from proposing any creative ideas about managing talent to their top executives. Thus, the participants mutually agreed that to provide some promising scientific information is an urgent HR agenda. There are currently few empirical investigations in the field of talent management in the Thai business context.

Key Words: Talent management, succession planning, HR practitioner, individual talent, Thailand



## Introduction

Since the phrase “war for talent” was coined by McKinsey in 1997 (Axelrod, Handfield-Jones, & Michaels, 2002; Michaels, Handfield-Jones, & Axelrod, 2001), the term “talent management (TM)” has received a remarkable degree of practitioner and academic interest (Berry, 2007; Birschel, 2006; Jenkins, 2006; Maxwell & MacLean, 2008; Powell & Lubitsh, 2007). Trends for talent management, talent wars, talent raids and talent shortages, talent metrics retention and concerns for talent strategy have been introduced in literatures across the continents and countries such as The USA, Europe, The UK, Australia, Japan, China, India and other countries in Asia (Bennett & Bell, 2004; Chugh & Bhatnagar, 2006; Kuptsch & Pang, 2006; Yeung, 2006;). Since the environment for most organizations today is global, complex, dynamic, highly competitive and extremely volatile, organizations both locally and globally recognize that they have a critical responsibility to recruit, develop, deploy, manage and retain their most valuable asset—talent (Cappelli, 2008). In this regard, recent research found that chief executive officers (CEOs) are increasingly involved in the talent management process, with the majority of those surveyed spending over 20% of their time on talent issues, while some spent up to 50% of their time on talent issues (Economist Intelligence Unit, 2006). The study also revealed that most CEOs explicitly pointed out that talent management was too important to be left to the Human Resources (HR) alone. A Boston Consulting Group (BCG) (2007) report identified talent management as one of the five critical challenges for HR in the European context.

Talent management is also a significant HR agenda in the Thai business context. Leading organizations have established talent management departments and programs.

For example, Siam Cement Group (SCG) has a talent management department under the supervision of the central HR office, while Charoen Pokaphan Group (CP) has established its own business institution for higher education, the Panyapiwat Institute of Technology, in order to educate, train and supply its talent pool. A survey in 2009 by researchers of training programs offered by the consulting firms - APM Group, PacRim Group and Thailand Productivity Institute - found that every consulting firm offers various programs involving talent management for different levels of employees. In addition, in telephone interviews with consultants, most of them stated that many leading Thai firms from both public and private sectors are significantly increasing their focuses on talent management such as The Bank of Thailand, The Stock Exchange of Thailand, Betagro Group, PTT Public Company and multinational companies operating like Pfizer (Thailand). The main reasons are that: (1) Thailand is welcoming global competition as one of the World Trade Organization (WTO) members; and (2) multinational corporations (MNCs) usually penetrate the Thai market with huge capital, ready to secure top talent to help gain market share and sustain competitive advantages. Therefore, Thai organizations need to be alert and prepare for highly organized talent management systems in order to compete. As mentioned earlier, talent management seems to be a priority for HR issue in Thailand, but a 2010 search of the term talent management on Google (accessed on 3 March) revealed 29,600,000 hits, with talent management solutions, talent management tools, talent management software and talent management guides dominating various HRM periodicals and websites. Only 125,000 hits appeared in Thai websites or items related to talent management in Thai organizations, accounting for only 0.0004%. Most articles found were professional works discussing talent

management in terms of definition, concept, system, procedure and perspectives on talent and talent management. There is no scientific-based study in the survey. No academics and HR practitioners discuss talent management in the Thai business context scientifically. Most of them posited their discussions on their consulting experiences and employed international case studies as their references.

It is clearly seen that the global conquerors in the knowledge-based economy are those who possess more scientific, concrete information (Collings & Mellahi, 2009; Green, Wu, Whitten, & Medlin, 2006). Similarly, Thai organizations cannot compete in a highly competitive situation without such information, and thus both professional insights and scientific-based information are needed to empower Thai organizations to compete in the war for talent. Less academic attention has been paid to talent management in the Thai business context (Petison & Johri, 2007; Piansoongnern, Anurit, & Bunchapattanasakda, 2008). Thus, this study should prove valuable and beneficial to both public and private organizations as well as HR practitioners, academics and policy makers, such as the Thai Chamber of Commerce, the Federation of Thai Industries, and the government agencies, in the preparation of policy and planning for competing in the war for talent effectively. This study is one of the pioneer empirical studies of its kind in Thailand conducted with HR practitioners specializing in the area of talent management.

#### Objectives of the Study

(1) To investigate Thai human resource (HR) practitioners' perspectives on talent management in terms of their definition and understanding.

(2) To assess trends in talent management in Thailand.

(3) To propose research topics to researchers in order to scientifically investigate key factors that influence effective talent management programs in preparing Thai organizations for the global war for talent.

## Literature Review

### *What is Talent?*

Many researchers provided various definitions of the term “talent” in different perspectives. Buckingham and Clifton (2001) points out that talent refers to a natural recurring pattern of thought, feeling or behavior that can be productively applied. Talent naturally exists within people, while skills and knowledge must be acquired. They preferred the term strengths, which are made up of a combination of knowledge, skills, and talents. People’s talents are innate, whereas skills and knowledge can be acquired through learning and practice. When talent is augmented with knowledge and skill, the results become individual strengths. Rath and Conchie (2008) will that natural talents are stable over time and are the key to effectiveness. Buckingham and Clifton (2001) emphasize that it is never possible to possess strengths without requisite talent.

Morton (2004) defines talent as an individual who has the capability to make a significant difference to the current and future performance of the company. Goffee and Jones (2007) support Morton’s definition that talent is a handful of employees’ ideas, knowledge and skills which give them the potential to produce the disproportionate value from the resource they have available from them. Tansley, Harris, Stewart, and Turner (2006) state that talent can be considered as a complex combination of employees’ skills, knowledge, cognitive ability and potential. Employees’ values and work preferences are also of major importance. The problem however is that everyone could be considered as

high potential at different points in time in different organizations. In some organizations, an individual may need to reach a certain level in the organizational hierarchy in order to be considered high potential. For this reason, it is every organization's interest to make a decision for themselves how and who to label as high potential.

For some researchers, talent may be defined as a critical ability set which is difficult to obtain in the labor market - a scarcity of skills. For example, Ingham (2006) considers people who are in a key position with talent, particularly as a leader team, to be an individual who has a specific of capabilities or contribute to an organization. Phillips and Roper (2009) narrowly define talent as a core group of leaders, technical experts and other key contributors that are quickly becoming an organization's most important asset. Groysberg, Nanda, and Nohria (2004) also calls such talent in an organization as a star—those who was ranked as one of the best in industry. An organization should focus on growing talent from individual employee within the organization and do everything possible to maintain the status as the star. Huselid, Beatty, and Becker (2005) define high performance employees who are placed in strategic positions as “A” players or talent. They describe that a business needs to adopt a portfolio approach to workforce management, placing very high performing employees (“A” players) in strategic positions (“A” positions), good performers in support positions and dismissing nonperforming employees and jobs that do not add value. Ready and Conger (2007) define talent as a group of employees who have above average knowledge and skill, and are ready to be promoted to executive positions and thus are the best people in an organization.

In summary, literature review on the term “talent” suggested that most definition of talent refers to potential, in particular high potentials, which were classified by both practitioners and academic publications into two main definitions: (1) individual potentials (Buckingham & Clifton, 2001; Rath & Conchie, 2008; Tansley et al., 2006); and (2) potential people (Goffee & Jones, 2007; Groysberg et al., 2004; Huselid et al., 2005; Ingham, 2006; Morton, 2004; Phillips & Roper, 2009; Ready & Conger, 2007). First, talent is something inherent in people, recurring patterns of thought, feelings and behavior that are innate in them. Importantly, maximizing talent drives people to perform in their jobs. Second, talent is defined as people who are in the key position, the team leader and the individual who has a unique capability or makes particular contributions to an organization. On the one hand, a group of employees having above average educational qualification, skill and performance, entitled to be promoted to executive positions, are also defined as talent because they are the best performers in the organization.

#### *What is Talent Management?*

There is no single consistent or concise definition of talent management because the terms “talent management strategy”, “succession planning” and “human resource planning” are often used interchangeably (Aston & Morton, 2005; Lewis & Heckman, 2006). Lewis and Heckman (2006) identify three perspectives on the concept of talent management. First, talent management is merely a substitute for the label talent management for human resource management. In this perspective, empirical studies often focus on some particular HR practices such as recruitment selection, leadership development and succession planning. The contribution of this literature is relatively

limited in the stream of the strategic HR literature, as it largely amounts to a rebranding of human resource management (HRM). Second, talent management is still the rebranding of HRM, but emphasizes on the development of talent pools focusing on projecting employee/staffing needs and managing the progression of employees through positions (Lewis & Heckman, 2006). Studies in this perspective classically build on earlier research in the succession planning literatures. While adopting a relatively narrow focus, studies in this tradition at least provide a degree of differentiation as to what talent management is relative to its HRM counterpart.

The last perspective of talent management focuses on managing talent according to performance and it is viewed that it as an undifferentiated good that emerges from humanistic and demographic perceptions (Buckingham & Vosburgh, 2001). In this aspect, talent management is considered “generic” and does not focus on specific positions or boundaries because people may have more to gain by developing and leveraging their natural skills than by trying to repair their weaknesses (Roberts et al., 2005). Critical to this line of thought is the ability to manage people to their highest potential toward a high performance organization. It includes the development of people and managing that process. This all requires cooperation and communication among managers at all levels (McCauley & Wakefield, 2006; Redford, 2005).

In summary, TM is mainly viewed in three perspectives: (1) traditional HR functions and practices; (2) a new term of succession planning; and (3) the management of people’s natural capability or learned skills that benefit an organization. The first two perspectives are deemed re-branding of HRM which do not advance understanding of the strategic and effective management of talent, while the last perspective is placed in this

challenging area that HR practitioners should underline because it involves the development of people and management of the process that requires cooperation and communication among managers at all levels.

### *Talent Management in Thailand*

Few empirical studies (Petison & Johri, 2007) in the area of talent management and high performance employees in Thailand are found in the peer-reviewed literature. The link between HR practices and organizational performance can be found in the study of Wattanasupachoke (2009). This research focused on how HR strategies of Thai enterprises can influence business performance. The findings indicated that extra pay and profit sharing schemes significantly influence non-financial performance. The extra pay and profit sharing scheme lead to a sense of belonging and greater commitment of staff because their wealth would be directly linked to their firms' financial performance. For the non-financial performances, the only influential group of variables is positive inner characters consisting of positive attitudes and politeness. The employees with these characters tend to be dedicated, faithful and committed to firms and customers. The link between HR practices and talent management has also been signified and examined in comparative studies across Asia. In this regard, Zheng, Soosay, and Hyland (2008) examined the issues relating to recruiting highly skilled managerial and professional staff experienced by multinational companies (MCNs) manufacturing in six Asian countries, namely Indonesia, Malaysia, Philippines, Singapore, Taiwan and Thailand. Data collected from 529 MNCs were used to examine critical HR planning and recruitment concerns of companies operating in high growth economies called "Dragon" and newly developed economies called "Tiger". The study examined differences in recruitment



practices between manufacturing and service companies and the issues related to how manufacturers maintain an adequate skills basis. There appears to be a considerable amount of competition for talent among Dragon and Tiger economies with the latter required to be more aggressive as they attempt to sustain growth. Manufacturing companies are experiencing a higher demand for more job-related managerial and technical capabilities while competing with service companies that are also in need of more talent. To succeed, manufacturing MNCs will need to adopt a strategic approach for recruitment and retention as well as the internal capability to train and maintain their skilled employees in order to sustain competitive advantage. Zheng (2009) further surveyed 281 service MNCs in six Asian countries as discussed earlier in order to test the link between HR practices, employee retention and service firm performance. The findings confirmed that there were statistically significant linkages between HR practices, talent retention and firm performance. In particular, various skill training and development programs are seen to be significantly associated with the capacity to deliver quality service and firm growth as perceived by managers surveyed. Informal recruitment methods that are used more by Asian-bred firms have contributed to better retention rates. Not all formalized HR practices lead to talent retention; and the degree to which HR is perceived to have impacted on firm performance varies.

