Time-Based Strategy and Business Performance under Environmental Uncertainty: *An Empirical Study of Design Firms in Taiwan*

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Now that design is acknowledged as an important consideration for businesses and is recognized as having the potential for driving competitiveness, the only sure thing in adopting a business strategy is that there will always be unknown variables in uncertain environments. Prior findings on the relationship between environmental uncertainty, time-based strategy, and business performance have been inconsistent. Meanwhile, the 'strategic planning' dimension of design consultancy firms has not attracted a great deal of attention. Thus, in this paper, we explore the moderating effects of environmental uncertainty on the relationship between time-based strategy and business performance in design firms. Based on data collected from 80 design firms in Taiwan, the findings first reveal that these firms can adopt different time-based strategies to pursue different performance outcomes. Second, the results show that three of four types of environmental uncertainty have direct effects on measures of business performance such as *adaptability* and *innovation*. Third, the findings suggest that appropriate matches between environmental uncertainty and time-based strategy can result in superior business performance. Specifically, the results indicate that the design-differentiation preemptor (DDP) strategy is beneficial for a design firm when it comes to achieving superior *adaptability* in an environment of high-perceived *technological evolutions* (TE) or *competitor movements* (CM) uncertainty. In addition, a design firm can adopt the DDP strategy in order to obtain superior levels of *innovation* in an environment of low-perceived *customer demands* (CD) uncertainty. However, the findings reveal that there are no moderating effects of environmental uncertainty found with the design-cost follower (DCF) strategy. Last of all, the limitations of this study and future research possibilities are also discussed.

Keywords – Environmental Uncertainty, Time-Based Strategy, Business Performance, Design Firm.

Relevance to Design Practice – In recent years, we have seen mounting evidence from exploration of the possible relationships among environment, strategy, and performance. However, very little attention has been paid to the effects of these relationships on design consultancy businesses. The results of this study clearly demonstrate that design firms which focus on long-term issues should not only consider the value of a time-based strategy but also should be aware of the types of environmental uncertainty present if they wish to achieve superior business performance.

Citation: Sung, T. J., Lu, Y. T., & Ho, S. S. (2010). Time-based strategy and business performance under environmental uncertainty: An empirical study of design firms in Taiwan. *International Journal of Design, 4*(3), 29-42.

Introduction

In essence, the use of design as an innovative activity is often treated as a means for increasing the competitiveness of enterprises or even of nations. Design is in fact becoming one of the most important determinants of success for many business firms (Bruce & Bessant, 2002; Roy & Riedel, 1997; Walsh, 1995). At present, the demand for design is not only increasing, but also changing. The term 'design service,' as a service provided by design consultancy firms (hereafter called 'design firms'), covers a wide range of activities, from conducting research and developing emerging products to making final products and marketing them (Vanchan, 2007). In general, a good design firm will continuously be searching for ways in which to differentiate its design services from its competitors so as to create a greater margin of competitiveness. Thus far, however, academics as well as practitioners seem to have a very limited understanding of how design firms make strategic decisions in the interests of their business, especially when these firms are themselves trying to help clients formulate strategies that can take advantage of the opportunities presented in a highly uncertain business environment. For the growth and evolution of professional service firms, Løwendahl (2005) has argued that "strategy is necessary in order to achieve coordinated activities in a highly decentralized and non-routinized structure..." (p. 101). Thus, if strategic planning is lacking, a design firm is likely to be handicapped in any efforts to focus on long-term issues or to

Received January 1, 2010; **Accepted** September 14, 2010; **Published** December 22, 2010.

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develop the unique design competencies necessary to achieve a sustainable competitive advantage. Of course, a strategy needs to take into account the demands for flexibility and responsiveness to clients' needs as well as other factors involving various degrees of environmental uncertainty. In combination, the development of a strategy is as important in a design firm as in a manufacturing firm, though the strategy content and the priorities emphasized may be different.

Numerous studies have explored, theoretically and empirically, the possible relationships among environment, strategy and performance in the manufacturing sector (Badri, Davis, & Davis, 2000; Miles & Snow, 1978; Swamidass & Newell, 1987). Yet so far, there has been relatively little research on the role of these relationships in the service sector. In general, a design firm, as a professional service provider, possesses abstract design knowledge or skills and provides related design expertise to its clients for a fee. In the present study, we have focused on the design sector for three reasons. First, the design sector, characterized as it is by its knowledge-intensive services and value-added solutions, operates in the midst of a great deal of uncertainty and risk. This compels design firms to engage heavily in service activities that represent a response to change. Second, the increasing importance of design services in today's knowledge-based economy has significant theoretical and practical implications on design practice. Third, several researchers (Løwendahl, 2005; Scott, 1998; Teece, 2003) have advocated that professional service firms should be treated as forerunners of the organizational forms that will be a mainstay in tomorrow's knowledge-intensive economy. In comparison to design firms in the US, Europe or Japan, the firms in many Asian countries face their own set of challenges, including those challenges presented by the emergence of new local brands in the home market, competition from foreign design firms, and a lack of long-term strategic planning (Eckersley, Spaeth, Borsboom, Johnston, & Hesse, 2003). Design firms in Taiwan offer a good representation of those firms that are confronting these unique Asian challenges and coming up with unique solutions. Taiwan design firms have in recent years been working hard to develop innovative designs and have performed well at international design competitions. These firms have been operating, moreover, in the midst of a transformation economy, one that has been undergoing continual shifts, from an agrarian- to an industrial-based economy, to a service-based economy, and now toward an experience-based one, a process which reinforces the effect of 'match' on business performance. For the above reasons, we have chosen to use Taiwan design firms as the subject of this study. We believe that the outcomes of the study will offer valuable insights for other Asian countries, such as China, India, and South Korea.

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However, today's design firms, no matter how large or small, are increasingly confronted with external environmental turbulence and complexity. As the external environment in which these design firms exist is changing rapidly and continually, how to properly adopt strategic choices in response to environmental uncertainty has become a great challenge. Lawrence and Lorsch (1967) embraced the notion that environmental uncertainty is both a threat and an opportunity to the development of an organization's internal structures and processes. It has been widely recognized that the inability to predict external changes can hinder success and even cause failure (Duncan, 1972). Past studies have identified some key sources of environmental uncertainty, such as technology and market changes, governmental laws and regulations, social transformation, client preferences, supplier support, and the behavior of competitors (Badri et al., 2000; Bourgeois, 1985; Karjewski & Ritzman, 1996).

