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Technological and Design Innovation Effects in Regional New Product Rollouts: A European Illustration*

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Firms are increasingly recognizing the importance of understanding regional dynamics and their effects on competitiveness. One such area that is gaining increased importance due to intra-regional trade is the factors contributing to the successful rollouts of new products within a region. New product rollouts are complicated by nature but are further compounded by intricacies in the type of innovation (i.e., technological or design) being introduced into a region. Unfortunately, limited research has investigated this area. This study works to address this limitation by examining the per country performance effects of regional new product rollouts of technological and design innovations. The study examines the introduction of 14 technological innovations and 12 design innovations across 17 unique firms operating in eight European countries from 2000 to 2007. Specifically, this study attempts to show (1) an important role of the type of innovation on a firm's regional new product rollout strategy; (2) a relationship between national culture and the effectiveness of regional rollout strategies; and (3) an influence of economic openness on the type of innovation for regional new product rollout strategies. The results indicate that a longer regional new product rollout strategy is a more effective strategy for technological innovations, while a shorter regional new product rollout strategy is a more effective strategy for design innovations. The study also presents significant interaction effects in relation to the cultural dimensions of uncertainty avoidance and power distance as well as a significant effect of economic openness. Implications for practitioners and academics are presented.

Introduction

Competitive advantage in today's marketplace increasingly relies on effective management of product innovation strategies within a regionalized strategic context (as researchers have found that strategic competition is founded at the regional level as opposed to the global level; Ghemawat, 2003, 2006, 2007; Rugman, 2001, 2003; Schlie and Yip, 2000). Firms are searching for effective strategies for introducing new products into markets to leverage regional entry and to gain superior market penetration (Calantone and Griffith, 2007; Tellis, 2008). From a competitive positioning standpoint, developing an effective rollout strategy (i.e., the timing of launch decisions across markets) for a firm's innovations is one of the most important decisions a firm faces (Calantone and Griffith, 2007; Chandrasekaran and Tellis, 2008; Chryssochoidis and Wong, 1998; Di Benedetto, 1999; Rackham, 1998; Tellis, 2008). The importance of product rollout has stimulated a significant amount of research (e.g., Chryssochoidis and Wong, 1998, 2000; Davidson and Harrigan, 1977; Rackham, 1998; Tellis, Stremersch, and Yin, 2003; Tellis, 2008). While the existing literature in this area has provided many new insights, Tellis (2008) notes that there is still much to learn pertaining to the rollout of innovations.

For example, much of the literature in this area has focused on innovation in general (e.g., Chryssochoidis and Wong, 1998, 2000; Rackham, 1998), as opposed to specific innovation types, thus oversimplifying the current understanding of this topic. Much as Hultink, Hart, Robben, and Griffin (2000) found differences in the effectiveness of launch decisions between industrial and consumer products or Kalish, Mahajan, and Muller (1995) argued for differing effectiveness based upon a product's life cycle, this study contends that recent advances in differential effects of types of innovation (i.e., technological and design innovations; e.g., Talke, Salomo, Wieringa, and Lutz, 2009; Verganti, 2003, 2006, 2008) result in differences in effectiveness pertaining to rollout strategies. Specifically, the study argues that the effectiveness of regional new product rollout strategies will have differential effects on specific market performance (i.e., market share in each market) based upon the type of innovation. As such, this study works to

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contribute to the literature by clarifying the influence of type of innovation on the effectiveness of regional new product rollout strategy.

Further, while the study argues that innovation type will influence the effectiveness of a firm's regional new product rollout strategy, researchers have consistently demonstrated the importance of cultural and economic factors in determining consumer response to innovations (Chandrasekaran and Tellis, 2008; Craig, Greene, and Douglas, 2005; Tellis et al., 2003; Tellis, Yin, and Bell, 2009; Yalcinkaya, 2008; Yeniyurt and Townsend, 2003). For example, Chandrasekaran and Tellis (2008) and Tellis et al. (2003) found that specific dimensions of culture, such as uncertainty avoidance, significantly influenced the rate of takeoff and adoption of products across markets. Similarly, economic differences across markets, such as economic openness, could also play a significant factor in determining the success of product launch strategies (Yeniyurt and Townsend, 2003). As such, this study contends that although regions form a central palette for firm strategy, unique intra-regional variations in elements such as national culture and economic openness provide unique influencing effects that could aid in understanding the effectiveness of regional product rollout strategies for technological (i.e., advances in the functioning of a product; Stremersch and Tellis, 2004; Tellis et al., 2003) and design innovations (i.e., advances in the stylistic features of a product; Talke et al., 2009; Verganti, 2003, 2006, 2008).