In the micro perspective on the talent management literature, Japanese companies in Thailand have attracted scholars with particular concentration on the implementation and transferability of Japanese managerial styles. Onishi (2006) examined the transferability of Japanese HRM to Thailand. Attitudes towards life-time employment, seniority system, consensual decision-making, quality circles and house unions were

considered. The results indicated that all five practices except seniority are transferable. The Thai employees have more positive attitudes towards consensual decision-making, quality circles and house unions than the Japanese managers in the Japanese manufacturers in Thailand. Some Japanese managers think that consensual decision-making and quality circles are not appropriate or accepted in Thailand. This belief may limit the implementation of these practices. Regarding seniority, both the Japanese managers and the Thai employees agreed that performance should be evaluated by achievement, but years of service should be part of any evaluation criteria. Petison and Johri (2007) also support that trust and respect are significant factors that influence the development of local talent in Japanese subsidiaries. Their findings demonstrated that the challenges and solutions in developing local employees for managing subsidiaries—implementation of Thainization philosophy in Toyota Motor Thailand (TMT), the management had to demonstrate respect for local employees and build trust between Thai and Japanese employees. Once the employees interacted each other on the basis of mutual respect and trust, it was relatively easy to collaborate and find the solutions.

In summary, the research in the topic “talent management” in Thailand is focused on the link between human resource practices and organizational performance and the factors affecting talent management. These empirical studies demonstrate a high value of human resource practices in managing talent through macro and micro perspectives. Data from different Asian countries were analyzed, while Japanese companies were mainly employed as the significant data source. This data developed an interesting question: Do Thai firms distinguish talent and talent management? Yet, a comparative study between

Thai firms and MNCs in different industries and countries regarding talent management were left unaddressed.

### Methodology

Quantitative and qualitative research methods were triangulated and divided into two phases, given that the term “talent management” has no clear meaning and has been used in different manners and is often a means to highlight the “strategic” importance of a HR specialty (recruiting, selection, development, and etc.) without adding to the theory or practice of that specialization (Lewis & Heckman, 2006, p. 141).

The quantitative research was originally inspired by the discussion of Lewis and Heckman (2006) that “it is apparent the term “talent management” has no clear meaning. It is used in too many ways and is often a means to highlight the “strategic” importance of a HR specialty (recruiting, selection, development, etc.) without adding to the theory or practice of that specialty (p. 141)”. Thus, the main objective of the quantitative study was to investigate Thai human resource (HR) practitioners’ perspectives on talent management in terms of definition and understanding. Data were collected on Thursday, March 19, 2009 in a conference on trends in Human Resources Management (HRM) organized by a university in Bangkok, Thailand. This one-day conference was selected as a site of data collection because approximately five hundreds HR practitioners from both public and private organizations participated in the conference. In this regard, four hundred structured questionnaires were distributed by the researchers from 8.30 a.m. until 17.30 p.m. A structured questionnaire with Cronbach’s Alpha of 0.756 was developed as discussed by Lewis and Heckman (2006). Sixteen questions were asked and focused on

HR practitioners' perspectives on the definition and their understanding about talent management.

In addition, in-depth interviews were also conducted in order to understand the reasons behind the answers obtained from the questionnaire survey. Interview consents were verbally proposed by the researchers to questionnaire respondents who demonstrated friendly cooperation. Forty HR practitioners, or ten percent of the questionnaires distributed in the quantitative study, were interviewed about the definition of talent management and its application in their workplace. Each interviewee was interviewed by means of face-to-face and telephone interviews lasting for 30 - 45 minutes. All interviews were anonymously diagnosed to protect the privacy of the respondents. Questions prepared were utilized as a guideline for the research because the interviews chiefly aimed at investigating what interviewees expressed in their own words about talent management. The data collected during the qualitative study was transcribed. Throughout the data collection and analysis process of the study, interviewees were willing to talk openly about talent management rather than providing politically corrected answers, while the researcher kept viewing the experiences under study from the interviewees' perspectives by practicing active listening and abstaining from using preconceived ideas or existing theories to interpret the experiences. Constant comparative method was used as a key method in data analysis for comparing one segment of data with another to determine similarities and differences regarding interviewees' perspectives on talent management of their organizations.

## Findings

In the quantitative phase, data from the survey revealed that respondents were working in three types of organizations: (1) Local-private (199 people, 49.8%); (2) Public (108 people, 27%); and (3) Multinational (93 people, 23.3%). Of these 358 respondents (89.5%) were involved in HR jobs and positioned in middle to high managerial levels in their organizations (69.8% or 279 respondents) such as senior HR manager, HR manager, training manager, organizational development manager and so on. Only 10.5% or 42 respondents worked in other departments or at junior managerial level (121 respondents, 30.3%). The majority of respondents had extensive experience in HRM and HRD jobs with 257 people (64.3%) working for more than 5 to 10 years. In this minor group, only 30 people (7.5%) had working experience of less than 3 years.

Regarding talent management in organizations, a major group of 381 people (95.3%) of questionnaire respondents indicated that their organizations have talent pools, but were not titled talent management programs, while 19 people (4.8%) indicated that their firms have talent management programs. The findings also revealed that 377 of respondents (94.3%) indicated that they never seen or read any empirical studies about talent management conducted in Thai organizations. Only 23 people (5.7%) had ever read or seen such a study. Regarding Thai HR practitioners' perspectives on talent management, the majority of the questionnaire survey's respondents agreed that talent management is an emerging hot human resource management issue in Thailand, but scholars have been paid very little attention to talent management. In respondents' perspectives, "talent" is a person who demonstrates higher performance than others, and has a readiness to be promoted to an executive position. Respondents also pointed out

that talent management in Thailand is the rebranding of HRM practices, particularly succession planning. Human resource departments should not be entirely responsible for managing talent in an organization.

In the in-depth interview phase, interviewees participating in the study came from various Thai organizations. The largest group were in banking and financial business (11 interviewees, 27.5%) followed by property development business (7 interviewees, 17.5%), construction business (5 interviewees, 12.5%), automotive business (5 interviewees, 12.5%), computer/electronic parts manufacturing (5 interviewees, 12.5%), retailing/consumer product distribution (4 interviewees, 10%), and healthcare and medical services (3 interviewees, 7.5%), respectively.

Talent was divided into two definitions by forty interviewees. First, it was mainly defined as a group of employees who demonstrate higher performance than others in an organization. Second was that individual talent such as employees' expertise or employees' talent, including a recurring pattern of thought, feeling, or behavior can productively be applied. In this definition, there were not many interviewees that responded to the question automatically. The researcher was a key person guiding them to recall this meaning by asking them about their opinion because most respondents automatically began their answers with the first definition. The main reason why the first definition was automatically expressed was high performance employees were a group of employees who were ready to be promoted to managerial positions because they had intensive experience and were trained by both their predecessors and external development programmes. Also, this group of employees is normally deployed in every strategic position in an organization. In this regard, executives can clearly view a talent

management plan proposed by the HR department, since they realize and understand several reasons why an organization has to invest such a huge budget for those employees identified as a group of talent. For this reason, the sentence “every employee possesses his or her own talent” seems to be unclear for executives, because it is difficult to identify individual talent, particularly how much talent they have and how to motivate them to perform by utilizing their talent. Thus, talent management is more easily said than done in the view of the interviewees’ perspectives.

However, talent management was a new HRM issue. It is not traditional succession planning or management; it is more than managing people for filling managerial positions in the future. Talent management should be the process of helping high performance employees to fully perform their jobs. However, interviewees also indicated that succession planning or management is an infancy stage of talent management. It is therefore fair to say that talent management is not a totally new HRM issue, but should mark that it is an incremental concept of succession planning. Every department must be responsible for the process of talent management because employees classified as having talent work in every department. Line managers should also be responsible in at least one process such as the identification of talent. The HRM department should be positioned as the centre of talent management, particularly talent management projects including distribution of talent management concepts to employees involved. However, some interviewees pointed out that talent management jobs are one of the significant functions of the HRM department, and thus it should be kept separately as an individual department as well as other HR departments, such as organizational development and training department. At the same time, another interviewee group

revealed that succession planning is a fundamental of talent management, it is therefore unnecessary to split HR department's jobs into a new one. Since this requires a large amount of investment, it might be necessary to acquire some number of HR specialists to manage its process. However, this opinion proposed that talent management specialists should be recruited and work under the HRM department. Traditional HR staff should not be assigned to manage this new challenging issue as it needs an alternative knowledge and skill to handle the subject properly.

From a global competition perspective, every interviewee agreed that talent management is one of the critical organizational issues particularly in the current turbulent global economic situation. Currently, every organization manages talented employees carefully in this economic condition because of two main factors: (1) lack of talent supply; and (2) fierce competition from both domestic and international organizations. Even though Thai universities offer various degree programs ranging from bachelor to doctoral degrees, the number of highly qualified candidates is still insufficient to meet the demand. Newly graduated applicants usually find it difficult to apply their knowledge to perform the task. This one crucial issue may answer the question "why talent management has been seen as an important issue?"

The interview of HR practitioners revealed that talent management's demand came from two major sources. First, talent management is an internal demand emerging from an organization itself because every organization needs intelligent, diligent, hard-working and high performance employees. Thus, an organization needs to manage these employees appropriately and systematically. Second, some organizations initiate the talent management program because of an external demand. Almost half of interviewees



indicated that their organizations launched a talent management program because other competitors in the same industry did. A highly competitive economy is another factor affecting talent management in organizations. Interviewees working in Thai organizations viewed global competition as a monster of HRM, because multinational corporations have sufficient resources and are ready to hunt talent from domestic markets as quickly as they have demand. HR practitioners have to improve and tailor HRM programs constantly in order to prevent and protect the penetration of global firms. Surprisingly, some interviewees also revealed that the talent management program sometime came from the annual HRM program offered by HR consulting firms.

### Conclusions and Discussion

Talent management is a new and challenging issue in both public and private organizations in Thailand (Berry, 2007; Cappelli, 2008; Maxwell & MacLean, 2008). Every organization has its own talent management program using different names, with some firms using the name “talent management program” directly, while other firms do not. Succession planning is recognized and utilized as the foundation of talent management in both public and private organizations. The word “talent” is automatically and mainly defined by HR practitioners as talented employees—a group of high performance people who are deployed in current strategic positions rather than individual talent (Goffee & Jones, 2007; Morton, 2004; Rath & Conchie, 2008). These findings are supported by Lewis and Heckman (2006) who pointed out that talent management is primarily concentrated on the concept of talent pools—a set of processes designed to ensure an adequate flow of employees into jobs throughout the organization.

However, talent in the terms of individual talent is also important as well as talent in terms of a group of high performance employees, but these people must be given the first priority because the concept is practical and measurable. Performance appraisal has been widely employed in talent identification because the HR department needs minimal effort to organize a new talent management program to measure complicated issues like individual talent or what an individual's strong points may be. However, the majority of in-depth interview participants suggested that they would like to manage individual talent, including encouraging and unleashing employees' potential, but do not realize how and where to begin the process. These problems significantly discourage them in proposing any creative ideas about managing talent to their top executives. In addition, the participants mutually agreed that scientific information should be an urgent HR agenda, because there are currently few empirical investigations in the field of talent management in the Thai business context.

Thus, a lack of scholarly investigation into talent management seems to be an important HR agenda that Thai scholars should urgently discuss. Scholars should investigate effective solutions for talent management in organizations in order to guide and assist them on how to appropriately manage talent both as a group basis of high performance people and an individual talent. Cultivating and managing individual talent should be given more attention. If organizations believe that talented employees and individual talent are the most valuable assets in global competition (Cappelli, 2008; Collings, & Mellahi, 2009; Green et al., 2006), Thai scholars should contribute significant effort to determine effective solutions to manage such talent, constructing a fit

within the Thai business context to leverage the competitiveness of Thai organizations in the global quest for talent.

#### Limitations

(1) According to the definitions of talent and talent management, they are unclear and often used interchangeably. HR practitioners sometime need to be educated about the concept in order to relate their ideas and opinions about talent management before responding to a structured questionnaire and in-depth interview.

(2) Due to the fact that the topic of “talent management” is a sensitive issue, HR practitioners usually are afraid to express their opinions and ideas about it, since most strategic plans that relate to talented employees are kept as mostly confidential information. Thus, an in-dept study in some firms may be difficult.