A design firm needs to have various responses to these different sources of environmental uncertainty. Along these lines, there is a great deal of literature, on both the service and manufacturing sectors, focusing on and verifying the benefits of time-based competition for attaining a competitive advantage (e.g., Stalk, Evans, & Shulman, 1992; Stenbacka & Tombak, 1995; Toni & Meneghetti, 2000). One significant example of a company that has adopted a preemptive strategic approach is IDEO. This well-known and innovative design and consultancy firm has moved beyond product, service, and experience design to an attempt to put itself in a position to be the first firm to help clients design a culture (Utterback et al., 2006).

We can see this as an example of time-based strategy, which is defined as "organizational timing and speed in the execution of product development, product delivery or service responsiveness" (Wagner & Digman, 1997, p. 336). In general, a design firm that offers quick responses to clients' needs is likely to attract more clients and to encourage loyalty, thereby increasing its pricing competitiveness. In addition, some researchers (Daft & Macintosh, 1981; Galbraith, 1973) have argued that business performance is determined by how well a match is made between the uncertainty of its tasks and the strategy in dealing with that uncertainty. Likewise, prior empirical research supports the idea that the relationship between a time-based strategy (speed-to-market) and business success is moderated by the degree of uncertainty present (Chen, Reilly, & Lynn, 2005; Kessler & Bierly, 2002). Therefore, a key premise in the normative literature is that a time-based strategy that will result in superior performance is dependent on the existing environmental circumstances.

The present article is organized as follows. First, we review the literature from which the definitions and domains of environmental uncertainty, time-based strategy, and business performance emerge. Second, we develop and test a conceptual model of the research hypotheses that examine the relationships among environmental uncertainty, time-based strategy and business performance. Third, we describe the nature and evolution

of Taiwan's design industry. Finally, we discuss the results of the study and offer design management implications, limitations, and directions for future research.

Literature Review

Environmental Uncertainty

Milliken (1987, p. 136) defines uncertainty as unpredictability of the state of the environment, inability to predict the impact of environmental change, and inability to foresee the consequences of a response choice. Furthermore, some researchers (Cheng, 1983; Galbraith, 1973) have argued that a firm encounters uncertainty when the information they possess is less than the information required to achieve their goals. As a result, Daft (2004) claimed that environmental uncertainty can be explained as a lack of critical environmental information when managers make decisions. Under these circumstances, the environment represents the factors that influence a design firm's operations, while uncertainty stands for the lack of information required to achieve their goals. Therefore, environmental uncertainty can be defined as a situation in which a design firm has little information about its external environment to use in achieving its organizational goals. Sutcliffi and Zaheer (1998) have noted that environmental uncertainty is a complex construct, since it is comprised of different factors from different areas. In this respect, Song and Montoya-Weiss (2001) have asserted that uncertainty should be studied in relation to specific components of the environment in order to properly attribute its causes. Lawrence and Lorsch (1967) divided environmental uncertainty according to two main dimensions: market and technology. Govindarajan (1984) further proposed four types of environmental uncertainty, related to: 1) customers, 2) competitors for markets and resources, 3) suppliers of material, labor, and capital, and 4) regulation groups (such as government agencies or unions). Porter (1980) proposed five types of environmental uncertainty, related to: 1) suppliers, 2) customers, 3) competitors, 4) latent competitors, and 5) alternative products. By modifying the previous research (Gordon & Narayanan, 1984; Govindarajan, 1984), Hoque (2004) proposed eight categories for assessing environmental uncertainty: 1) customer demands, tastes, and preferences, 2) supplier's actions, 3) market activities of competitors, 4) deregulation and globalization, 5) government regulation and policies, 6) economic environment, 7) industrial relations, and 8) production and information technologies. As no labor union has been established in the design sector, industrial relations need not be considered in an analysis of environmental uncertainty in such a study. Therefore, we have adopted seven of the eight types proposed by Hoque (2004) for the assessment of environmental uncertainty among design firms. Table 1 shows the approaches used for measurement of these seven types of environmental uncertainty. All of the items in the measurement sets have been adjusted based on the characteristics of the design consultancy services.

Time-based Strategy

Tyson (1997) noted in his book entitled *Competition in the 21st Century* that "Time-based competition will be the rule of the day" (p. 64). According to a study conducted by Maidique and Patch (1982), one of the fundamental strategic choices facing firms is

Table 1. Measurement of environmental uncertainty.

Type of Uncertainty	Measurement	Measurement items
Customer demands, tastes, and preferences	Client preferences	Predictability of client preferences
	Requirements for design quality	Predictability of requirements for design quality
Supplier actions	Supplier support	Predictability of supplier support
	Supplier quality	Predictability of supplier quality
Market activities of competitors	Competitor prices	Predictability of competitor prices
	Competitor quality	Predictability of competitor quality
	Competitor technology	Predictability of competitor technology
	Competitor speed	Predictability of competitor speed
	Competitor marketing activities	Predictability of competitor marketing activities
Deregulation and globalization	Global market maturity	Predictability of global market maturity
	Global design demands	Predictability of global design demands
Government regulation and policies	Pricing policy	Predictability of pricing policy
	Design regulations	Predictability of design regulation
	Laws related to labor and capital	Predictability of laws related to labor and capital
Economic environment	Interest rate changes	Predictability of interest rate change
	Raw material prices	Predictability of raw material prices
	Environmental protection requirements	Predictability of environmental protection requirements
Design and information technologies	Emerging design technologies	Predictability of emerging design technologies
	Application of manufacturing technologies	Predictability of the application of manufacturing technologies
	Application of new materials	Predictability of the application of new materials

Source: Revised from Hoque (2004).