Taken together, the main research objective of this study is to show the type of innovation's important role on a firm's regional new product rollout strategy. In particular, this study (1) demonstrates the effectiveness of different regional new product rollout strategies of technological and design innovations on market performance; (2) presents the specific influences of national culture on the effectiveness of technological and design innovations for regional new product rollout strategies; and (3) shows the influence of economic openness on technological and design innovations for regional new product rollout strategies.

The remainder of the paper is organized as follows. The next section presents a review of the relevant literature followed by the development of a set of hypotheses. The hypotheses are tested by examining the launch of 14 technological innovations and 12 design innovations across 17 unique firms operating in eight European countries from 2000 to 2007. Next, the results are presented and described. The results suggest that a longer regional new product rollout strategy is a more effective strategy for technological innovations, while a shorter regional new product rollout strategy is a more effective strategy for design innovations. The study also demonstrates significant interaction effects in relation to the cultural dimensions of uncertainty avoidance and power distance as well as a significant interaction effect of economic openness. Finally, implications for practitioners and academics are presented.

Conceptual Framework and Literature Review

Growing Importance of Regional Strategies

Globalization continues to be at the forefront of business discussions. However, recently, there has been an increasing questioning of the practical reality of

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globalization in relation to firm activities (Ghemawat, 2003, 2006, 2007; Rugman, 2001, 2003; Schlie and Yip, 2000). While, clearly, the marketplace has become more global, and corporate strategy can be conceptualized at that level (e.g., Harvey and Griffith, 2007; Porter, 1998), recent research efforts are increasingly bringing forth evidence that firm operations are localized at the regional, more than the global, level (Ganesh, 1998; Rugman, 2001, 2003; Schlie and Yip, 2000). For example, Rugman (2001) notes that the world's largest multinational companies derive 50% or more of sales from their home regions and that only 9 of the top 500 multinational enterprises are global when examined in terms of percent of foreign/home market sales. In fact, he notes that 72% of multinational corporation (MNC) sales are derived from their own region (Rugman, 2003). The fact that a substantive portion of operations occur regionally is also reflected in examinations of firm strategy.

Schlie and Yip (2000) indicate that many firms have evolved past global strategies and are engaging in regional strategies. The findings of Schlie and Yip (2000) are strategically important as they observe that regional strategies are not a strategic stepping stone to global strategies but rather that firms gain strategic advantages by moving beyond global strategies toward regional strategies. This logic is supported in the work of Ghemawat (2003, 2006), who notes that regardless of the global presence of a firm, its strategies are primarily regional (whether geographic or otherwise). He contends that it is through regional strategic approaches that firms are able to secure competitive positioning, and therefore call for the understanding of semi-global or regional strategies and their implementation. Therefore, consistent with Rugman (2003), who urges scholars to begin to explore geographic regional competition, it can be argued that greater insights may be able to be gained into competitive actions by examining the regional activities of firms. Furthermore, the examination of geographic regional approaches is most important when considering new product rollouts, as market proximity could generate substantive spillover effects (e.g., information flows to proximate markets due to advertising and word-of-mouth), which would influence proximate market entry performance.

New Product Rollout Strategies

In the new product literature, rollout concerns the timing of product introductions across a series of countries (Chryssochoidis and Wong, 1998, 2000; Rackham, 1998). Within the product innovation literature, researchers have traditionally dichotomized rollout strategies into either simultaneous or sequential (e.g., Chryssochoidis and Wong, 1998; Davidson and Harrigan, 1977; Harvey and Griffith, 2007; Kalish et al., 1995; Stremersch and Tellis, 2004; Tellis et al., 2003; Tellis, 2008), where simultaneous product launch strategies refer to when products are introduced either at the same time across markets or in very quick succession (Kalish et al., 1995) or sequential product launch strategies that refer to when products are slowly rolled out across a number of markets (e.g., Kalish et al., 1995; Stremersch and Tellis, 2004; Tellis et al., 2003). To better capture the timing aspect of the firm's launch strategy, the study conceptualizes the rollout of the innovation as the lag between the initial market introduction of the innovation within the region and the introduction of the product within the focal market. Next, the study investigates how this rollout timing influences the performance (i.e., market share) within the focal market.