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## INNOVATION CREATION AND INNOVATION ADOPTION: A PROPOSED MATRIX TOWARDS A BETTER UNDERSTANDING

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### Abstract

It is a fallacy to equate adoption of innovations with innovation creation). In other words, organizations, which adopt innovations, should not necessarily be innovative. Organizations must create radically or incrementally if they are to be categorized innovative and thus innovativeness is an antecedent to innovation. The number of innovations adopted is not a good measure for innovativeness. An analysis of previous studies on innovation indicates that researchers committed both content and contextual fallacy by equating adoption of innovation with innovation creation. This conceptual paper attempts to distinguish between innovation adoption and innovation creation as two different concepts. It also attempts to differentiate between innovativeness, invention, and creativity. Finally, this paper introduces a matrix, which explains the concepts of innovation creation and innovation adoption as two separate concepts. This matrix differentiates between those firms, which are innovative from those, which are adopters of innovation.

Key words: Innovation Creation, Innovation Adoption, Innovation Matrix

## Introduction

If any sudden economic growth of any country happens, it can be mainly due to innovations. In fact, there are certain factors that have made organizations go for innovation. These factors include the scarcity of resources and the rising customer expectations. Thus, organizations have always been motivated to create technological and managerial innovations (Snow & Hrebiniak, 1980; Thomas, 1995). Seaden (2001) also mentioned that there are certain drivers that made organizations go for innovation. These drivers include the demands of strict environmental legislations, the challenges of the increasing global competition, and the emergence of clients who have become more demanding.

Innovation is said to have close relationship with economic growth. Dulaimai et al. (2002) emphasized that when the levels of innovation in the construction industry is high, the likelihood that the contribution of such industry to the economic growth will also be high. For example, manufacturers claim that a steel frame house can be completed in 5 weeks, compared to 8-10 weeks that completing an equivalent traditionally-built house takes. Timber frame producers claim that timber frames are beneficial. Innovation in floor joist systems allows much greater spans. Moreover, the use of concrete flooring, which is common in many European countries, is said to increase space flexibility as well as to improve sound and thermal insulation. In addition, in brick and block construction, there have been developments which can improve productivity. Larger lightweight concrete blocks, for instance, has improved their own ease of handling. New mortars make house builders rapidly build to full height since the lower layers of blocks set much faster (Barlow, 1999).



Research on innovation began to grow in the early 1960s and continued to advance since then. In those early years, the focus was on conceptualization and theory building. Studies in those years were more of a descriptive nature, analyzing the association between various contextual factors and characteristics of organization. Later, in the 80s and 90s, the research was initiated to broaden the theory of innovation and thus offered prescriptions towards designing innovative firms. Studies, which emerged during the 80s and 90s, broadened the theory of innovation and offered prescriptions towards designing innovative organizations.

The field of 'Innovation' has been given an obvious importance. This importance is quite evident in the special issue on this topic by Academy of Management Journal (Oct, 1996), and regular publications in other journals as well as in popular magazines. However, as Damanpour (1991) stated, innovation is a broad concept that is conceived in a variety of ways. He mentioned that previous attempts to capture what constitutes innovation have resulted in widely varying conceptualizations. Consequently, innovation and innovativeness are either distinguished from each other or used interchangeably. However, he points out that innovation seems to incorporate the adoption or/and implementation of "new" defined rather in subjective ways, whereas innovativeness appears to embody some kind of measurement depending on an organizations' proclivity towards innovation. Prajogo and Sohal (2000) supported Damanpour (1991) and mentioned that the review of literature on innovation has shown different definitions of innovation from different perspectives although these definitions are satisfactorily coherent as he stated. However, looking at the origin of the word, innovation, as Tidd et al.

(2001) mentioned, is derived from the Latin word 'innovare', which means 'to take something new'.

Downs & Mohr (1976) claimed that the findings of innovation research are “*non cumulative*”, “*unstable*” and “*variant*”. However, this claim was based on the theme of adoption. Damanpour (1991, 1992) attempted to test and refute their theory. His attempts contributed towards general theory development in certain ways. However, these attempts were not successful because Damanpour looked at innovation from the adoption perspective. Thus, the theory failed to advance conceptualization and thereby a measure for the phenomenon of innovation. Indeed, the research into innovation has become a multidisciplinary effort, which involves sociology, economics, marketing, and organizational behavior. Innovativeness has been looked at and approached in a variety of ways and perspectives including customer, supplier (Drucker 1999, Goldsmith and Newvell 1997), level of innovation in terms of individuals, teams or projects and organizations (Drucker 1999, Subramanian 1996) or “intensity of innovation” (Hollenstein 1996). Furthermore, innovativeness has also been considered from the perspective of innovation management concerning the strategic implications for organizations (Markides 1997, Nemeth 1998).

In fact, the major problem that concerns organizational innovation is the absence of a valid and general approach to organizational innovation and this is due to the absence of a single accepted method through which innovations could be conceived. Some authors look at innovation as a uni-dimensional phenomenon while others looked at it as a multi-dimensional one. Through the literature on innovation, it is clear that past researchers concentrated on the characteristics, processes, determinants, sources and

types of innovations. However, theoretical advancements to resolve the complexities of innovation have not been fully achieved. Most innovation research conducted so far is related mainly to the context of adoption. This notion is well stated by Schoonhoven, Eisenhardt & Lyman (1990: 179) who said: “*Although innovation has been widely studied in the past fifteen years . . . much of the research is about innovation adoption and diffusion*”. This has defeated to arrive at a generalized definition and measurement that would have set a precedent for further research and add to the rich stream of studies. For example, as early as 1965, Thompson defined innovation as “the generation, acceptance and implementation of new ideas, processes, products and services”. While this definition rightly highlights the “creation” and “utilization” aspects — the very essence of innovation, it is unfortunate that researchers, with some exceptions, failed to enhance this view, and bounded themselves within the adoption perspective.

The objectives of this conceptual paper are (1) to differentiate between the concepts of creativity, innovativeness, invention, and innovation and (2) to differentiate between the concept of innovation creation and innovation adoption. In other words, this conceptual paper attempts to answer the following two questions:

1. What is the difference between the concepts of creativity, innovativeness, invention, and innovation? and
2. How are innovation creation and innovation adoption different concepts?

#### Literature Review

#### *Creativity, Invention, and Innovation*

It is useful to explicitly distinguish between *creativity*, *invention*, and *innovation* since these terms could be misunderstood. Creativity is a noun from the adjective creative. According to Oxford, “*creative*” means involving the use of skill and the imagination to produce something new while invention is defined as “*a thing or an idea that has been invented*”. From these two definitions by Oxford, we can see that creativity is a process of generating a new thing. Once such a new thing, be it a product or process, is carried out and exist in the real world, it becomes an invention. However, innovation is defined by Oxford as “*the introduction of new things, ideas or ways of doing something*”. Innovation is a broader term, which involves many things including creative employees, a culture which supports generating new ideas, and investing in R&D. While creativity is typically used to refer to the act of producing new ideas, approaches or actions, innovation is the process of both generating *and applying* such creative ideas in some specific context. In order to differentiate between innovation and invention, it is worth contemplating how Roberts (1989) defined innovation. He defined innovation as the summation of invention and exploitation. This points out that an invention does not become an innovation unless it is implemented or utilized.

In the context of an organization, therefore, the term innovation is often used to refer to the entire process by which an organization generates creative new ideas and converts them into novel, useful and viable commercial products, services, and business practices, while the term creativity is reserved to apply specifically to the generation of novel ideas by individuals or groups, as a necessary step within the innovation process. For example, Amabile et al. (1996) suggest that while innovation “*begins with creative*

*ideas," ". . .creativity by individuals and teams is a starting point for innovation; the first is a necessary but not sufficient condition for the second."*

Innovation is all about coming up with a new idea and implementing such idea whether in a new product or a new process. However, implementing a new idea involves risk. In his article "*Risk Taking and Innovation Performance*", Parther (N.D.), explained that risk taking does not mean "*taking a blind chance or throwing caution to the wind and rolling the dice*". He mentioned that risk taking means implementing a well-reasoned idea where the benefits far outweigh the loss. It is trying things out earlier, making mistakes at a low cost, refining the idea, product, or process, and re-trying. To Parther, "*creativity*" is the process, which leads to ideas while risk-taking is the process, which is responsible for taking ideas to a result. He highlighted that many people recognize that taking ideas to a result as "innovation". He explained that the process of innovation requires much more than just risk-taking, but he stressed that risk-taking lies in the heart of innovation. He emphasized that every successful innovation has a number of implementers and that risk-taking is what makes a good implementer. He also mentioned that the process of creativity and innovation are of critical importance because the work environment can determine whether or not risks are taken.

#### *Innovation and Innovativeness*

The definition of innovation is believed to firstly appear in Joseph Schumpeter's writing in 1930s particularly in 1934. Joseph Schumpeter was one of the first economists to define innovation. He defined five possible types of innovation. These types are (i) the introduction of a new product or a qualitative

change in an existing product, (ii) process innovation new to an industry, (iii) the opening of a new market, (iv) development of new sources of supply for raw materials or other inputs, and (v) changes in industrial organization.

Damanpour (1991) stated that innovation is a broad concept that is conceived in a variety of ways. He mentioned that previous attempts to capture what constitutes innovation have resulted in widely varying conceptualizations. Consequently, innovation and innovativeness are either distinguished from each other or used interchangeably. However, he points out that innovation seems to include the adoption or/and implementation of "new" defined rather in subjective ways, whereas innovativeness appears to embody some kind of measurement depending on an organizations' proclivity towards innovation. Thus, innovation is more about the product or the result of applying new ideas, but innovativeness is more about the process and the measurement of the innovation itself.

According to Rogers (1983), innovativeness is the degree to which an individual or other unit of adoption is relatively earlier than any other member of the system in adopting new ideas. He highlighted that such innovativeness indicates behavioral change. Thus, he considers the time to innovate compared to other members of the innovation system. However, Rogers (1995) broadly defined innovation as an idea, process, product, system or device that is perceived to be new to an individual, a group of people or firms, an industrial sector or society as a whole.

Moreover, Ettlie (1983) and Dewar and Dutton (1986) highlighted that innovation is defined as applying new ideas to the firm whether the newness of

these ideas is embodied in products, processes, management or marketing systems. The degree of innovation reflects the extent of knowledge embedded in an innovation.

Subramanian and Nilakanta (1996) and Wolfe (1994) pointed out two broad streams of organizational innovativeness. The first stream is concerned with the firm's external or/and internal processes of innovation. The second one focuses on the determinants of innovation or /and its impact on organizational performance. Both streams carry out research, but the latter is more attractive because much research have been done to identify innovativeness determinants in various disciplines such as marketing (Roberston and Gatignon,1986), economics (Mansfield, 1968) and organizational behavior (Kimberly and Evanisko,1981).

Ansoff's typolog (1957) suggests three product innovativeness categories, notably: (1) incrementally new products; (2) moderately innovative products; and (3) really new products. This results from a combination of products (existing and new) and markets (existing and new). This typology has been adapted by many researchers (Cardozo et el.,1993;Meyer and Roberts, 1986,; Pavia,1990).

Apart from the issues of categorizing innovativeness, plenty of research has investigated different natures of innovations via probing different levels of innovation adoption, for example, radical vs. incremental, evolutionary vs. revolutionary, as well as discontinuous vs. continuous.

Wang and Ahmed (2004) identified five dimensions of an organization's overall innovativeness. These five dimensions are product innovativeness, market innovativeness, process innovativeness, behavioral innovativeness, and strategic

innovativeness. Henard and Szymanski (2001) mentioned that product innovativeness is most often referred to as perceived newness, novelty, originality, or uniqueness of products. Moreover, Andres and Smith (1996) consider appropriateness, the extent to which a new product is viewed as useful or beneficial to some consumers, as an important feature of product innovativeness.

Contemplating the literature on innovation and innovativeness, we strongly believe that innovativeness and innovation are concepts that should be clearly differentiated, not treated interchangeably as Damanpour (1991) said. We believe that innovativeness is an antecedent to innovation. Organizations cannot achieve innovation without being innovative. Innovativeness is the process in which new ideas are generated and applied to come up with inventions that, if put into the organizational system as a whole, will form innovation. Innovation is a broader concept that incorporates creativity, innovativeness and invention. Moreover, we do believe that innovativeness is not / should not be measured by the number of innovations adopted by a firm/organization because both innovation creation and innovation adoption are two different concepts as we propose in this paper. Innovativeness is an antecedent to innovation because innovation is an output of or a result to innovativeness.

A recent study by Hovgaard and Hansen (2004) looked into the forest products industries of Oregon and Alaska. In their study, three aspects of innovativeness were identified. They are namely: (product, process, and business systems). Product innovativeness was defined as a successful change in a firm's output that can be in the form of either goods or services. Although Hovgaard and



Hansen (2004) defined innovation as an output, they still did not differentiate between innovation and innovativeness. As for innovativeness, we do believe that it is an antecedent to innovation. As for innovation, we believe that creation is the key indicator for measuring innovativeness at the organizational level. The section below highlights our view.