that of strategic timing, that is, whether to be first movers (first-to-market), fast followers (second-to-market), or late movers (late-to-market). Lieberman and Montgomery (1988) have pointed out that the advantages first movers enjoy include technological leadership, access to scarce assets, and the ability to switch products or services. However, Lieberman and Montgomery (1988) have identified the following disadvantages of being a first mover: 1) free ride effects, 2) technological and market uncertainty, 3) shifts in technology or customer needs, and 4) incumbent inertia. Numerous studies examining the relationship between time-based strategy and business performance have provided equivocal results. While many researchers contend that a time-based strategy has a positive relationship with business performance (Calantone, Garcia, & Dröge, 2003; Tatikonda & Montoya-Weiss, 2001; Wagner & Digman, 1997), others argue there is no overall relationship (Griffin, 2002; Lambert & Slater, 1999). Thus, there is a need to further examine the effects of time-based strategy on the business performance of design firms. By integrating the time-based competitive viewpoint and the idea of competitive advantage, Chang, Lin, Wea, and Sheu (2002) developed an integrative taxonomy of business strategies that captures the extent to which firms are proactive or reactive in relation to their environment. Based on their classification, all firms can be categorized into three types, according to their respective time-based strategy: preemptive/first mover, low cost/follower, and differentiation/follower. A preemptive/first mover tends to enter a new market or adopt a new technology earlier to achieve a competitive advantage. A low cost/follower enters a market or adopts new technology later. A differentiation/follower closely observes how its competitors develop new products and technologies. In this study, we adopt this set of key decision variables of time-based strategy suggested by Chang et al. (2002) for three reasons. First, Namiki (1989) argued that strategic typologies have to be tested and validated for usefulness through empirical investigation. In this regard, Chang et al.'s (2002) strategic taxonomy was empirically constructed in relation to the speed aspect of time-based business, which is one of the focal points of this study, especially with respect to Taiwan design firms (Eckersley et al., 2003). Second, their strategies bear some relationship to other well-known strategy categorizations found in prior studies, such as those of Maidique and Patch (1982), Miles and Snow (1978), and Porter (1980). Third, there are existing scales for measuring these strategies. Perhaps more importantly, business strategy for a design firm accounts not only for its mission and long-term objectives, but also its relative position in comparison to its competitors in the design service marketplace. The approaches used for measurement of time-based strategy for the design firms are shown in Table 2.

Business Performance

Roy (1994) has pointed out that companies increasingly rely on design to create and develop new products or services as a means for achieving commercial success in the marketplace. Hertenstein, Platt, and Brown (2001) have also asserted that design can play a significant role in a firm's competitiveness. Generally speaking, indicators of business performance are results-oriented, so some imperceptible or procedural outcomes often have been overlooked.

As a result, it is difficult to evaluate the key factors in business success or failure. Hoque (2004) noted that "a number of researchers report an increased organizational use of non-financial measures for performance evaluations in the last few years" (p. 486). Although business performance can be measured and judged from various perspectives, Walker and Ruekert (1987) proposed a three-dimensional conceptualization of performance consisting of effectiveness, efficiency, and adaptability. Effectiveness is defined as the success of business products and services compared with those of a company's competitors in the marketplace. Efficiency is treated as an index (a set of outputs of business products and services divided by a set of inputs of resources employed in implementing them). Adaptability refers to success in responding over time to change in a dynamic environment. To be explicit,

Table 2. Measurement of time-based strategy.

Type of strategy	Measurement	Measurement Items
Differentiation design	High design differentiation	Importance of adopting design differentiation as a competitive advantage
	High-price market segment	Importance of focusing on the high-price market segment as a competitive advantage
	High identification of company name	Importance of emphasizing the identification of the company name as a competitive advantage
	High design quality	Importance of offering high design quality as a competitive advantage
	Superior design image	Importance of emphasizing the superior design image as a competitive advantage
Low cost design	Competitive design prices	Importance of offering competitive design prices as a competitive advantage
	Low-cost components or parts	Importance of adopting low-cost components (or parts) as a competitive advantage
	Common components or parts	Importance of adopting common components (or parts) as a competitive advantage
	High designer productivity	Importance of emphasizing high designer productivity as a competitive advantage
	High-efficiency distribution channels	Importance of focusing on high-efficiency distribution channels as a competitive advantage
	Low-cost production methods	Importance of adopting low-cost production methods as a competitive advantage
Timing of new design / technology	Fast market entry with new design	Importance of fast market entry with new design as a competitive advantage
	Quick adoption of new technology	Importance of quick adoption of new technology as a competitive advantage

Source: Revised from Chang et al. (2002)

Source: Revised from Chang et al. (2002).

effectiveness is most closely associated with nonfinancial goals, efficiency is highly associated with achieving profitability, and adaptability is associated with adaptation to change.

However, the "balanced scorecard" (BSC) structure proposed by Kaplan and Norton (1992) measures performance from four perspectives: *financial measures*, *customer measures*, *internal business measures*, and *innovation and learning measures*. Pineno (2002) highlighted that the BSC, including both objective and subjective measures, is used to communicate and evaluate achievement of the mission and strategy of an organization. Neufeld, Simeoni, and Taylor (2001) have argued that the BSC offers the most promising of all approaches when it comes to helping research organizations measure performance and achieve operational excellence. Perhaps more importantly, the BSC provides a basis for linking measures to strategy (Bremser & Parsky, 2004). Moreover, from the design management point of view, as Borja de Mozota (2006) asserted, the BSC is also a cause-and-effect model, since each perspective has an impact on others. Therefore, the BSC could be treated as a feasible framework for clustering and balancing performance measures. Building on the findings of the studies by Kaplan and Norton (1992) and Walker and Ruekert (1987), our study classifies measures of business performance into four dimensions—*effectiveness*, *efficiency*, *innovativeness*, and *adaptability*—for assessing the performance of the design firms in the study. The approaches used for measurement of business performance of the firms are shown in Table 3.

The general conceptualization developed for this study and used in evaluating the design firms is based on the hypothesized moderating effects of environmental uncertainty on time-based strategy and business performance. The conceptual framework presented in Figure 1 outlines the impact of time-based strategy on business performance, the potential effects of environmental uncertainty on business performance, and the relationship between time-based strategy and business performance.

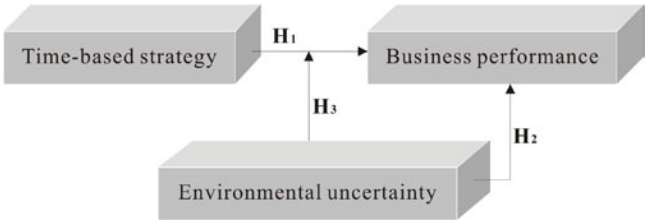

Figure 1. Conceptual framework.