In the literature, researchers indicate that the timing of rollout strategies have specific advantages and disadvantages (Harvey and Griffith, 2007; Kalish et al., 1995; Riesenbeck and Freeling, 1991; Tellis et al., 2003). For example, when products are rolled out more slowly, the firm incurs lower initial costs (allowing the firm time to modify its products for secondary market launches), making available income from previous market entries to cofinance later market entries, expanding the product life cycle especially for technological products, and decreasing the complexity of coordinating product launch support, inclusive of distribution infrastructures, coordinated advertising, production, pricing, and so on (Chryssochoidis and Wong, 1998; Harvey and Griffith, 2007). Alternatively, when a shorter rollout period is employed across markets, a firm incurs higher costs (through substantial investment in manufacturing, inventory, advertising, distribution, and human resources), a later entry (as the firm must wait until all products are ready for each market before rollout), less or no time to learn from mistakes, limited knowledge transfer, and increased complexity of managing/coordinating the launch (Chryssochoidis and Wong, 1998; Harvey and Griffith, 2007). However, a shorter rollout also maximizes revenues by exploiting economies of scale in research and development (R&D) and manufacturing, builds up market entry barriers as an early entrant, and hinders late entrants chance of success (Lieberman and Montgomery, 1988), minimizes the risk of other firms creating copy products for the first-mover advantage into those markets, minimizes gray/black market activity by consumers and firms

in markets where demand exists but the product has not yet been introduced, and so on (Harvey and Griffith, 2007).

The complexity of new product rollout is evident in the extant literature where scholars have found a myriad of complicating factors influencing performance. For example, as noted earlier, Hultink et al. (2000) found differences in the effectiveness of launch decisions between industrial and consumer products, and Kalish et al. (1995) argued for differing effectiveness of product launch strategies based upon a product's life cycle. Here, this study builds upon recent advances in differential effects of types of innovation (i.e., technological and design innovations; e.g., Talke et al., 2009; Verganti, 2003, 2006, 2008). Specifically, the study argues that the effectiveness of regional new product rollout strategies will have differential effects on specific market performance (i.e., market share in each market) based upon the specific type of innovation rollout.

Types of Innovation: Technological versus Design Innovation

Researchers contend that a product is a combination of function, design, and meaning (Rindova and Petkova, 2007; Srinivasan, Lilien, Rangaswamy, Pingitore, and Seldin, 2008; Verganti, 2003). Whereas meaning is a consumer outcome, firms determine function and design, and it is within the confines of function and design that innovations ensue (Verganti, 2008). Accordingly, our focus here is on technological and design innovations.

Specifically, technological innovations refer to advances in the functioning of a product. Technological innovations are a key component of product innovation and as such have generated a significant amount of research (e.g., Stremersch and Tellis, 2004; Tellis et al., 2003). Examples of technological innovations range from innovations in hydrogen fuel cell propulsion systems to advances in computing power exhibited by next-generation information processors. Alternatively, design innovations refer to advances in the stylistic features of a product. Although design innovations are plentiful in practice (e.g., Panasonic's award-winning designs for its Massage Soffer or Sony's VAIO P series), researchers are only recently beginning to understand their importance (e.g., Talke et al., 2009; Verganti, 2003, 2006, 2008).

The distinction between technological and design innovation is strategically important given their potential for differential effects. First, design innovations are more visible than technological innovations, as design innovations relate to a product's external appearance whereas technological innovations are typically internal to a product's form. As such, visual influence in the diffusion of design innovations is greater than technological innovations, which rely more fully on verbal communication (Gatignon and Robertson, 1985). Second, risk related to adoption is argued to differ across innovation types (Midgley, 1983). Specifically, technological innovation mainly generates performance risk whereas design innovation generates social risk (Eisenman, 2009). Third, technological and design innovation satisfies different needs. Technological innovation addresses prevention need by changing product functionalities, which are related to the desire of behaving in a safe and secure way and being responsible (Chitturi, Raghunathan, and Mahajan, 2007). Alternatively, design innovation addresses promotion needs (which are related to the desire of separating oneself from others; Chitturi et al., 2007), by changing product form and by generating products that are considered status symbols (Eisenman, 2009; Solomon, 1983).

Hypotheses

Regional New Product Rollout Strategy and Type of Innovation

Regional new product rollout strategy denotes the timing of market entry across a number of markets within a region. Here, this study makes a point that the effect of the time lag between the initial market introduction and the focal market introduction on performance (i.e., market share) within the focal market will vary by type of innovation (i.e., technological or design). Specifically, the study argues that for technological innovations, a longer time lag between initial regional market introduction and introduction into the focal market will be more effective than a shorter time lag. The logic underlying this expectation is that technological innovations require a substantial amount of resource investments when introducing them to the market (Tellis et al., 2003). Technological innovations require a higher degree of consumer learning, and therefore a firm is required to invest significant resources to (1) communicate the technical aspects of the innovation, (2) persuade the consumer of the superiority of the new technological features compared with current technologies in the market, and (3) educate channel partners and consumers as to the use of the innovation (Gatignon and Robertson, 1985).