### *Innovation Creation and Innovation Adoption*

Despite the clear differences between the two terms “innovation creation” and “innovation adoption” it is surprising to find how researchers equated these two terms and measured innovation as the number or the rate of adoption. For instance, the differences in the process of innovation and adoption exist, differences in the cost are evident and differences in the management of adoption and innovation can easily be noticed. For example, Utterback (1974), Daft (1982), and Attewell (1992) defined an innovative firm as one that adopts innovations. Rogers (2003, pg.22) looked into the time of adoption, making the definition of innovativeness more comprehensive. However, Rogers (2003) still looks at innovation from an adoption perspective. A recent study by Hovgaard and Hansen (2004) looked into the forest products industries of Oregon and Alaska. To them, innovativeness is the propensity of firms to create and / or adopt new products, manufacturing processes, and business systems. This shows that they did not differentiate between innovation creation and innovation adoption.

Differentiating between innovation creation and innovation adoption is important because the literature has shown a confusion and a lack of innovation measurement. This lack of conceptualization and measurement is mainly due to misperceiving innovation as an adoption or looking at it from an adoption perspective. For example, if we look at

innovation definition by Damanpour (1987), we will clearly see such misperception of innovation. Damanpour (1987) defines innovation as adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting company. It is clear that Damanpour is measuring and conceptualizing innovation from adoption perspective. This makes us believe that proposing a matrix, through which innovation creation and innovation adoption can be clearly differentiated, is a very necessary thing towards a better conceptual understanding. This matrix could serve as a first step towards coming up with a clear measurement to the phenomenon of innovation.

Although the studies on innovation are plenty, there seems to be a general lack of conceptual clarity that could lead to a clear definition and measurement of organizational innovation. What affected the theory and measure of organizational innovation is the fact that the two terms “innovation” and “adoption” were used interchangeably. Authors seem to equate the construct of innovation with that of innovation adoption.

Research in innovation adoption/diffusion gained much recognition by the very important work of Rogers (1962). Nevertheless, adoption/diffusion research has rich traditions in various fields such as sociology, anthropology, geography, economics, advertising and market research, and communication studies. Studies on adoption are abundant. Over thirty-nine years of diffusion research in various fields have produced more than 3,000 publications on the diffusions of innovations (Rogers & Kim, 1984). Further, theoretical works on the nature of innovation and its relation to the adoption of new products have also been reported (Midgley & Dowling, 1978; Hirschman, 1980; Mudd, 1990).

The most cited work in innovation theory is Downs & Mohr (1976). However, this work does not seem to have any departure from the conventional approach because they equated organizational adoption to innovation and offered guidelines for developing innovation theory in the context of adoption. The authors state, “*We will be employing the rather broad, conventional definition of innovation as the adoption of means or ends that are new to the adopting unit*” (p. 701). This conventional definition, which has been misconceptualized by several past researchers added to the confusion and, inhibited the development of a theory of innovation different from adoption. Most studies on innovation (e.g., Mohr, 1969; Baldrige & Burnham, 1975; Daft, 1978; Damanpour & Evan, 1984) appear to focus on innovation, but in content they pertain to adoptions only. For example, Mohr (1969) conceived innovativeness as the number of adoptions that a health department had incorporated.

Rogers & Kim (1984) construed innovation ‘*as the degree to which an individual or the adopting unit is early to use an innovation*’. Quoting earlier studies, Scott and Bruce (1994: 581) state, “*innovation has to do with the production or adoption of useful ideas and idea implementation*”. Damanpour (1992), in performing a meta analysis, concerning organizational size and innovation, identified conceptual and methodological factors as the cause for the inconsistencies in the findings between these two variables. Ironically, Damanpour (1992: 397), also equated adoption with innovation, and defined innovation as, “*the adoption of an idea or behavior, whether a system, policy, program, device, process, product or service, that is new to the adopting organization*” (Daft, 1982; Damanpour & Evan, 1984). Damanpour (1992: 397), also stated that “*organizational innovativeness is normally measured by the rate of adoption of*

*innovations. The rate of adoption is often measured by the number of innovations adopted within a period”* (Daft & Becker, 1978; Ettlie et al., 1984), or occasionally by the percent of innovations adopted (Baldrige & Burnham, 1975). This raises a significant question: if organizations are classified innovative based on the innovations they adopt, what about the innovations they create or innovate? We believe that we should look at innovation and innovation adoption as two different concepts organizations can clearly measure innovation and adoption as two different concepts and thus know how to be innovative. Therefore, in order to answer question 3 in this paper (how are innovation and innovation adoption different concepts?), we propose the matrix below through which we look at innovation and innovation adoption as two different concepts.

Matrix I. Innovation Creation vs. Innovation Adoption

	Create	Adopt	
I		III	Radically
II		IV	Incrementally

- I (Create Radically) = Radical Real Innovators
- II (Create Incrementally) = Incremental Real Innovators
- III (Adopt Radically) = Radical Adopters of innovation
- IV (Adopt Incrementally) = Incremental Adopters of innovation

We believe that any organization involved in innovation will fall in one of the four categories proposed in Matrix I above. Organizations falling under categories I and II will be truly involved in innovation creation. However, organizations falling under categories III and IV will be involved in innovation adoption. Below is the explanation of the four categories of the proposed matrix.

Category I means that the organization comes up with a completely unique product or a process that is unique either to the company or to the industry provided that other competitors in the industry have not introduced it earlier on. In other words, those organizations come up with a unique product or process. In this case, the organization introduces “something”, which is completely new to the industry. Thus, such an introducer becomes the first mover in the market. This case is indeed risky, but it can achieve a competitive advantage if the new product or process proves to be successful in the market. In case the new introduction proves to be a failure, the company (the introducer) may incur losses. This company needs some time to recover from those losses. However, coming up with a new idea and implementing this idea is worthy because if this idea proves to be successful, such a company or what we like to call (risk-taker) will enjoy a competitive advantage over its competitors in the market. This requires the organization to do a screening study where they can anticipate to what extent the new product or process will be successful. In other words, the risk being taken should be built on a preliminary study not done haphazardly. This is due to the fact that not every new product or process is to certainly going to be successful.

As mentioned above, organizations that fall under the category I are risk-takers where risk-taking is a part and parcel of innovation. They are leaders who take the

initiative and introduce something new to the industry. Those firms that introduce something unique not to the firm itself, but to the market, are called radical innovators. They are usually the first movers in the market.

Category **II** means that a firm / an organization comes with a partially unique product or process, that is, the firm/ organization improves a certain existing product, process , or design. This new introduction makes the existing product, process or design newer or much more efficient than the existing one. This is known as incremental innovation. The firms falling under this category could be called incremental / partial innovators because they themselves come up with an enhancement to an existing product or process. They could imitate a product/ process with enhancing certain aspects of it. If those firms adopt a new product or process and improve that adopted product or process, they are still called partial/incremental innovators.

Category **III** means that firms / organizations completely adopt an innovative product, process, or technology from a certain market / industry. Those firms do not bring about any change to that adopted innovation. All what they do is implementing that innovation efficiently. Under this category, two types of radical adopters could be classified namely: (active and passive radical adopters). Active radical innovation adopters are those who try to improve the innovation adopted by making some changes or enhancements to the adopted innovation. These enhancements could be in the process of implementing such adopted innovation. They could also try to think of improving that adopted innovation. Passive radical innovation adopters, however, are those who do not try to make any enhancement to the adopted innovation. They just adopt innovation and implement it without even thinking of how to enhance that adopted innovation.

Category **IV** means that firms / organizations adopt one part or aspect of innovation from another industry or another competitor and implement it. The firms falling under this category only adopt just one aspect of a certain innovation.

Thus, innovation adoption and innovation creation are two different concepts. They should be treated differently regardless of the arguments that innovative firms have the tendency to adopt innovations. Unlike Rogers (1991), we believe that innovation adopters are not innovators even though they have the potential to become innovators more than those that are not willing to adopt innovations. We believe that getting involved in innovations adoptions, be it radical or incremental, is a good exercise for companies to open rooms for them to be innovative.

Our argument that both innovation creation and innovation adoption are two different concepts is based on certain justifications. Firstly, the culture in innovative firms (firms that come up with a uniquely new idea and implement it) is different from the culture in firms that adopt innovations. Wilson (1966) argues that greater the diversity within an organization, the greater the probability that participants will propose major innovations, and smaller the probability that such proposals will be adopted — due to the difficulties in obtaining a decision in an organization characterized by diversity. This assumption indicates that the properties required to induce innovative behavior may prohibit implementation of innovation. The culture for adoption while not risk-ready would not tolerate failures because of the adopted innovation's demonstrated success beforehand. The flow of information within the organization, which adopts innovation, is also relatively less than that in organization that creates innovation.

Secondly, organizing a successful innovation requires the firm to match the technical capabilities with the market needs. Thus, an integration between different departments such as R&D, marketing, and production is necessary. However, in case of innovation adoption, the focus is only on how to apply such innovation efficiently. Earlier studies demonstrated how the product and technological innovations come as a response to market needs (Myers & Marquis, 1969). The Japanese firms, acknowledged as the most innovative firms, employ highly flexible role schemes (Mac Dowall, 1984), which help to achieve a firm collaboration between R&D, production, and marketing to promote innovations. However, Moenart, Souder, Meyer & Deschoolmeester (1994) state that the level of integration needed between R&D and marketing will be less once the product specifications have been formulated and resources have been allocated. Thus, the integration in case of innovation creation is much higher than that in innovation adoption. Finally, in terms of employees and workers, innovative firms must have creative employees and skilled workers who have the abilities to think out of the box. Collaborative efforts must exist between the management and the employees as well as among the different departments, but that level of collaboration is not necessarily the same in organizations which adopt innovation/s. Table 1 below summarizes the differences between innovation creation and innovation adoption.

Looking at the definition of innovation and its Latin origin 'innovare', (which means come up with a new thing), we stress in the table below the importance of creation as the main component of innovation. It is worth mentioning here that the table below is modified from Ravichandran (2000) who compared innovation to innovation adoption.



Here, we build on his work by focusing on the concept of creation as a key component that differentiates between innovation creation and innovation adoption.

Table1. Innovation Creation (I.C.) versus Innovation Adoption (I.A.)

Innovation Creation (I.C.)	Innovation Adoption (I.A.)
Created	Bought/ borrowed
New	Familiar
Original	Derivative
Pioneers	Followers
Innovativeness	Responsiveness
Top management's support	Top management's decision
Committed, concerted efforts	Not necessarily
External visibility (due to creation)	Not necessarily

*Source: Modified from Ravichandran, 2000*

### Conclusion

This paper attempted, through an analysis of previous research, to present an agenda for further research to develop a better understanding towards the distinction between “innovation creation” and “innovation adoption”. Innovation was used by many researchers interchangeably with or as a cover form of innovation adoptions, which we believe is a fallacy. Therefore, there has been a conceptual ambiguity of innovation. Innovativeness is an antecedent to innovation and innovation cannot be measured by the number of innovations adopted by a particular firm. It is of great importance to bear in mind that creativity, invention, innovativeness, and innovation are different concepts. It is also important to know that creativity will lead to innovativeness, that innovativeness will

lead to invention/s, and that applying those inventions within a broad and comprehensive system in a firm can lead to organizational innovation. Finally, both innovation creation and innovation adoption are and should be treated as different concepts. The proposed matrix attempted to differentiate between these two concepts. This paper is hoped to pave the way to researchers to conceptualize innovation and adoption of innovation as two different concepts so that a more reliable measurement for innovation could be introduced.

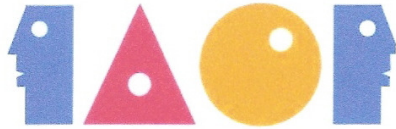
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## A STUDY ON THE INFLUENCE OF THE ERGONOMIC DESIGN OF LAPTOPS ON USERS

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### Abstract

The study focused on investigating the influence of the ergonomic design of laptops on users and mainly discussed the effect of tilt angle of laptops on the fatigue and soreness subjectively perceived by users. User's subjective perception of fatigue and soreness was evaluated with the Borg's CR-10 Scale. Five males and five females familiar with typewriting were selected for a test to evaluate their subjective perception of tiredness and soreness when typing under the conditions that the laptop tilted 0°, 10°, 15° and 20°. In addition, relation between sitting sight and the tilt of monitor ( $\beta$ ) as well as influence of tilt angle ( $\alpha$ ) on heat emission are investigated.