Environmental Uncertainty, Time-based Strategy, and Business Performance

Time-based strategy is a powerful approach that can be treated as a crucial variable linked to business performance (Stalk, 1988). Cordero (1991) contended that the firm which is proactive can preempt competition from entering the market with new versions of a product. Also, a number of research projects have asserted that the first-mover strategy has a crucial impact on project success (Davis, Dibrell, & Janz, 2002; Kessler & Bierly, 2002). Chen et al. (2005) claimed that "time-based strategies, such as first-mover or fast-follower strategies, have become the latest key to competitive advantage in the current environment of fast-changing technologies and customers' demands" (p. 199). However, while the first mover literature argues in favor of moving first, some scholars (Lilien & Yoon, 1990; Mathews, 2001) have strengthened the concept that a fast second mover (or an early imitator) still can produce superior results. Likewise, the findings of Walsh, Roy, Bruce, and Potter (1992) indicated that a firm pursuing a second-to-market strategy can be just as successful as one that adopts a first-to-market strategy. Thus, we hypothesize:

> **Hypothesis 1**: A positive and significant association between time-based strategy and business performance exists in design firms.

Table 3. Measurement of business performance.

Dimension	Measurement	Measurement Items
Effectiveness	Alignment of design with strategy	Degree of alignment of design outcome with the strategy used in the past year
	Successful design	Degree of success of design outcome perceived by customers for the past year
Efficiency	Design quality control	Number of projects reaching a high level of design quality / total number of projects during the past year
	Design lead-time control	Number of projects under design lead-time control/ total number of projects during the past year
	Design budget control	Number of projects under design budget control / total number of projects during the past year
Innovativeness	Winning design awards	Number of design-award-winning projects / total number of projects participating in design competition during the past year
	Design innovations	Degree of achievement of design innovations during the past year
	Various design patents granted	Number of various design patents granted / total number of various design patents applied for during the past year
Adaptability	Design team cooperation	Degree of design team cooperation during the past year
	Overall design service	Degree of stockholder satisfaction with overall design service for the past year
	Market share	Degree of high design market share for the past year
	Company reputation	Degree of good reputation for the company for the past year

Source: Revised from Kaplan and Norton (1992).

Dess and Beard (1984) argued that uncertainty is one major facet of environmental characteristics. Rumelt (1991) asserted that the business environment influences performance. As for the relationship between environmental uncertainty and business performance, Reed and DeFillippi (1990) claimed that environmental uncertainty has a negative relation to business performance. Nevertheless, Osborn and Hunt (1974) found that the complexity of the environment is partially associated with organizational effectiveness; that is, complexity does not directly effect business performance. Moreover, Souder and Song (1997) discovered that no significant relationship exists between low/high market uncertainty and project success. Although not all findings suggest that environmental uncertainty has a direct effect on business performance, we contend that a design firm's ability to perceive and predict environmental uncertainty is essential to business success. Thus, we hypothesize:

> **Hypothesis 2**: A positive and significant association between perceived environmental uncertainty and business performance exists in design firms.

In general, managers often make decisions based on their perceptions of the degree of environmental uncertainty (Chang et al., 2002; Miles & Snow, 1978; Swamidass & Newell, 1987). Furthermore, the strategic choices made by managers are influenced by the environmental pressures of the industry (Hibbets, Albright, & Funk, 2003). Christensen (1997) argued that preemptive and innovative firms tend to adopt a proactive approach in dealing with new product development in emerging or highly unpredictable markets. Miller (1988) found that a cost leadership strategy has a negative relationship with uncertainty, especially among high performers. Clearly, higher environmental uncertainty necessitates different efforts in order to move confidently toward better performance. Calantone et al. (2003) asserted that higher environmental uncertainty can increase the need for speed to market in order to create opportunities and success. After investigating the electronics industry, Souder and Song (1997) found that, under higher market uncertainty, firms could adopt a radical design to enhance new product development performance. Thus, a moderating effect of perceived environmental uncertainty on the relationship between time-based strategy and business strategy is accepted. Consequently, we hypothesize:

> **Hypothesis 3a**: The positive effect of the preemptor strategy on business performance is stronger when perceived environmental uncertainty is high in design firms.

> **Hypothesis 3b**: The negative effect of the follower strategy on business performance is stronger when perceived environmental uncertainty is high in design firms.

Taiwan's Design Industry

According to a report by the Industrial Development Bureau (IDB) of Taiwan's Ministry of Economic Affairs (MOEA), issued in 2008, there are more than 2,300 design firms (excluding in-house design departments) in Taiwan, with a total turnover of NT$77.09 billion (approximately 2.36 billion USD), including exported turnover of NT$33.83 billion (43.88%) and domestic turnover of NT$43.26 billion (56.12%) in 2007. Taiwan's design firms are primarily rooted in mass production rather than marketing and sales. During the 1980s, Taiwan, similar to other Asian countries such as Singapore and Korea, experienced tremendous growth in computer production. During the late 1990s, many Taiwanese manufacturing firms adopted the dual approach of making commodity-level products for OEM/ODM services and continuing to develop and design higher value-added products under their own brands through in-house design efforts or in cooperation with external design consultants. In general, the first generation of Taiwan design firms was established in the 1960s. Up to the 1990s, Taiwan's design industry grew rapidly along with the high demand for cost-effective products; however, it entered a dark period during the early 2000s. Sea changes in the global economy and global competition have necessitated that Taiwan's design firms, if they are to remain internationally competitive, aim to develop to the highest level. Similar to the most commercially successful design firms in the U.S. (Vanchan & Mapherson, 2008) and the more innovative design communities in the EU (such as in the U.K., Italy and France) (Chiesa, Mazzini, & Pizzurno, 2004), a growing tendency towards design outsourcing has created a new category of design service called TDS (total design solutions) or TTP (total package providers) that offer a comprehensives array of new product (or service) developments in Taiwan.

As stated earlier, Taiwanese design firms have recently worked hard at design-driven innovation and performed well at international design competitions. In 2008, Taiwan firms received a total of 201 international design awards, including 99 iF design awards, 66 red dot design awards, 31 G-Mark design awards, and 5 IDEA design awards (IDB, 2008a). Of the products receiving these awards, 46 were developed by design firms. However, these firms have also confronted many relentless environmental challenges. For example, 90% of Taiwanese design firms, excluding large firms with more than NT$2,000 million/per year turnover, encountered difficulties in running their businesses (IDB, 2008a). In addition, more and more Taiwanese enterprises have established in-house departments, which could lead to a decrease in the number of commitments to design firms. At present, Taiwan's design industry is being subjected to significant change, with the emergence of alternative design service providers, diversification in the range of design services offered, and greater integration of design and technology for implementation. In such a competitive landscape, finding ways for design firms to make progress and to survive is vital. Taken together, the above characteristics make Taiwan's design firms an interesting subject of study.