Alternatively, this study argues that for design innovations, a shorter time lag between initial regional market introduction and introduction into the focal market will be more effective than a longer time lag. The logic underlying this expectation is founded on the observability of design and ease of adoption. Specifically, design innovations are readily observable, that is, consumers can easily assess design innovations without the need for costly consumer information programs, and have low adoption cost (as there are limited risks associated with adopting new design innovations other than social risk) that heightens their ability to diffuse across markets. More formally,

H1a: The longer the time lag between initial and focal market introduction, the greater is the market performance in the focal market for a technological innovation.

H1b: The shorter the time lag between initial and focal market introduction, the greater is the market performance in the focal market for a design innovation.

The Influence of National Culture

National culture refers to the homogeneity in characteristics separating one society from another, providing for a society's profile of characteristics. A number of cultural frameworks have been offered in the literature (e.g., Hofstede, 2001; Schwartz, 1992; Triandis, 1995; Trompenaars and Hampden-Turner, 1998). However, the work of Hofstede (2001) is most directly applicable to this work as Hofstede's framework (1) is founded on the norms/values approach, and this approach is directly related to the attitudinal and behavioral aspects underlying the consumer adoption decisions, and (2) is consistent with prior research exploring national culture influences on adoption and diffusion of innovations (e.g., Tellis et al., 2003; Yalcinkaya, 2008).

Hofstede (2001) specifies five national culture dimensions: uncertainty avoidance, power distance, individualism, masculinity, and long-term orientation. Consistent with Hofstede's (2001) approach to culture, researchers have employed culture at the nation-state level (e.g., Chandrasekaran and Tellis, 2008; Stremersch and Lemmens, 2009; Tellis et al., 2003), thus directly associating country to national culture. Although Hofstede (2001) identifies five dimensions of culture, to maintain parsimony in the theoretical explication of the relationships under study, and consistent with prior research (e.g., Hofstede, 1983; Tellis et al., 2003; Van den Bulte and Stremersch, 2004), only those dimensions directly linked to technological and design innovation strategies are examined. Thus, in this study, the dimensions of masculinity (i.e., separation of emotional and social roles of genders within a society; Hofstede, 2001) and long term (i.e., the temporal focus of a culture; Hofstede, 2001) are not included.

Uncertainty avoidance. Uncertainty avoidance refers to how a culture manages the fact that the future is uncertain (Hofstede, 2001; Inkeles and Levinson, 1969). Weak uncertainty avoidance cultures accept higher levels of risk and socialize their citizens to accept the fact that the future is uncertain. Alternatively, strong uncertainty avoidance cultures attempt to formulate ways of controlling future events via planning, technology, religion, or other methods, to reduce uncertainty and risk (Hofstede, 2001; Inkeles and Levinson, 1969). Researchers argue that cultures high in uncertainty avoidance work to avoid novel products (Hofstede, 2001; Van den Bulte and Stremersch, 2004).

In relation to technological innovations, it can be argued that consumers in higher uncertainty avoidance cultures would be less likely to adopt such innovations. The logic underlying this argument is that as new technological innovations are untested within the market and therefore may not perform as intended, thus, these innovations embody significant performance risk and consequently would diminish adoption and market share. This argument is consistent with previous literature that found supporting evidence that innovations are less likely to be accepted in cultures that are high on uncertainty avoidance. For example, Steenkamp, ter Hofstede, and Wedel (1999) found that consumers are less innovative in cultures high in uncertainty avoidance. Tellis et al. (2003) and Rogers (1995) also demonstrated that consumers are less likely to adopt new products in high uncertainty-avoidance cultures than in low uncertainty-avoidance cultures. Recently, a growing number of researchers have argued that positive word-of-mouth can be a remedy to lessen uncertainty and to increase the likelihood of adoption (e.g., Lam, Lee, and Mizerski, 2009; Schumann et al., 2010).