According to the data, the female participants were higher than the males in the subjective perception of fatigued and sore shoulder and neck. The participants generally liked 15° tilt angle of the laptop while typing. The subjective perception of fatigue and soreness was the strongest when the laptop tilted 0°. The tilt angle of the laptop had no impact on typing speed and error rate. Sitting sight of the participants was not significantly different, which caused little variation in the tilt of monitor. Concerning the temperature rise of the laptop, it surged within 20 minutes of use and changed little after 1 hour of use. In regard to long-term use, a laptop with a 15° tilt angle had better heat removing effect than that with a 0° tilt angle.

Keywords: Ergonomic Design Subjective perception, Borg's CR-10 Scale

## Introduction

In the electronicalized, computerized society full of information, light, thin, and easy-to-carry laptops enable people to obtain information easily. Gilbert (2005) and Cushman & Rochester (1991) mentioned that desk-top computers gradually replaced by laptops. The use of keyboards and computer mice mouse is most closely related to the use of computers. Kroemer, Kroemer, & Kroemer-Elbert (2001) state a great deal of research have showed that the long-term use of computers causes human beings great physical harm which easily generates burdens partially on muscles and bones, such as shoulder, neck, back, wrist, and arm, and, more seriously, causes physical illness, such as carpal tunnel syndrome and tendonitis. Therefore, the ergonomic design of computers gradually becomes important. The study aimed to investigate the influence of the tilt angle of laptops on the partial muscle and joint fatigue subjectively perceived by human bodies as well as the relationship between height and sitting sight. The result was provided designers as the reference to the design of laptops in the future.

## Literature Review

Cushman & Rochester (1991) mentioned that the correlation between keyboard and the input devices of computers was indeed specific. Çakir (2000) and Stewart (2000) state that ISO ergonomics standards for work on computers or Council Directive 90/270/EEC (1990) "on the minimum safety and health requirements for work with display screen equipment, "which is mandatory for all member states of the European Union, as well as ANSI/HFES 100-1988 (1988) for the American National Standard of Human Factors Engineering of Visual Display Terminal Workstations.

According to Hsieh, Lin, and Lin (2000), the keyboards of desk-top computers and laptops have significant influence on the physical burden and subjectively perceived fatigue of users. In addition, Syu (2009) and Hsieh and You (2000) addressed that the size, tilt angle, and wrist rest allocation of a computer keyboard had significant influence on typing performance, subjective evaluation, and operation posture. Lee (1998) and Lin & Cheng (1997) discovered that the ergonomic design of computer keyboards had obvious influence on the operation performance of consumers. Hsu (2009) argued that, comparing with the structure of desk-top computers, laptops would cause people more physical harm when they used them. Hence, it is necessary to apply the methods of ergonomic design to the improvement and design of laptops.

The fundamental condition of hand movement lies in motion coordination and stability, and when one uses a keyboard and mouse, the hand muscles simultaneously play the roles of brake and stabilizer (Tsai, 2002). Cheng, Wei, Huang, Wu and Huang. (2003) mostly observed muscle by measuring the electromyographic (EMG) signals of muscles in exercise in their research. In summary, the influence of the ergonomic design of laptops on users lies in the partial muscle and joint fatigue subjectively perceived by human bodies as well as the relationship between height and sitting sight, which were the aims of the study.

## Test Materials and Methodology

### *Test Tools*

1. Measuring Tape: to measure the size of a motionless human body.
2. Laptop: ASUS A2500 with a 14'' monitor. The size was 330×270×40 (mm).
3. Test Materials: four copies of Chinese input simulation test questions of the



Computer Skills Foundation, the codes of which were respectively CHN-0001-1 P.1, CHN-0001-1 P.2, CHN-0001-1 P.3, and CHN-0001-1 P.4, and the size of which was respectively A4.

4. Imaging Bolometer: the model was IRIS1001E.

#### *Test Participants*

There were totally ten test participants, respectively five males and five females, in this experiment. They were college students between 21 and 23 years old. They did not have color blindness and strabismus, and their corrected eyesight was above 0.8. They were all familiar with the Novel Zhuyin Input Method for Traditional Chinese, and the speed was approximately 20~40 words per minute.

#### *Basic Environmental Design*

1. Before the test, the basic physical data of each test participant was measured, including height, sitting sight, shoulder width, elbow length, arm length, and palm width.
2. The fixed height of the table was 750mm, and the height of the chair was 430mm. The operation environment was properly adjusted to avoid glare. The test environment was as indicated by Figure 1.
3. Different copies of test questions were applied to different tilt angle in order to avoid the difference caused the familiarity of the test participants with the same test material. The test materials belonged to the same level.

#### *Experiment Methodology*

1. The included angle between the monitor and mainframe of a laptop ( $\beta$ ): the elevation angle of monitor between each test participant and each of the four tilt angles of

keyboard was respectively measured to discover the most distinct included angle of monitor, and the data were noted down. The illustration of the installation was as indicated by Figure 2.

2. The included angle between the laptop and the desk ( $\alpha$ ): Each test participant used the laptop with the  $\alpha$  tilting respectively  $0^\circ$ ,  $10^\circ$ ,  $15^\circ$ , and  $20^\circ$ . Every ten minutes was regarded as one unit, and totally four units were conducted for each tilt angle. In addition, Borg's CR-10 Scale was employed to note down the subjectively perceived fatigue, in which 0~10 were used to indicate the fatigue or soreness. Table 1 is the comparison with the scale.

Table 1. Borg's CR-10 Scale

Score		Feeling
0	Nothing at all	No feeling at all
0.5	Just noticeable	Just noticeable feeling
1	Very weak	Very weak
2	Weak	Weak
3	Moderate	Moderate
4	Somewhat strong	Somewhat strong
5	Strong	Strong
6		
7	Very strong	Very strong
8		
9		
10	Extremely strong	Extremely strong

3. Investigation on the Temperature of Laptops:

When a laptop tilted respectively  $0^\circ$  and  $15^\circ$ , a thermal imager, the model of IR1001E made by IRISYS, UK, was used to measure the temperature rise of the laptop chassis. After the instruments were installed, a digital camera was used to photograph them for comparison. In the measurement, the laptop was in the status of run.

The measurement of temperature was divided into two parts. One was to retrieve the temperature images of respectively 0 minute, 20<sup>th</sup> minute, 40<sup>th</sup> minute, and each hour for

continuously six hours to investigate the temperature rise. The other was, after running the laptop for nine hours, to remove the laptop to understand the temperature distribution on the desk top in which the laptop was placed. The aforementioned images and photos were combined to comprehend the temperature distribution of the laptop.

## Conclusion and Discussion

### *The Values of the Static Physical Measurement*

The test participants in the study included five males and five females. All of them were college students between 21 and 23 years old. According to the static physical measurement values of the test participants in Table 2, the mean and standard deviation of respectively the height, sitting sight, shoulder width, upper arm length, forearm length, and palm width were calculated.

### *The Elevation Angle of Monitor ( $\beta$ )*

Table 3 and Figure 1 were combined and compared, and the direction of sight was employed for observation. The optimal standing sight was  $10^\circ$  whereas the optimal sitting sight was  $15^\circ$ , the secondary  $30^\circ$ . The range of sight was  $67.8^\circ$ . It was thus known that the  $\alpha$  tilt angle had little influence on the test participants' angle of vision.

Table 2. The Values of the Static Physical Measurement (Unit: cm)

Male	Height	Sitting Sight	Shoulder Width	Upper Arm Length	Forearm Length	Palm Width
	170.8 (6.14)	78.3 (3.42)	43.2 (1.30)	33.8 (1.64)	43.6 (1.89)	10.6 (0.55)
Female	Height	Sitting Sight	Shoulder Width	Upper Arm Length	Forearm Length	Palm Width
	161.6 (4.16)	74.2 (2.49)	36.4 (1.52)	32.4 (1.52)	42.8 (1.30)	9.1 (0.22)

( ) Standard Deviation

Table 3. The most distinct monitor angle of the participants in each tilt angle (unit: cm)

Code	Height	Sitting Sight	Elevation Angle of Monitor ( $\beta$ )			
			0°	10°	15°	20°
Participant 1	178	82 <sup>a</sup>	110	110	120	120
Participant 2	176	79	109	110	115	125
Participant 3	169	81	115	110	115	120
Participant 4	168	75	110	110	115	120
Participant 5	163	74.5	115	110	110	121
Participant 6	160	74	115	110	115	120
Participant 7	164	76	115	110	118	115
Participant 8	165	76	115	115	120	120
Participant 9	163	75	110	110	120	120
Participant 10	155	70 <sup>b</sup>	105	110	115	120

a: maximum; b: minimum

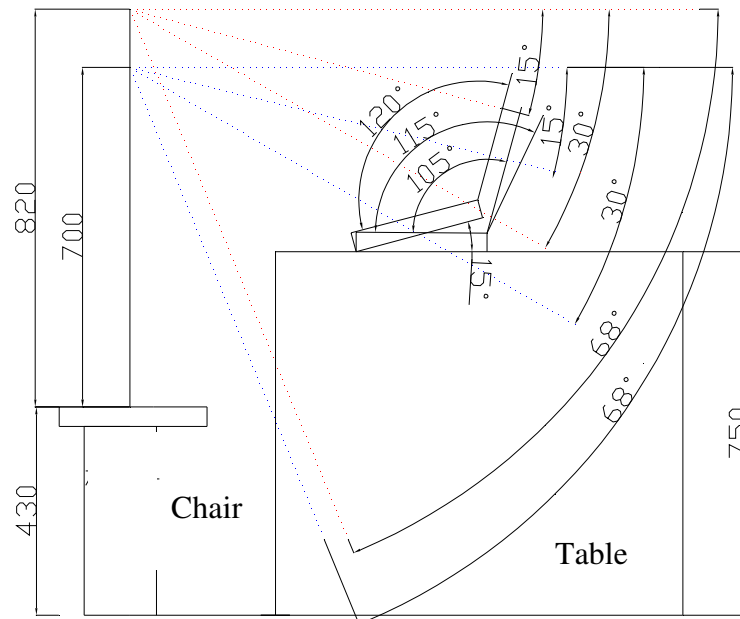


Figure 1. The range of the most distinct monitor angle of the participants in each tilt angle (unit : mm)

*The Included Angle,  $\alpha$ , between the Laptop Chassis and the Desk*

When the included angle,  $\alpha$ , was  $0^\circ$ , the fatigue and soreness subjectively perceived by the male participants were indicated by Figure 2, and those subjectively perceived by the female participants were indicated by Figure 3.

By comparing Figure 2 and 3, it was found that due to greater height and build, the fatigue of most of the body parts of the male participants was greater than that of most of the body parts of the female participants, but the fatigue of the fingers of both the males and females was not significantly different. Furthermore, the fatigue of the shoulders of the female participants was significantly greater than their other body parts since they had petite builds, and they had sore shoulders because of shrugging the shoulders unnaturally.

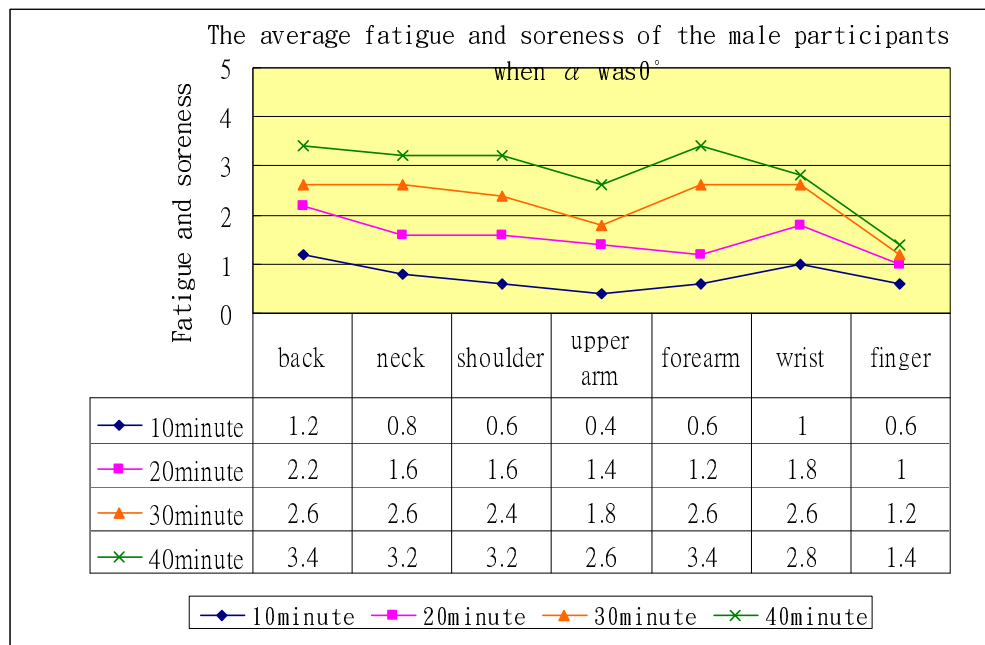


Figure 2. The average fatigue and soreness of the male participants when  $\alpha$  was  $0^\circ$ .