The Empirical Study

Sample and Data Collection

According to the Industrial Development Bureau (IDB), in 2006, two major categories of the design industry were product design and service design, with visual communication design representing the major part of service design in Taiwan. Generally speaking, the design industry in Taiwan can be further divided into design firms and in-house design units. Based on strategic thinking and

management, the main difference between these is: the former aims at defining target markets or business regions, while the latter focuses on organizational functions. As research on design firms may allow us to observe their ability to adapt to the environment more clearly and, thus, discern the competitiveness of a specific industry, strategy at the business level will be investigated in this study. The focus of the study is the range of available strategic choices with regard to different dimensions of environmental uncertainty. One way to investigate choice is to examine the results a design firm achieves. Consistent with the purpose of this study, design firms that focus mainly on product design and visual communication design were selected. A total of 122 eligible design firms listed under the sub-categories of product design (number DE1) and visual communication design (number DE2), under the main category of design service (DE), of the Technical Services Login System of Taiwan's Industrial Development Bureau (IDB, 2008b), were chosen as the sample. Questionnaires were sent to the design executives or design managers of the selected design firms. A two-stage mailing method was employed to collect data. The first mailing included: a cover letter addressed to each recipient explaining the purpose and importance of the study, a self-administered questionnaire, and a pre-paid reply envelope. Follow-up mailings were conducted one or two weeks after the first mailing. A total of 82 questionnaires were returned and 80 were defined as valid samples, with an effective response rate of 65.6%. The descriptive analysis of the responding design firms is summarized in Table 4.

Measures

To test the hypotheses suggested by the research framework, measures of each construct were initially developed by undertaking a thorough literature review. Then, a two-round Delphi process was conducted to determine the clarity of the scale items used in all of the research constructs—environmental uncertainty (see Table 1), time-based strategy (see Table 2) and business performance (see Table 3)—for the design firms before mailing the questionnaires. Ten design managers who were familiar with the issues of the design business were selected from five different design firms to examine these items. After two Delphi rounds, concordance had been achieved in all, except for 11 items, consisting of seven measured items of environmental uncertainty (competitor quality, competitor technology, competitor speed, pricing policy, design regulations, laws related to labor and capital, and interest rate changes), one measured item of time-based strategy (high-efficiency distribution channels), and three measured items of business performance (successful design, various design patents granted, and market share). Meanwhile, concordance was defined as agreement among 80 percent or more of the 10 design managers. As a result, the final questionnaire in this study included 13 measured items of environmental uncertainty, 12 measured items of time-based strategy, and 9 measured items of business performance. As for the 13 measured items of environmental uncertainty, the respondents were asked to indicate the degree of predictability for each measured item. In this construct, a five-point Likert scale, ranging from "very low" to "very high," was used. As for the 12 measured items of time-based strategy, the respondents were asked to indicate the importance of each time-based approach relative to achieving a competitive advantage. In this construct, a five-point Likert scale, ranging from "least important" to "most important," was used. As for the five measured items of business performance, which are alignment of design with strategy, design innovations, design innovation ability, design team cooperation, overall design service, and company reputation, the respondents were asked to indicate the degree of their agreement for each measured item on a five-point Likert scale, ranging from "very low" to "very high." As for the remaining four measured items of business performance, which are design quality control, design lead-time control, design

Table 4. Descriptive analysis of the responses of the participating design firms.

Item	Categories	N	Subtotal	%	Subtotal
Major clients	Traditional industry	32	80	40.00	100%
	Technological industry	25		31.25	
	Service industry	23		28.75	
Years in existence (before 2008)	Under 5	22	80	27.50	100%
	6~10	19		23.75	
	11~15	19		23.75	
	Over 16	20		25.00	
Employees in 2008 (number of persons)	Under 5	25	80	31.25	100%
	6~10	30		37.50	
	11~20	21		26.25	
	21~50	3		2.50	
	51~100	0		0.00	
	Over 101	1		1.25	
Total Assets in 2008 (NT$ million) *	Under 100	18	80	22.50	100%
	101~500	34		42.50	
	501~1,000	26		32.50	
	1,001~5,000	0		0.00	
	Over 5,001	2		2.50	

Note: * 1 U.S. $ = 32.58 NT $ on 11/02/2008

budget control, and design-award-winning projects, we classified the measures into five categories of accomplishment, ranging from "0~20%," "21%~40%," "41%~60%," "61%~80%," to "81%~100%." The respondents were asked to indicate the level of achievement for each measured item during the past year.

Control Variable

Design firms are usually very small, a factor affecting their influencing powers (UK Design Council, 2005). In general, firm manpower and firm assets are related to firm size. In this study, exploratory factor analysis was used to generate the predicated factor(s) that emerged from the scale items of firm manpower and firm assets. It was found that one extracted factor, renamed as firm size, of the factor analysis of firm manpower and firm assets accounted for 71.872% of the total variance. Also, the factor scores of firm size, as the control variable, are used in the moderated regression analyses in the next section.

Data Analysis and Results

Descriptive Statistics

The means and standard deviations of the research variables can be found in Table 5. First, in regards to perceived environmental uncertainty, the participants revealed high predictability (Mean>4) on "client preferences" (Mean=4.26), "environmental protection" (Mean=4.16), and "requirements for design quality" (Mean=4.15). In other words, the participants regarded the environmental uncertainty of these three items to be lower than that of the others. Second, in regards to time-based strategy, the respondents highly agreed that the strategic approaches of "superior design image" (Mean=4.20), "high design quality" (Mean=4.16), "high identification of company name" (Mean=4.06), and "high designer productivity" (Mean=4.01) are important for obtaining competitive advantages. Last, in regards to business performance, the respondents revealed that they achieved good business performance with regard to "design team cooperation" (Mean=4.03) during the past year. However, the mean score of "winning design awards" was 2.40, representing the average rate of "winning design awards" at the range of 41~60%. One possible explanation for this is that participation in design competitions was not the major business objective of most of the design firms.