Alternatively, this study argues that design innovations are less risky. While social risk does exist with design innovations, it does not specifically relate to the fundamental theoretical aspects of the cultural dimension of uncertainty avoidance (i.e., reducing future uncertainty). Furthermore, the study also makes a case that design innovations, because of their high observability, are more quickly adopted within a marketplace. As such, the study contends that in higher uncertainty avoidance countries, a shorter new product rollout

strategy would be more effective for design innovations. More formally,

H2a: In higher uncertainty avoidance countries, the longer the time lag between initial and focal market introduction, the greater is the market performance in the focal market for a technological innovation.

H2b: In higher uncertainty avoidance countries, the shorter the time lag between initial and focal market introduction, the greater is the market performance in the focal market for a design innovation.

Power distance. Power distance reflects the manner in which a culture addresses physical and intellectual inequalities among societal members, determining differences in wealth and power (Hofstede, 2001). More broadly, power distance describes how sensitive people are to status differences. Larger power distance cultures allow inequalities to grow among members within the society while small power distance cultures try to minimize inequalities (Hofstede, 2001). As a result, high power distance cultures are characterized by greater social stratification.

Firms employing shorter regional rollout strategies with regard to technological innovations are expected to achieve enhanced market share in the focal market. In high power distance cultures, there is significant social stratification within the marketplace and therefore low communication among members, which hinders the dissemination of technological innovations (Carl, Gupta, and Javidan, 2004; Chandrasekaran and Tellis, 2008). As technological innovations traditionally require higher levels of word-of-mouth communication due to these innovations' low observability, and communication is relatively low among members of these cultures, a more rapid product introduction across a region allows for greater market share in each country.

Alternatively, this study argues that a longer rollout for design innovations will result in greater per country market shares. The logic underlying this derives from the high observability and promotion aspects of design innovations and the fact that in high power distance cultures, individuals look to relevant peer groups for comparison purposes. Individuals in high power distance cultures do not readily adopt design innovations as they wish not to separate themselves from their relevant peer group. Rather, individuals in high power distance cultures embrace innovations after they are first adopted by others of similar status. The end result is a slower adoption process for design innovations within countries. The desire to not engage in promotion aspects associated with design innovations will lead to slower adoption within countries. Therefore, in a regional setting, allowing for a longer rollout strategy allows design innovations to gain momentum within the region, becoming more acceptable to peers across countries, increasing the design innovation's adoption rate when rolled out over a longer time horizon. More formally,

H3a: In higher power distance countries, the shorter the time lag between initial and focal market introduction, the greater is the market performance in the focal market for a technological innovation.

H3b: In higher power distance countries, the longer the time lag between initial and focal market introduction, the greater is the market performance in the focal market for a design innovation.

Individualism. Individualism refers to the strength of relations between members of a culture (Hofstede, 2001). People in individualist cultures prefer to act as individuals rather than as a cohesive group and work toward separating themselves from those in other groups (Hofstede, 2001). Alternatively, collectivist cultures (i.e., low on individualism) share similar opinions and beliefs, and work toward a feeling of harmonious interdependence (Hofstede, 2001).

Countries that have cultures high in individualism are expected to be more receptive to technological and design innovations as these innovations are novel and allow adopters to separate themselves from others (either through the inherent functioning of products or through the observable design aspects). This expectation is founded on the logic that (1) innovations (whether technological or design) are by definition novel; (2) novel products allow consumers of such products to differentiate themselves from others; (3) consumers in individualist cultures are attitudinally predisposed to social differentiation and uniqueness (Aaker and Maheswaran, 1997), while (4) consumers in collectivist cultures work toward homogeneity among their peers. This argumentation is consistent with Steenkamp et al. (1999), who found that consumers are more innovative in individualist than in collectivist cultures. Similarly, previous studies show that innovations take off faster in individualist than in collectivist cultures (Chandrasekaran and Tellis, 2008; Yeniyurt and Townsend, 2003). Although the extant literature only provides an empirical foundation for technological innovations, the foundational logic can be extended to design innovations as well, as the inherent differences between design and technological innovations do not provide justification for a priori differential effects. More formally,

H4a: In more individualistic countries, the shorter the time lag between initial and focal market introduction, the greater is the market performance in the focal market for a technological innovation.

H4b: In more individualistic countries, the shorter the time lag between initial and focal market introduction, the greater is the market performance in the focal market for a design innovation.