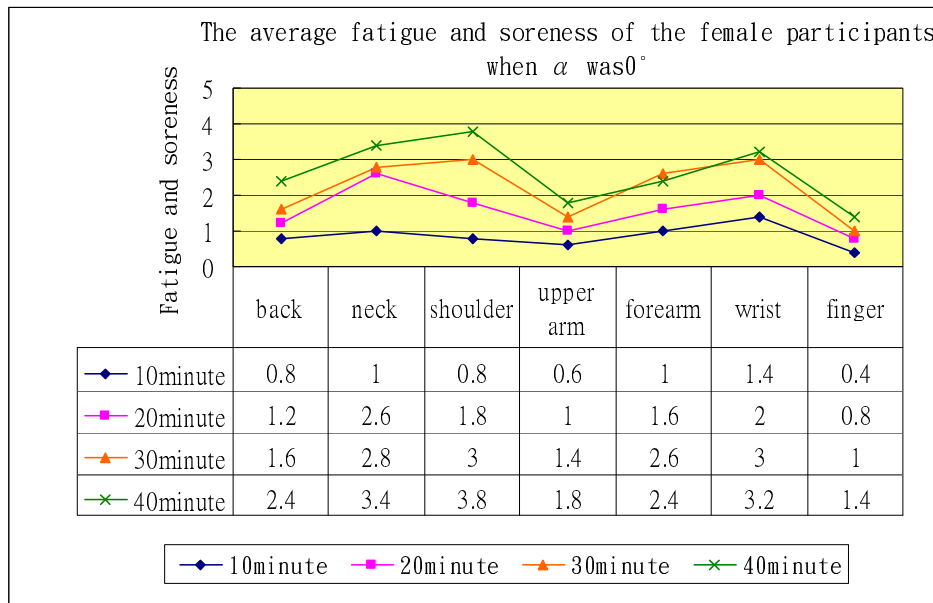


Figure 3. The average fatigue and soreness of the female participants when  $\alpha$  was  $0^\circ$ .

When  $\alpha$ , the included angle, was  $10^\circ$ , the fatigue and soreness subjectively perceived by the male participants was as indicated by Figure 4, and the fatigue and soreness subjectively perceived by the female participants was as indicated by Figure 5.

According to Figure 4 and 5, the fatigue of finger was still close to 0. The male participants' fatigue of neck was approximately between 0.8 and 1.4, indicating the neck was the least tired body part except the fingers. The fatigue of back was between 0.8 and 2.2, and the fatigue of shoulder was between 1 and 2, indicating they were the more tired parts comparing with other body parts. In terms of the female participants, the fatigue of neck was between 0.8 and 3, and that of shoulder was between 0.4 and 2.8, indicating they were both more tired than other body parts.

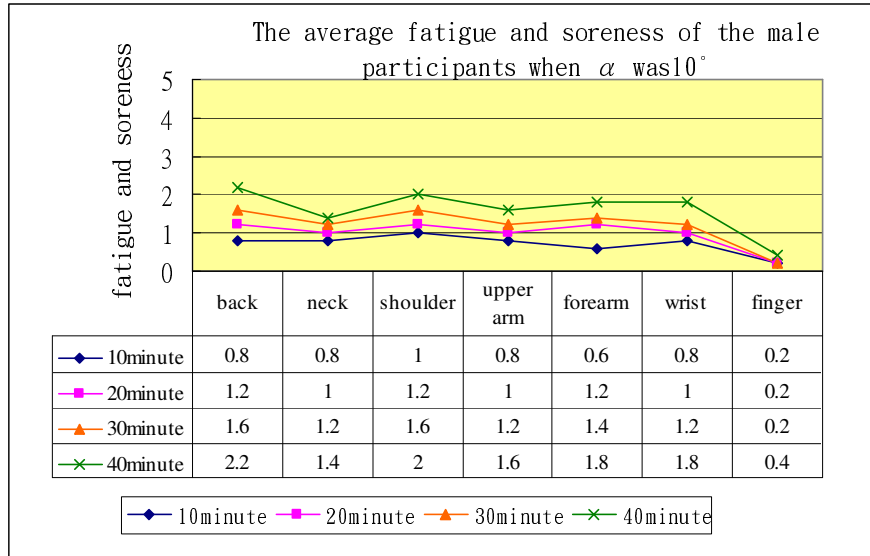


Figure 4. The average fatigue and soreness of the male participants when  $\alpha$  was  $10^\circ$ .

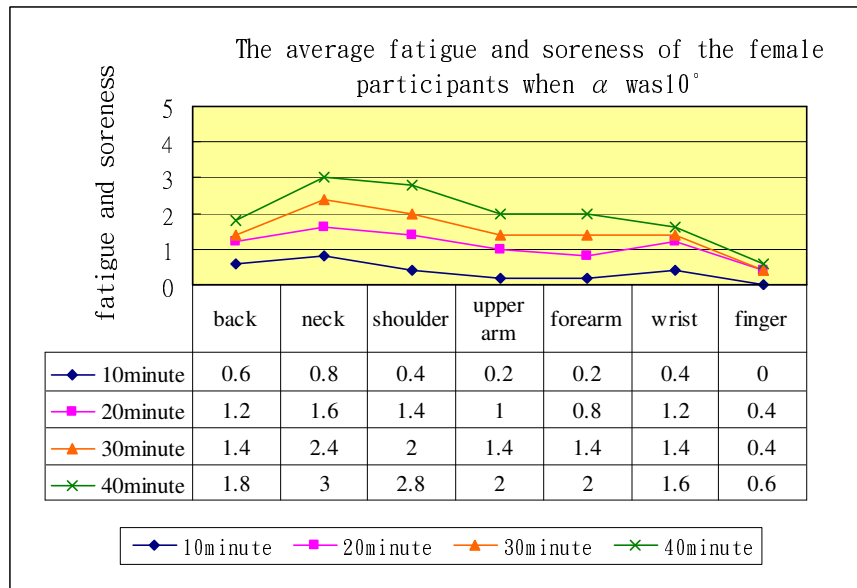


Figure 5. The average fatigue and soreness of the female participants when  $\alpha$  was  $10^\circ$ .

When  $\alpha$ , the included angle, was  $15^\circ$ , the fatigue and soreness subjectively perceived by the male participants was as indicated by Figure 6, and the fatigue and soreness subjectively perceived by the female participants was as indicated by Figure 7.

According to Figure 6, the fatigue of all of the body parts tended to be low. In contrast with that, the fatigue of shoulder was between 0.2 and 2.2, and that of upper arm was between 0.4 and 2, both of which belonged to the more tired parts. Moreover, according to Figure 12, the fatigue of forearm was the lowest, and the fatigue of neck and shoulder was between 0.2 and 3, belonging to the more tired body parts.

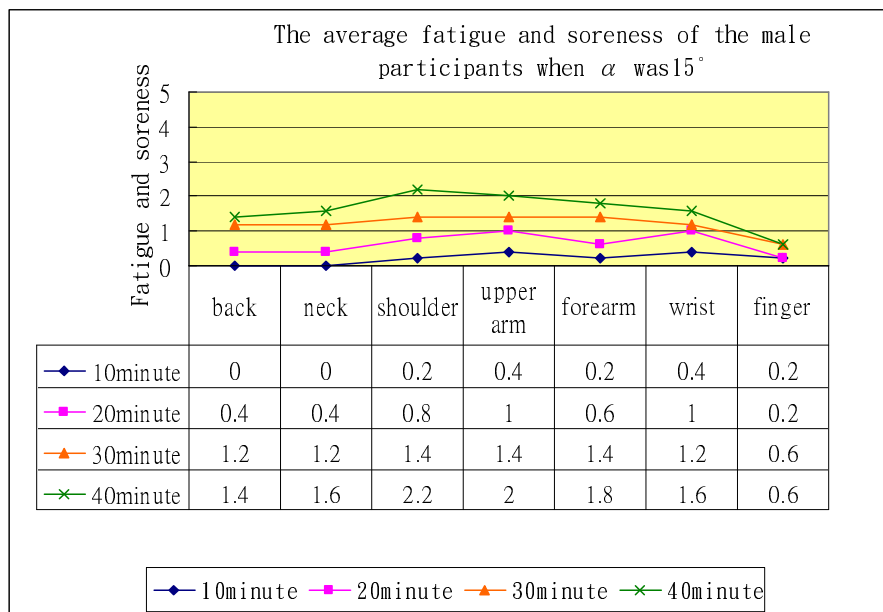


Figure 6. The average fatigue and soreness of the male participants when  $\alpha$  was  $15^\circ$ .



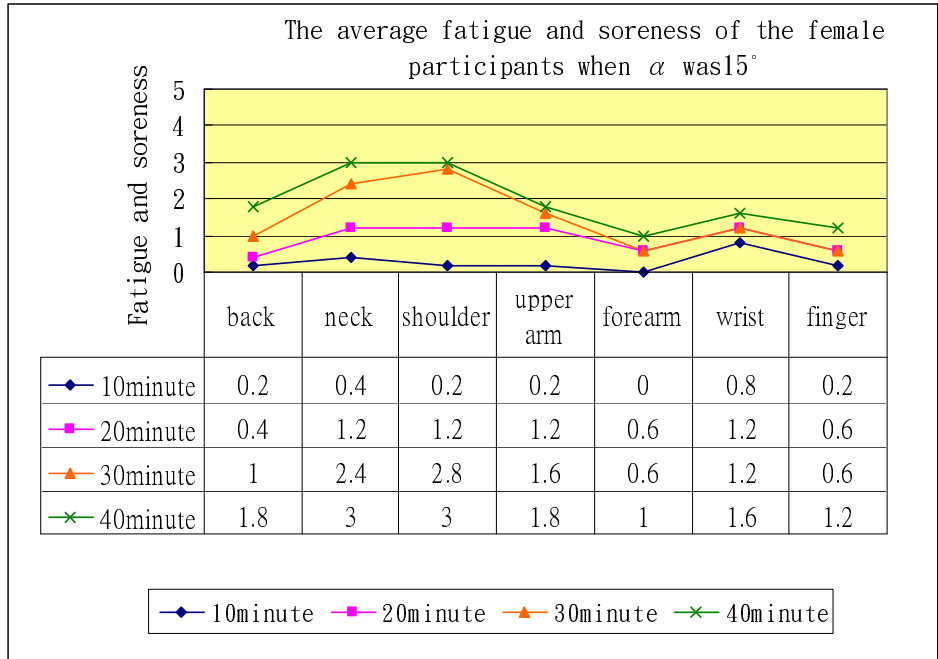


Figure 7. The average fatigue and soreness of the female participants when  $\alpha$  was  $15^\circ$ .

When  $\alpha$ , the included angle, was  $20^\circ$ , the fatigue and soreness subjectively perceived by the male participants was as indicated by Figure 8, and the fatigue and soreness subjectively perceived by the female participants was as indicated by Figure 9.

It was found in Figure 8 that the fatigue of upper arm, higher than that of other body parts, was between 0.8 and 3.2, and the fatigue of wrist was between 0.8 and 2.6, both of which were the more tired body parts. Figure 9 indicated that the fatigue of neck was between 0.6 and 3.2 while that of shoulder was between 0.4 and 3, both of which were the more tired parts. The greatest difference between Figure 8 and 9 lay in the fatigue of upper arm.