Factor Analysis of Environmental Uncertainty, Time-based Strategy, and Business Performance

Exploratory factor analysis (EFA) was used to analyze the factors of environmental uncertainty, time-based strategy, and business performance with Varimax rotation and criterion with an Eigenvalue of common factors greater than one. Moreover, through KMO (Kaiser-Meyer-Olkin Measure) and Bartlett's test of sphericity, this study examined the correlation between different research variables. The KMO values of environmental uncertainty (0.759), time-based strategy (0.832), and business performance (0.710) were greater than 0.6. In addition, all of the Bartlett's tests of sphericity were significant ($p < 0.001$). Also, the cumulative variance of common factors of environmental uncertainty, time-based strategy, and business performance were 75.156%, 68.534%, and 76.215%, respectively, as shown in Tables 6-8. With regard to perceived environmental uncertainty, four extracted factors were renamed as: technological evolutions (TE), market dynamics (MD), client preferences (CP), and competitor movements (CM). As to time-based strategy, two extracted factors were renamed as: design-differentiation preemptor (DDP) and design-cost follower (DCF). Regarding business performance, three extracted factors were renamed as: adaptability, efficiency, and innovation. Cronbach's α values for the respective scales were sufficiently high (>0.63) to warrant confidence in internal consistency reliability (Nunnally, 1978).

The Relationships among Environmental Uncertainty, Time-based Strategy, and Business Performance

Table 9 shows the results of the regression equations for the relationships between independent variables and three dimensions of business performance: *adaptability*, *efficiency*, and *innovation*. In Step 1 (Models 1, 5, and 9 of Table 9), firm age, firm assets and manpower were entered as a set of control variables. In Step 2 (Models 2, 6, and 10 of Table 9), the two extracted factors of time-based strategy, design-differentiation preemptor (DDP) and design-cost follower (DCF), were entered as a set of main effect variables. In Step 3 (Models 3, 7, and 11 of Table 9), the four extracted factors of environmental uncertainty, technological evolutions (TE), market dynamics (MD), client preferences (CP), and competitor movements (CM), were entered as a set of moderating variables. Then, the cross products of each aspect of main effect variables and each aspect of moderating variables were entered into the fourth step (Models 4, 8, and 12 of Table 9). If the interaction accounts for a significant amount of incremental variance to support the hypothesis, then there is a significant moderating effect of environmental uncertainty on the relationship between time-based strategy and business performance. To check for multicollinearity, we ran regressions to generate variance inflation factors (VIFs) for each independent and control variable. It was found that the average value of VIFs associated with each coefficient was lower than 1, suggesting no serious problems with multicollinearity.

Hypothesis 1 posited that a positive and significant association between time-based strategy and business performance exists in design firms. The factor of design-differentiation preemptor had significant and positive effects on *adaptability* and *innovation*, but no significant effect on *efficiency* (see Models 2, 6, and 10 of Table 9). One possible explanation for this result may be that, in the context of our sample, being early or speedy to market with a design differentiation strategy could quickly capture new or emerging clients and meet target clients' needs, thereby producing high *adaptation* and *innovation* in an unpredictable setting. Also, the factor of design-cost follower had a significantly positive effect on *efficiency*, but no significant effect on *adaptability* and *innovation*. One feasible interpretation of this result is that the design-cost follower strategy creates the basis for a price competitive advantage, which is a key efficiency driver in the present sample firms. Considered jointly, the results indicate

Table 5. Means and standard deviations of research variables (N = 80 projects).

Variables	Measure	N	Mean	SD	Min.	Max.
Environmental uncertainty	E1. Client preferences	80	4.26	0.76	2	5
	E2. Requirements for design quality	80	4.15	0.86	2	5
	E3. Supplier support	80	3.75	0.83	2	5
	E4. Supplier quality	80	3.68	1.00	2	5
	E5. Competitor prices	80	3.55	0.83	2	5
	E6. Competitor marketing activities	80	3.39	0.99	2	5
	E7. Global market maturity	80	3.17	1.07	1	5
	E8. Global design demands	80	3.38	1.08	1	5
	E9. Raw material prices	80	3.40	1.09	1	5
	E10. Environmental protection requirements	80	4.16	0.79	2	5
	E11. Emerging design technology	80	3.75	0.88	2	5
	E12. Application of manufacturing technology	80	3.68	0.94	2	5
	E13. Application of new materials	80	3.58	0.95	1	5
Time-based strategy	S1. High design innovation	80	3.99	1.10	2	5
	S2. High-price market segment	80	3.93	1.05	1	5
	S3. High identification of company name	80	4.06	0.93	2	5
	S4. Competitive design prices	80	3.88	0.95	2	5
	S5. High design quality	80	4.16	1.11	1	5
	S6. Superior design image	80	4.20	1.02	1	5
	S7. Low cost components or parts	80	3.45	1.07	2	5
	S8. Common components or parts	80	3.64	1.03	1	5
	S9. High designer productivity	80	4.01	1.03	2	5
	S10. Low-cost production methods	80	3.56	1.04	1	5
	S11. Fast market entry with new design	80	3.83	0.99	1	5
	S12. Quick adoption of new technology	80	3.83	0.95	2	5
Business performance	P1. Alignment of design with strategy	80	3.86	0.91	1	5
	P2. Design innovations	80	3.75	1.24	2	5
	P3. Design team cooperation	80	4.03	0.90	2	5
	P4. Overall design services	80	3.88	0.88	2	5
	P5. Company reputation	80	3.77	1.02	2	5
	P6. Design budget control	80	3.63	0.92	1	5
	P7. Design quality control	80	3.60	0.84	2	5
	P8. Design lead-time control	80	3.33	0.91	2	5
	P9. Winning design awards	80	2.40	1.52	1	5

Table 6. Factor analysis of environmental uncertainty (N = 80 projects).

Variables	Factor Loadings				%Variance Explained	% Cumulative variance	Cronbach's α
	TE	MD	CP	CM			
Supplier support	0.854				28.313%	28.313%	0.897
Supplier quality	0.829						
Application of new materials	0.823						
Emerging design technology	0.796						
Application of manufacturing technology	0.786						
Raw material prices		0.832			18.984%	47.297%	0.787
Environmental protection requirements		0.805					
Degree of global market maturity		0.569					
Degree of global design demands		0.507					
Requirements for design quality			0.839		14.566%	61.863%	0.648
Client preferences			0.807				
Competitor prices				0.921	13.293%	75.156%	0.793
Competitor marketing activities				0.826			
Eigenvalues	3.681	2.468	1.894	1.728			

Table 7. Factor analysis of time-based strategy (N = 80 projects).