The Influence of Economic Openness

Trade liberalization policies, brought about by regional cooperative efforts, have drawn increased competition. Economic interdependence depends on factor mobility and the degree of international mobility of goods and services (Corbo and Ossa, 1985; Hine, 1992). Openness, conceptualized as the relative proportion of international trade activity to domestic production, provides an indication of the magnitude of the international transactions in a country compared with its overall economy. A country's level of openness is partially derived from its trade policies. Trade liberalization policies are a critical avenue to spawn economic growth (Czinkota and Ronkainen, 1987; Lutz and Singer, 1994). However, trade liberalization policies only provide the platform to allow openness. Specifically, while trade liberalization policies provide an opportunity for trade, openness represents the post hoc assessment of the effectiveness of the trade liberalization policies. For example, although countries in the European Union have very similar regional trade policies, the level of openness of each country differs depending on consumer purchases and employment productivity.

Here, this study argues that openness influences the effectiveness of regional new product rollout strategies in relation to technological and design innovations. Specifically, openness serves as an important indicator for understanding market convergence. Those countries demonstrating greater openness allow for greater spillover effects across markets (Johnson and Tellis, 2008; Nijssen and Douglas, 2008). These spillover effects positively influence the effectiveness of shorter rollout strategies. For example, a country with greater openness will expose its consumers earlier to technological and design innovations originating in other markets. Alternatively, a less open market presents greater hurdles to the regional rollout of technological and design innovations. As new products are rolled out more quickly, firms can take advantage of the spillover effects across geographically proximate markets that enhance focal market penetration. Alternatively, longer regional new product rollout strategies may create awareness across markets and build up unfulfilled demand, which may hinder market adoption when the product is launched in the secondary market. As such, the study argues that openness influences the effectiveness of regional new product rollout strategies. More formally,

H5a: In countries with higher economic openness, the shorter the time lag between initial and focal market introduction, the greater is the market performance in the focal market for a technological innovation.

H5b: In countries with higher economic openness, the shorter the time lag between initial and focal market introduction, the greater is the market performance in the focal market for a design innovation.

Method

The data contain specific information on all the mobile phones introduced in eight European countries from 2000 to 2007. The eight countries are Belgium, France, Germany, Italy, Netherlands, Spain, Sweden, and United Kingdom. Consistent with the recommendations of Sivakumar and Nakata (2001), the countries provide a wide variety of cultural settings. Our model is tested in the cell phone industry for four main reasons. First, it is an industry characterized by many relevant design and technological innovations. Second, it is a relatively young market allowing for the investigation of a significant life span of the industry. Third, the cell phone industry is characterized by global players, which compete in different countries, with few, if any, local players. Such characteristics makes this industry the ideal setting to study whether differences in market share of the same firm across cultures are due to different effects of the firm's aesthetic and technological strategies. Fourth, the market is oligopolistic, thereby allowing a clear examination of each firm operating in each market.

The database was generated via multiple sources. Market share data were collected from Global Market Information Database and DataMonitor. Information specific to cell phones in each market was collected through Alatest.com. This website, developed by International Consumer Services Sweden AB, presents an extensive dataset of different electronics products (e.g., digital cameras, TVs, and computers) introduced in different countries, inclusive of aesthetic and technological innovations. Table 1 presents the technological and design innovations that occurred during the time period under study. For each cell phone in the database, Alatest

Table 1. Technological and Design Innovations in Our Sample

Type of Innovation	Category	
Aesthetic innovation	Convertible filter	
	Dual slider	
	Flip	
	Flip down microphone	
	Folder type phone	
	Iconic revolving	
	Rotating folding type phone	
	Sidekick	
	Slider	
	Swivel	
	Twist-on	
	X2type (cross-to-type)	
Technological innovations		Typology (further analysis)
Standby innovation (battery life when the phone is not active)	At least 150 hours	Design innovation
	At least 200 hours	Design innovation
	At least 240 hours	Design innovation
	At least 270 hours	Design innovation
	At least 300 hours	Design innovation
Talk time innovation (length of time a cell phone can be engaged in transmission before running out of power)	At least 180 minutes	Design innovation
	At least 215 minutes	Design innovation
	At least 240 minutes	Design innovation
	At least 300 minutes	Design innovation
	At least 400 minutes	Design innovation
	At least 540 minutes	Design innovation
Technology	GSM	Platform innovation
	GSM/GSM PRO	Component innovation
	CDMA2000 1X	Platform innovation
	CDMA2000 1X / AMPS	Component innovation
	CDMA2000 1X/GSM	Component innovation
	CDMA/AMPS	Component innovation
	AMPS/D-AMPS	Platform innovation
	WDCMA (UMTS)/GSM	Platform innovation
	IDEN/GSM	Component innovation
	iDEN	Platform innovation
Wireless interface	Bluetooth	Platform innovation
	Bluetooth 2.0	Component innovation
	Bluetooth 2.0 EDR	Component innovation
	Bluetooth (A2DP)	Component innovation
	Infrared (IrDA)	Platform innovation

provides information on the month and year in which the phone was introduced. Our final sample is made up of 109 firm–country observations and eight time periods (see Table 2).