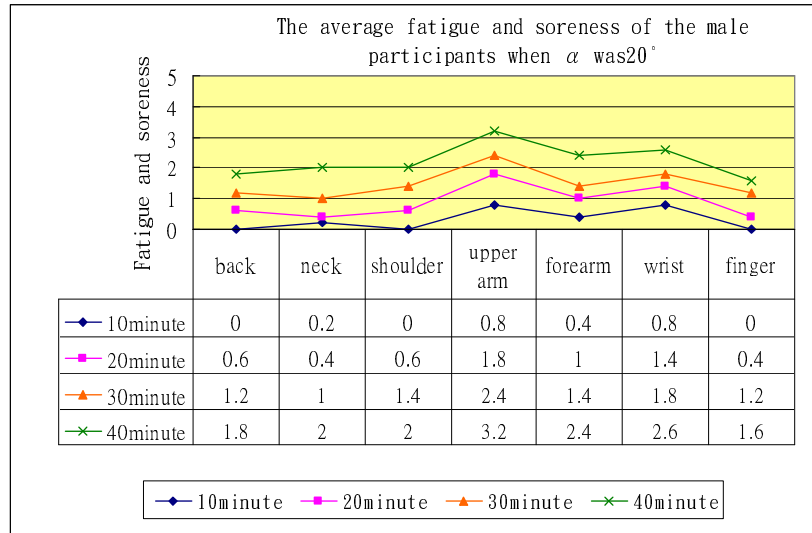


Figure 8. The average fatigue and soreness of the male participants when  $\alpha$  was  $20^\circ$ .

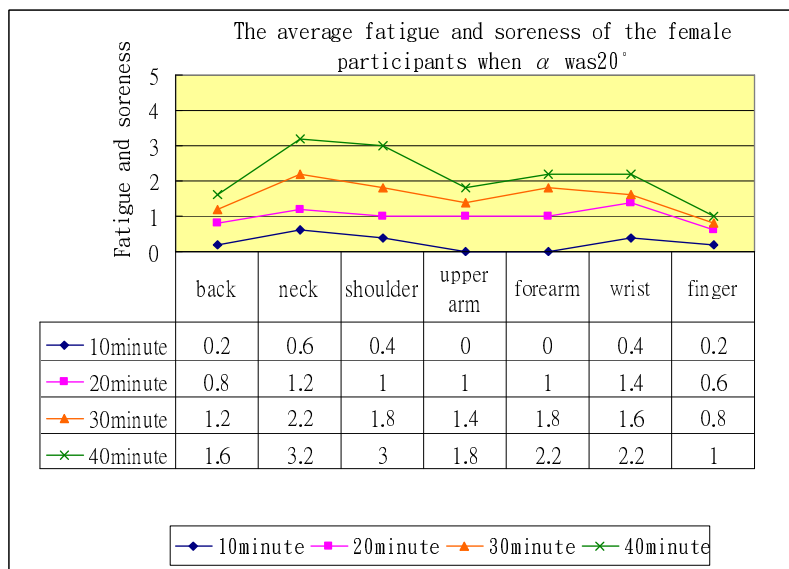


Figure 9 The average fatigue and soreness of the female participants when  $\alpha$  was  $20^\circ$ .

When  $\alpha$ , the included angle, was respectively  $0^\circ$ ,  $10^\circ$ ,  $15^\circ$ , and  $20^\circ$ , and the test time was 40 minutes, the fatigue and soreness subjectively perceived by the male participants was as indicated by Figure 10, and the fatigue and soreness subjectively perceived by the female participants was as indicated by Figure 11.

It was found in Figure 10 that the male participants had the least fatigue when  $\alpha$ , the included angle, was  $15^\circ$ , following by  $10^\circ$ ,  $20^\circ$ , and  $0^\circ$ . The angle of  $0^\circ$  caused the most fatigue. However, in terms of upper arm, the angle of  $20^\circ$  caused the most fatigue. In light of Figure 16, the female participants also had the least fatigue when  $\alpha$ , the included angle, was  $15^\circ$ , following by  $10^\circ$ ,  $20^\circ$ , and  $0^\circ$ . The angle of  $0^\circ$  also caused the most fatigue. In addition, their fatigue of neck and shoulder was the maximum whatever the angle was. For wrist, the fatigue caused by the angle of  $20^\circ$  was slightly higher than that caused by the angle of  $10^\circ$  or  $15^\circ$ .

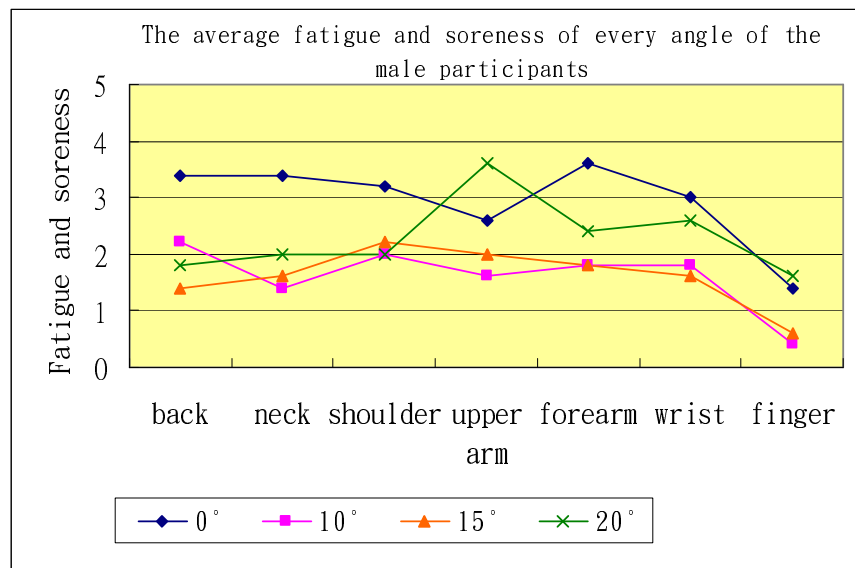


Figure 10. The average fatigue and soreness of the male participants when  $\alpha$  was between  $0^\circ$  and  $20^\circ$ .

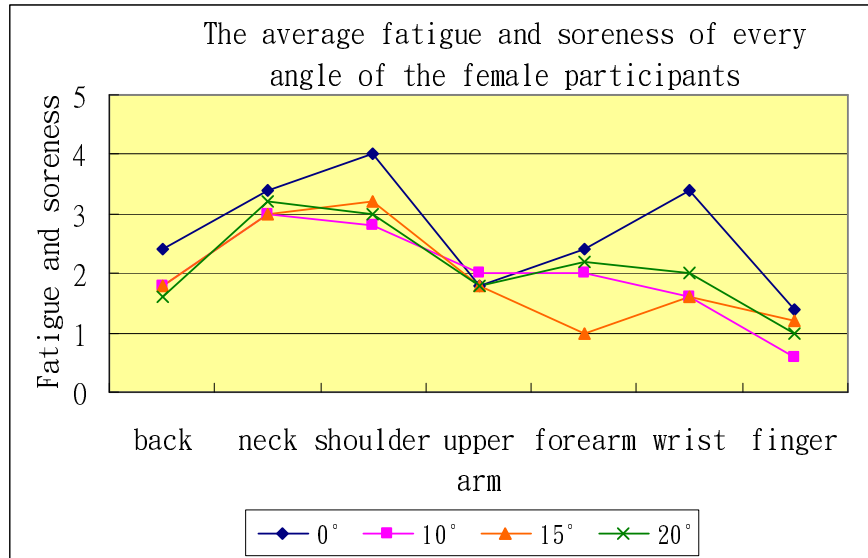


Figure 11. The average fatigue and soreness of the female participants when  $\alpha$  was between  $0^\circ$  and  $20^\circ$ .

From Table 4, it was found that different angles had tiny difference in the error rate of use.

The difference in total words was also considerably tiny.

Table 4. The error rate<sup>1</sup> (unit: %) and total words resulted from the test participants' use of each tilt angle of the laptop.

Error Rate	0°	10°	15°	20°
Participant 1	0.2	0.21	0.32	0.2
Participant 2	0.31	0.27	0.11	0.28
Participant 3	0.84	0.54	0.38	0
Participant 4	0.34	0.14	0	0
Participant 5	0.65	0.74	0.73	0.8
Participant 6	0.7	1.05	0.57	0.44
Participant 7	0.59	0.37	0.3	0.59
Participant 8	0	0.2	0.38	0
Participant 9	0.18	0.4	0.35	0.35
Participant 10	0.31	0.55	0.49	0.54
Average	0.41	0.45	0.36	0.32

Table 4 (Continued). The error rate<sup>1</sup> (unit: %) and total words resulted from the test participants' use of each tilt angle of the laptop.

Total Words	0°	10°	15°	20°
Participant 1	999	1390	1258	1434
Participant 2	956	1131	902	1071
Participant 3	717	741	190	660
Participant 4	892	694	695	847
Participant 5	919	808	822	999
Participant 6	712	758	879	679
Participant 7	843	813	985	852
Participant 8	1001	1016	1053	999
Participant 9	1093	1019	1127	1142
Participant 10	956	901	1022	934
Average	908.8	927.1	893.3	961.7

$$\text{Error rate} = (\text{misspelled words} \div \text{total words}) \times 100\%$$

#### *Analysis on Thermal Images*

The setup situation for testing the laptop temperature was employed in the study (Figure 12). The image of the laptop surface taken by digital camera was divided into 9 divisions (Figure 13). Division 2 is the position of the battery; division 3 is the position of the power plug and CPU; division 4 is the position of CD ROM; division 5 is the position



Figure 12 The setup situation for testing the laptop temperature

of the RAM; division 6 is the CPU fan; division 8 is the position of the graphic card; division 9 is the position of the hard disk drive. The ventilation holes of the laptop locate in division 2, 3, 5, and 8.

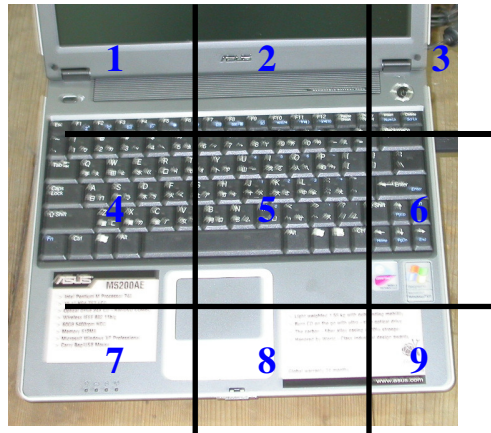


Figure 13 The divisions of the laptop surface

Figure 14 indicates the temperature distribution measured by the thermal imager before the laptop was used in the tilt angle of  $0^{\circ}$ . The room temperature on the day was approximately  $27^{\circ}\text{C}$ , and the thermal image showed that the temperature distribution was between  $27^{\circ}\text{C}$  and  $28^{\circ}\text{C}$ . Figure 15 indicates the temperature distribution measured by the thermal imager before the laptop was used in the tilt angle of  $15^{\circ}$ . The room temperature on the day was approximately  $28^{\circ}\text{C}$ , and the temperature distribution was between  $28^{\circ}\text{C}$  and  $29^{\circ}\text{C}$ .

After the laptop was used for 20 minutes, the temperature distribution changed. When the laptop tilted  $0^{\circ}$ , the temperature of division 5 and 8 rose to  $36^{\circ}\text{C}$  (Figure 16) whereas the temperature of division 5 and 8 rose to  $37.6^{\circ}\text{C}$  (Figure 17) when the laptop tilted  $15^{\circ}$ .