Variables	Factor Loadings		%Variance Explained	% Cumulative variance	Cronbach's α
	DDP	DCF			
High-price market segment	0.899		41.066%	41.066%	0.930
High design quality	0.864				
Quick adoption of new technology	0.855				
Superior design image	0.847				
High design innovation	0.847				
High designer productivity	0.790				
Fast market entry with new design	0.736				
Common components or parts		0.852	27.469%	68.534%	0.860
Low-cost components or parts		0.821			
Competitive design prices		0.820			
Low-cost production methods		0.786			
High identification of company name		0.692			
Eigenvalues	4.928	3.296			

Table 8. Factor analysis of business performance (N = 80 projects).

Variables	Factor Loadings			%Variance Explained	% Cumulative variance	Cronbach's α
	Adaptability	Efficiency	Innovation			
Overall design service	0.882			34.849%	34.849%	0.903
Alignment of design with strategy	0.877					
Design team cooperation	0.867					
Company reputation	0.865					
Design quality control		0.853		23.924%	58.772%	0.782
Design lead-time control		0.834				
Design budget control		0.806				
Design innovations			0.841	17.442%	76.215%	0.636
Winning design awards			0.836			
Eigenvalues	3.136	2.153	1.570			

Table 9. Moderating regression analyses of business performance.

Independent Variables		Adaptability				Efficiency				Innovation			
		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Control Var.	Firm size	0.04	0.03	-0.06	0.04	0.04	-0.00	-0.07	-0.11	-0.01	-0.15	0.16	1.22
Main Effects	DDP		0.41 ***	0.36 ***	0.41 ***		0.05	0.05	0.04		0.23 *	0.18	0.16
	DCF		-0.04	-0.07	-0.02		0.54 ***	0.56 ***	0.60 ***		0.09	0.00	0.04
Moderators	TE			0.18 *	0.13			0.05	0.11			0.09	0.15
	MD			0.25 **	0.19			-0.13	-0.11			0.48 ***	0.46 ***
	CP			0.02	0.01			0.02	0.10			0.02	0.17
	CM			0.42 ***	0.50 ***			0.13	0.13			-0.30 **	-0.33 **
Inter. Terms	DDP×TE				-0.20 *				-0.10				0.05
	DDP×MD				0.13				-0.05				0.21 *
	DDP×CP				0.13				-0.17				-0.14
	DDP×CM				-0.32 ***				0.03				0.09
	DCF×TE				-0.12				0.07				0.20
	DCF×MD				0.01				0.14				0.03
	DCF×CP				-0.16				-0.10				-0.08
	DCF×CM				0.08				-0.03				0.01
R^2		0.00	0.17	0.43	0.61	0.00	0.29	0.32	0.37	0.00	0.06	0.35	0.43
ΔR^2		0.00	0.17 **	0.26 ***	0.18 **	0.00	0.29 ***	0.03	0.06	0.00	0.06	0.29 ***	0.08
F-value		1.13	5.10 **	7.67 ***	6.64 ***	0.10	10.25 ***	4.82 ***	2.55 **	0.00	1.62	5.46 ***	3.21 **

Note: N=80; *p < 0.05; **p < 0.01; ***p < 0.001

that both types of time-based strategy are important determinants of business performance, but they displayed different effects on each of the three types of business performance. Hypothesis 1 received strong support.

Hypothesis 2 posited that a positive and significant association between perceived environmental uncertainty and business performance exists in design firms. We found that technological evolutions (TE), market dynamics (MD) and competitor movements (CM) were statistically significant and positively associated with *adaptability*, while client preferences (CP) had no significant effect. Furthermore, the present study found that market dynamics (MD) uncertainty was a significantly positive predictor of *innovation*, while competitor movements (CM) uncertainty was a significant negative predictor. The results indicate that better *innovation* performance could be pursued by a design firm under low-perceived uncertain market dynamics or high-perceived uncertain competitor movements. Unexpectedly, client preferences (CP) had no significant effect on any of the three dimensions of business performance, though it was highly identified by the respondents. This surprising result can be interpreted in the light of the nature of Taiwan's design industry. Here, the main clients of Taiwan's domestic design services are OEM/ODM firms. These design firms are not directly involved in their clients' marketing activities, isolating them from the customer. Thus, Hypothesis 2 only received modest support.

Hypothesis 3a posited that the positive effect of the preemptor strategy on business performance is stronger when perceived environmental uncertainty is high in design firms. The hierarchical moderated regression analysis with interaction terms determines whether there is a moderating relationship between time-based strategy and business performance. The findings indicated that environmental uncertainty related to technological evolutions (TE) and competitor movements (CM) had moderating impacts on the relationship between design-differentiation preemptor (DDP) strategy and *adaptability*. These findings would be in accordance with the observations by Paine & Anderson (1977) and Miles & Snow (1978), who found that managers who perceived themselves to be in a more turbulent environment tended to assume greater risks and to be more likely to employ a differentiation strategy than managers who perceived themselves to be in a more stable environment. It also could be said that design firms facing higher uncertainty with regard to technological evolution or competitor movements tend to employ the differentiation strategy to quickly capture new or emerging clients and to meet target clients' needs, thereby producing high *adaptation* to an unpredictable setting. As evident in Model 8 of Table 9, the interactions of two types of time-based strategy and four types of environmental uncertainty had no significant effect on *efficiency*. However, environmental uncertainty in relation to market dynamics (MD) had moderating impacts on the relationship between DDP strategy and *innovation* (see Model 12 of Table 9). This result indicated that adopting a design-differentiation preemptor strategy is beneficial for design firms in achieving superior *innovation* in an environment of low-perceived market dynamics (MD) uncertainty. Therefore, Hypothesis 3a received partial support. In contrast, Hypothesis 3b posited that the negative effect of the follower strategy on business performance is stronger when perceived environmental uncertainty is high in design firms. The overall set of interaction terms between the design-cost follower (DCF) strategy and the four types of environmental uncertainty did not account for a significant amount of the incremental variance for any of the three dimensions of business performance. Thus, Hypothesis 3b was not supported. Taken together, the findings showed that technological evolution, competitor movements, and market dynamics had significantly moderating effects on the relationship between time-based strategy and business performance for the sample firms.