Measures

Time lag. Time lag is measured between initial regional market introduction and introduction in country j as the number of months elapsed between the month in which an innovation (either technological or design) was introduced in the first of the eight countries in our sample

Table 2. Number of Firms and Cell Phones Analyzed per Country

	Number of Firms	Number of Cell Phones
Belgium	13	197
France	9	635
Germany	9	668
Italy	17	699
Netherlands	16	422
Spain	16	593
Sweden	16	472
United Kingdom	17	695
Total	109	4381

and the month in which the innovation was introduced in the country j.

Culture. Hofstede's (2001) index scores for the cultural variables of uncertainty avoidance, power distance, and individualism were used.

Economic openness. Each country's economic openness is measured by its level of international trade, measured as the sum of exports and imports per capita in thousands of U.S. dollars (cf. Tellis et al., 2003).

Market share. Market share was collected from Global Market Information Database and DataMonitor. Data were collected for each company in each country from 1999 to 2007.

Control variables. Although no specific hypotheses were developed for the effects of total assets available to a firm at time t to account for the resources available to a firm, the number of employees (log-transformed) to account for firm size, and the number of cellular subscribers per 1000 people to account for the total size of the market, these variables were incorporated in the analysis as control variables. The data for the number of employees were collected from Compustat while the data for the number of cellular subscribers per 1000 people were gathered from the database of IB statistics (available at www.http://globaledge.msu.edu) and from the World Bank.

Model Estimation

Because data on firm market share are nested within countries, hierarchical linear modeling (HLM) is employed. The antecedents of market share differential between time t and time t-1 is evaluated using an incremental model-building approach, as in Palmatier, Gopalakrishna, and Houston (2006). For ease of exposition, the subscript t is dropped. All the dependent variables are measured at time t-1:

$$\begin{aligned}\Delta\text{Market share}_{fj} &= \gamma_{00} + \gamma_{10}\text{TL}_{fj} + \gamma_{20}\text{DL}_{fj} + \gamma_{30}\text{Size}_{fj} + \gamma_{40}\text{Assets}_{fj} \\ &+ \gamma_{01}\text{UA}_j + \gamma_{02}\text{PD}_j + \gamma_{03}\text{IND}_j + \gamma_{04}\text{Openess}_j \\ &+ \gamma_{05}\text{Subscribers}_j + \gamma_{11}\text{TL}_{fj}\times\text{UA}_j + \gamma_{12}\text{TL}_{fj}\times\text{PD}_j \\ &+ \gamma_{13}\text{TL}_{fj}\times\text{IND}_j + \gamma_{14}\text{TL}_{fj}\times\text{Openess}_j + \gamma_{21}\text{DL}_{fj}\times\text{UA}_j \\ &+ \gamma_{22}\text{DL}_{fj}\times\text{PD}_j + \gamma_{23}\text{DL}_{fj}\times\text{IND}_j + \gamma_{24}\text{DL}_{fj}\times\text{Openess}_j \\ &+ u_{0j} + ri_j,\end{aligned}$$

where $\upsilon_{0j} \sim N(0, \tau_{00})$ and $r_{ij} \sim N(0, \sigma^2)$; τ_{00} defines the variance in market share across countries, and σ^2 defines the variance in market share across firms within countries; f and j are indices for firm and country; TL refers to the time lag in the introduction of a technological innovation; and DL refers to the time lag in the introduction of a design innovation.

Empirical Results

The study compared a series of nested models (see Table 3). In model 1, the mean of market share as the sum of a fixed part, which contains the grand mean γ_{00}, and a random part, which contains two random effects at the firm- and at the country-level, was estimated.

$$\Delta\text{Market share}_{ij} = \gamma_{00} + \upsilon_{0j} + r_{ij}$$

Model 1 shows that there is variation among firms within countries ($\sigma^2 = 21.31$, $p < .001$) and across countries ($\tau_{00} = 4.39$, $p < .01$): both firm and country factors contribute to explain the differential market share across firms. The proportion of the total variance that occurs across countries (calculated as $\frac{\tau_{00}}{\tau_{00} + \sigma^2}$) is 17.1%, which suggests that the use of HLM is appropriate for our sample.