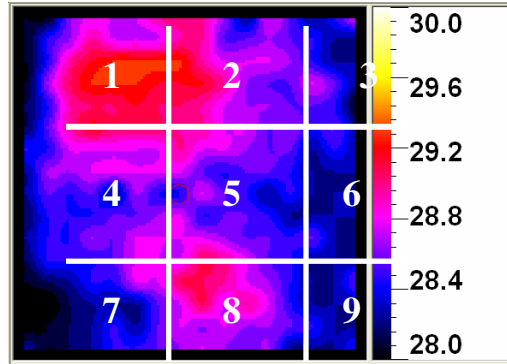
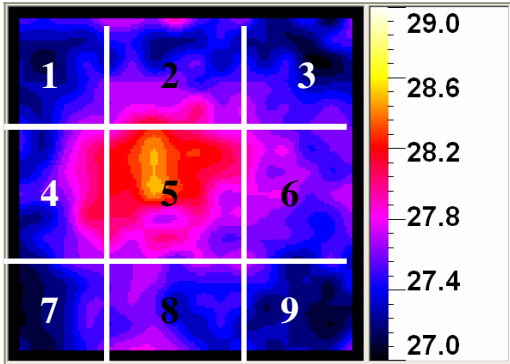


Figure 14. The thermal image before use ( $0^\circ$ )      Figure 15. The thermal image before use ( $15^\circ$ )

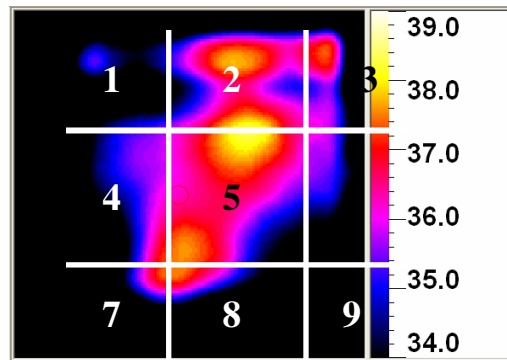
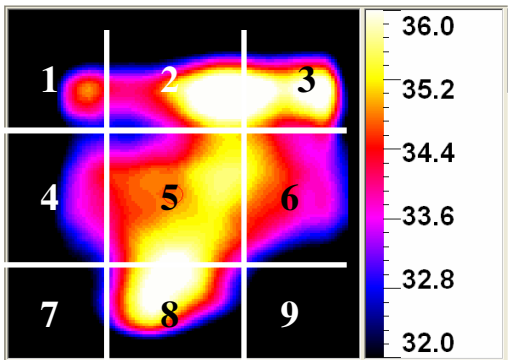


Figure 16. The thermal image after 20 minutes of use ( $0^\circ$ )      Figure 17. The thermal image after 20 minutes of use ( $15^\circ$ )

After the laptop was used for respectively 40 min, 60 min, 120 min, 180 min, 240 min, and 300 min, the area located between division 5 and 8 became the major high temperature area, the temperature rise of which was as indicated by Figure 18. It was found that within the first 20 minutes after the laptop was turned on, the temperature of the laptop chassis rapidly rose from respectively  $27.6^\circ\text{C}$  and  $28.6^\circ\text{C}$  to respectively  $36.2^\circ\text{C}$  and  $37.6^\circ\text{C}$ . After that, the temperature rose slowly until the time reached 60min, in which the temperature slowly increased  $2^\circ\text{C}$  when the laptop tilted  $0^\circ$  whereas the temperature slowly increased  $2.7^\circ\text{C}$  when the laptop tilted  $15^\circ$ . Afterward, the temperature almost maintained the same. After 300min, the temperature rose to  $39.5^\circ\text{C}$

when the laptop tilted  $0^\circ$  whereas the temperature rose to  $41.2^\circ\text{C}$  when the laptop tilted  $15^\circ$ . Within 300min, the temperature rose approximately  $11.9^\circ\text{C}$  in total when the laptop tilted  $0^\circ$  whereas the temperature raised approximately  $12.6^\circ\text{C}$  in total, when the laptop tilted  $15^\circ$ .

The temperature measured by a thermal imager is surface temperature. The higher the surface temperature is, the better heat removing effect a laptop chassis has. The total risen temperature of the  $15^\circ$  tilt angle was higher than that of the  $0^\circ$  tilt angle, which indicated that the heat removing effect of the  $15^\circ$  tilt angle was better than that of the  $0^\circ$  tilt angle.

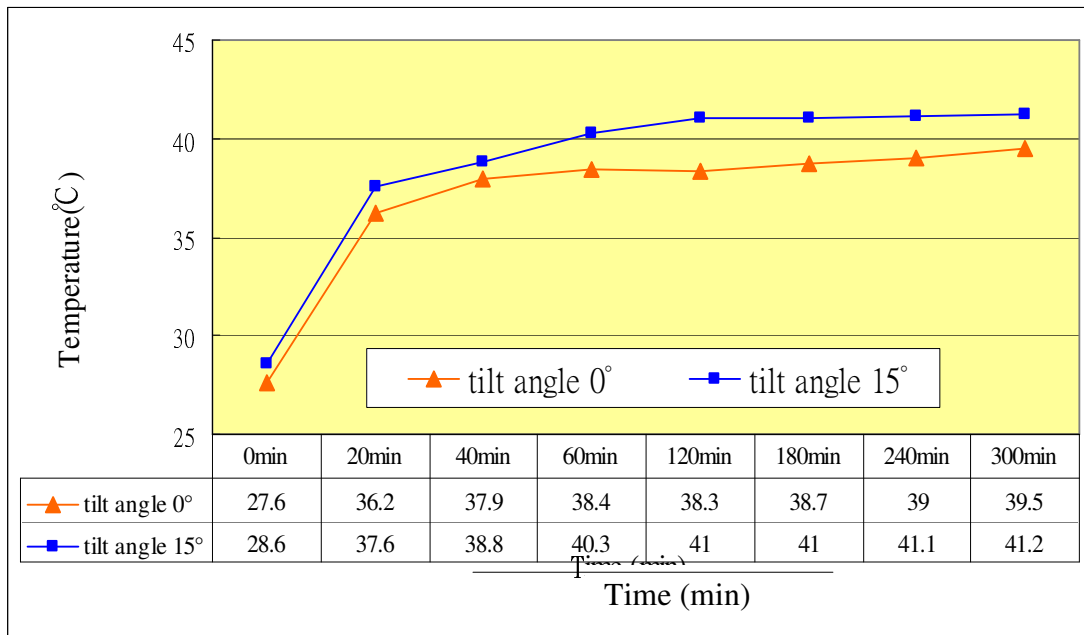


Figure 18. The temperature rise of the laptop tilting  $0^\circ$ 及 $15^\circ$



For another part of the test, Figure 19 indicated the temperature distribution before use when the laptop tilted  $0^\circ$ . The temperature evenly distributed between  $27^\circ\text{C}$  and  $28.6^\circ\text{C}$ , which was similar to the room temperature on the day. Figure 20 indicated the temperature distribution before use when the laptop tilted  $15^\circ$ . The temperature evenly distributed between  $26^\circ\text{C} \sim 27^\circ\text{C}$ , which was similar to the room temperature on the day.

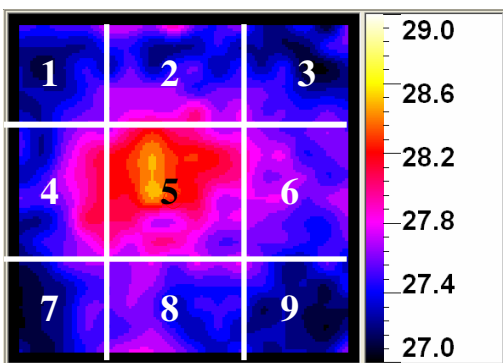


Figure 19. The thermal image before use ( $0^\circ$ )

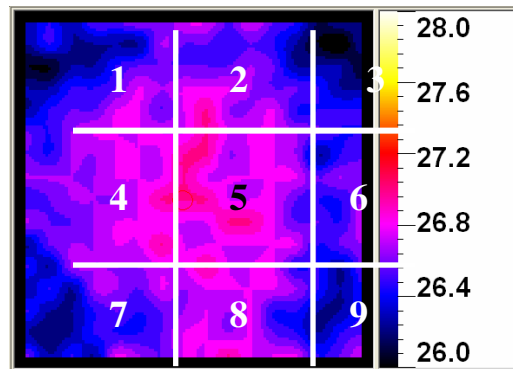


Figure 20. The thermal image before use ( $15^\circ$ )

After the laptop was used for 9 hours, it was found in Figure 21 that the temperature of the  $0^\circ$  tilt angle was higher in division 2 and the area between division 5 and 8, and it was between  $37^\circ\text{C}$  and  $38^\circ\text{C}$ . In addition, according to Figure 22, the temperature of the  $15^\circ$  tilt angle was higher in division 5, which was different from that of the  $0^\circ$  tilt angle, and it was approximately  $38.5^\circ\text{C}$ . The temperature of the laptop chassis rose approximately  $10^\circ\text{C}$  in total when the tilt angle was  $0^\circ$ , and it raised approximately  $11.7^\circ\text{C}$  in total when the tilt angle was  $15^\circ$ .

After the laptop was used for 9 hours, it was immediately moved away, and the thermal imager was employed to measure the temperature distribution of the desk top. The temperature distribution of the  $0^\circ$  tilt angle and the  $15^\circ$  tilt angle was significantly different (Figure 23 and 24).

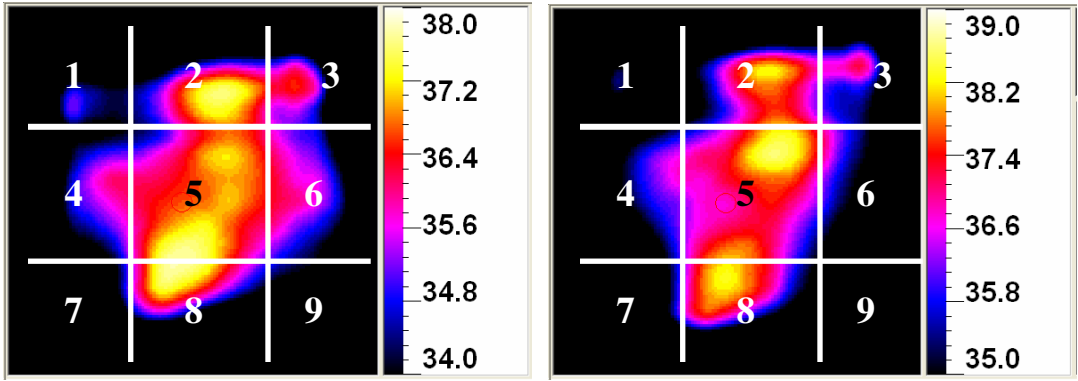


Figure 21. The thermal image after 9 hours of use (0°) Figure 22. The thermal image after 9 hours of use (15°)

When the tilt angle was 0°, division 5 was the major high temperature area, in which the temperature was around 35°C, and when the tilt angle was 15°, division 8 and 9 were the major high temperature area, in which the temperature was approximately 32°C. The temperature of the 0° tilt angle was higher than that of the 15° tilt angle, and their temperature distribution was also different. When the laptop tilted 0°, it completely stuck to the desk top, and the desk top absorbed most of the heat. On the contrary, when the laptop tilted 15°, the air circulated, and the heat removing effect was better.

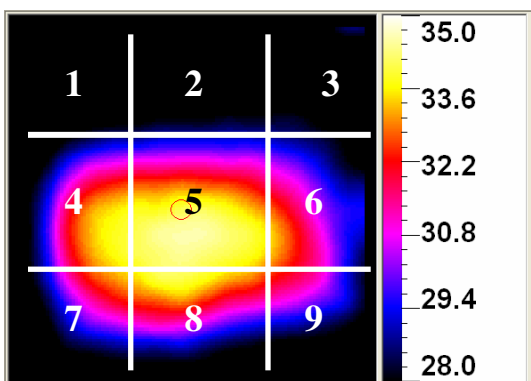


Figure 23. The thermal image of the desk top after 9 hours of use (0°)

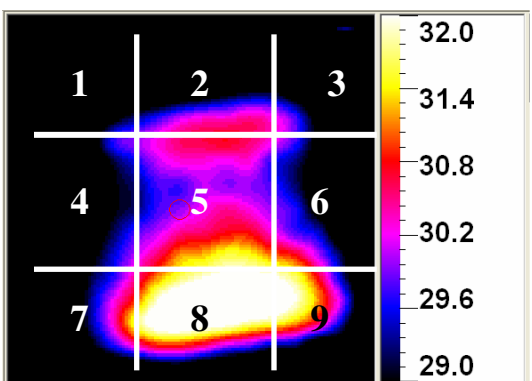


Figure 24. The thermal image of the desk top after 9 hours of use (15°)

## Conclusion

In each different  $\alpha$  angle, the fatigue and soreness subjectively perceived by the female participants were obviously higher than those subjectively perceived by the male participants since the builds of the female participants were smaller than those of the male participants, and the desk was slightly too high, which caused them to shrug their shoulders unnaturally, and which might easily cause complications in terms of long-term use.

The test participants generally preferred the laptop with the  $\alpha$  angle of  $15^\circ$ , the secondly preferred one the  $\alpha$  angle of  $10^\circ$ . However, the preference the  $\alpha$  angle of  $20^\circ$  was fair. When the  $\alpha$  angle was between approximately  $10^\circ$  and  $20^\circ$ , the subjectively perceived fatigue and soreness tended to be lower. The tilt angle,  $\alpha$ , of the laptop did not have influence on typing speed and error rate. The laptop with a tilt angle of  $15^\circ$  had a better heat removing effect than the laptop with a tilt angle of  $0^\circ$ . The findings of the study will provide designers for creating new laptop computers in order to reduce the influence of the ergonomic design of laptops on users.

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