Discussion

By examining design firms in Taiwan, this study explored the moderating effects of environmental uncertainty on time-based strategy and business performance. We will begin our discussion by reviewing the empirical findings, then turn to the general implications. Our research has extended knowledge in strategy and performance research in three essential aspects. First, the study reinforces the argument that no single time-based strategy has been proven best in all instances (Schnaars, 1986). More specifically, design firms employing the design-differentiation preemptor strategy are likely to achieve better business performance with regard to *adaptability* and *innovation,* while firms employing the design-cost follower strategy are likely to achieve better business performance with regard to *efficiency*. Second, we believe our findings contribute to the design field in providing more detailed insights concerning the effects of environmental uncertainty on business performance. In particular, the findings suggest that technological evolutions (TE), market dynamics (MD) and competitor movements (CM) have direct effects on *adaptability*. It could be that design firms facing a lower level of environmental uncertainty in terms of technological evolutions, market dynamics, and competitor movements see it as an opportunity to improve their *adaptability*. Also, the perceived uncertainty of market dynamics (MD) was a positive predictor of *innovation*, while perceived uncertainty related to competitor movements (CM) was a negative predictor. The reasons for these results could be that, in a predictable marketplace, a design firm is likely to strive for innovative designs as a way to outperform its competitors; however, a design firm that fully understands its competitors' movements is likely to tend toward a less proactive approach, which may result in difficulties achieving superior *innovation.* Third, the study represents a contribution to the overlooked research area of the moderating roles of environmental uncertainty on time-based strategy and business performance. One of the critical research insights of the study is that the effect of a design-differentiation preemptor strategy on *adaptability* increases with high-perceived uncertainty regarding technological evolutions (TE). This is congruent with Tatikonda and Montoya-Weiss's (2001, p. 168) results that technological uncertainty moderates the relationship between a strategic response and operational outcomes. Likewise, uncertainty with regard to competitor movements (CM) moderates the relationship between a design-differentiation preemptor strategy and *adaptability*. Also, market dynamics (MD) moderates the relationship between

a design-differentiation preemptor strategy and *innovation*. To sum up, the managerial prescription from the above findings is that, in our sample context, adopting a design-differentiation preemptor (DDP) strategy is beneficial for a design firm seeking to achieve superior business performance through *adaptability* when there exists high-perceived uncertainty regarding technological evolutions (TE) or competitor movements (CM), while adopting a DDP strategy is beneficial for improving performance through *innovation* in an environment of low-perceived market dynamics (MD) uncertainty. In other words, better understanding of the nature of environmental uncertainty will allow design firms to better manage their design project portfolios and to allocate the resources necessary for getting a better design job done more flexibly when speed is critical.

Conclusion and Limitations

Conclusion

In conclusion, this study has taken a further step in the direction of examining the moderating effects of environmental uncertainty on time-based strategy and business performance in design firms. To our knowledge, no such research has been conducted in the design sector. We believe the present study can contribute to the literature of design management in a number of ways. First, the findings reveal that design firms tend to adopt different time-based strategies in pursuing different performance outcomes. Specifically, the results show that design firms which adopt the DDP strategy are likely to be pursuing superior business performance in areas such as *adaptability* and *innovation*, while design firms which adopt the DCF strategy are likely to be aiming for superior *efficiency*. Such distinctions are essential if design firms wish to understand how to develop their own distinctive design competencies and monitor their own design service needs. Second, the findings also reveal that three of four types of environmental uncertainty have direct effects on business performance. In particular, the results suggest that design firms facing low-perceived uncertainty in the areas of technological evolutions, market dynamics, and competitor movements are likely to chase after better *adaptability*. And design firms that are encountering high-perceived uncertainty in the area of competitor movements or low-perceived uncertainty with regard to market dynamics are likely to pursue a greater degree of *innovation*. Third, the findings reveal that appropriate matches between environmental uncertainty and time-based strategy can result in superior business outcomes. In specific, the results suggest that a design firm can employ a DDP strategy to achieve superior *adaptability* under high-perceived uncertainty regarding technological evolutions or competitor movements. Or, a firm can also adopt the DDP strategy to obtain superior *innovation* under low-perceived uncertainty in relation to market dynamics. Yet, surprisingly, the findings also reveal that there are no moderating effects of environmental uncertainty found with the DCF strategy. One possible explanation for this is that design firms which adopt the DCF strategy tend to be less conscious of environmental uncertainty issues. Stated differently, if a design firm intends to transform its current business strategy into the DDP strategy, it should devote greater efforts to learning how to measure and ameliorate related uncertainties. Given the long time frame required for design firms to implement an appropriate time-based strategy, this study reinforces the argument that a good match (or fit) between environmental characteristics and strategic orientation can lead to superior business performance. This is in partial agreement with the claim of Jennings and Haughton (2002): "…being faster doesn't mean being out of breath. It means being smart" (p. 3). This concept is important for design academics as well as design practitioners.

Limitations

Given the paucity of empirical research on the issues examined in this study, these findings are tentative rather than definitive. Like any empirical research effort, this study is not without its limitations. The first limitation is the cross-sectional nature of the study, which might limit its ability to capture the causal relationship among environmental uncertainty, time-based strategy and business performance. Therefore, a longitudinal research approach using multiple informants would be useful for providing evidence of causation that cannot be obtained using the cross-sectional approach. Second, as shown in Table 4, because the sample firms chosen from the design industry were small businesses, which have a distinct advantage over larger firms in the sense that being small is likely to allow greater responsiveness, and, in turn, flexibility with regard to the environment (Dean, Brown, & Bamford, 1998), the results should be cautiously applied to large firms, even though firm size did not significantly influence the relationships studied. Third, not all potential moderators of the linkage between time-based strategy and business performance have been explored here. Given the great importance of diffusion of the RBV through the strategy literature, there is a need for additional research to further examine other moderating factors, such as capability (Teece, 2007). Last, the current findings pertain to design firms in Taiwan, and results may differ in other settings; therefore, future work is necessary to validate the findings in other industries or countries to rule out possible sample biases. However, it should be noted that single industry studies are warranted when the internal validity of the study is more important than generalization of the results (McKee, Varadarajan, & Pride, 1989, p. 25). Despite these limitations, the preliminary empirical findings and the implications for design management can definitely serve as a basis or as guidelines for understanding the alignment of environmental uncertainty, time-based strategy, and business performance, especially when design firms need to develop their strategic planning in order to focus on long-term issues.

Acknowledgements

This study received partial financial support from the National Science Council of the Republic of China, under Grant No. NSC 98-2410-H-011-016-MY2.

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