In model 2, the predictors at the firm level were added to model 1. The results suggest that technological time lag has a positive impact on market share ($\gamma_{10} = .12$, $p < .001$), thus suggesting that a longer rollout strategy is more beneficial than a shorter one, in support of H1a. The results indicate that design time lag has a negative impact on market share ($\gamma_{20} = -.15$, $p < .001$), thus suggesting that a shorter rollout strategy has a more positive effect on market share than a longer one, in support of H1b. The inclusion of firm-level effects explains ([21.31–16.32]/21.32) 20% more in the firm's market share variation *within* countries.

In model 3, the country-level variables were added to model 2. The results show that uncertainty avoidance ($\gamma_{01} = -.05$, $p > .05$) and individualism ($\gamma_{03} = .04$, $p > .05$) have no direct effect on market share, suggesting that the effect of a firm's market share does not differ across countries with different levels of uncertainty avoidance or individualism. However, power distance ($\gamma_{02} = -.11$, $p < .01$) had a significant negative effect on market share, thus suggesting that firms have on average a higher market share in countries with lower power distance. Finally, economic openness had a significant positive effect on market share ($\gamma_{04} = .12$, $p < .01$), thus suggesting

Table 3. Model Estimation Results

	Model 1: Null Model	Model 2: Firm Level	Model 3: Country Level	Model 4: Interaction Effects
Fixed effects				
Intercept	5.39(1.73)***	5.84(2.37)**	5.82(2.48)**	5.86(2.75)*
Technology time lag		.12(.03)***	.14(.03)***	.15(.03)***
Design time lag		−.15(.05)***	−.15(.04)***	−.15(.05)***
Assets		.01(.01)	.00(.01)	.00(.00)
Size		1.31(.95)	1.36(.97)	1.36(.94)
Uncertainty avoidance (UA)			−.05(.03)	−.05(.04)
Power distance (PD)			−.11(.04)**	−.12(.04)***
Individualism (IND)			.04(.03)	.02(.03)
Economic openness			.12(.05)**	.13(.05)**
Cellular subscribers			.001(.002)	.002(.002)
UA × technology time lag				.005(.001)***
UA × design time lag				−.007(.002)***
PD × technology time lag				−.007(.002)**
PD × design time lag				.008(.003)*
IND × technology time lag				.004(.004)
IND × design time lag				.01(.03)
Economic openness × technology time lag				−.09(.05)*
Economic openness × design time lag				−.03(.01)**
Random effects				
Countries	4.39(1.6)*	4.08(2.43)**	3.01(1.28)**	1.96(.95)*
Residual	21.31(6.32)***	16.32(6.44)***	15.85(5.38)***	12.48(5.241)**
Proportion of variance explained		20.62%	26.61%	43.81%
Total proportion: Firm variance explained		23.4%	25.6%	41.4%
Total proportion: Country variance explained		7.1%	31.4%	55.4%
Deviance (−2 log likelihood)	3128.3	3097.2	3076.8	3046.7
Deviance difference		31.1***	20.4***	30.1***
Degrees of freedom for evaluating deviance differences		4	4	8

* Significant at 5% level; ** Significant at 1% level, *** significant at 0.1% level. Standard errors are reported in parentheses.

that firms have on average a higher market share in countries with higher economic openness. The inclusion of country-level effects explains 26% more in the firm's market share variation *across* countries.

In model 4, the interaction effects as specified in H2a–H5b were tested. This model explains 43.8% of the total variance in market share. The predictors explain 55.4% of the variance in market share across countries and 41.4% of the variance in market share across firms.

H2a argued that firms adopting a longer rollout strategy for technological innovations have greater market share than firms adopting a shorter rollout strategy in countries with higher uncertainty avoidance. In support of H2a, the results point out that there is a positive interaction effect between technological time lag and uncertainty avoidance ($\gamma_{11} = .005$, $p < .001$). H2b contends that firms adopting a shorter rollout strategy for design innovations have greater market share than firms adopting a longer rollout strategy in countries with higher uncertainty avoidance. In support of H2b, the results suggest that there is a negative interaction effect between design time lag and uncertainty avoidance ($\gamma_{21} = -.007$, $p < .001$).

H3a argues that firms adopting a shorter rollout strategy for technological innovations have greater market share than firms adopting a longer rollout strategy in countries with higher power distance. In support of H3a, the results confirm a negative interaction effect between technological time lag and power distance ($\gamma_{12} = -.007$, $p < .01$). H3b contends that firms adopting a longer rollout strategy for design innovations have better market share than firms adopting a shorter rollout strategy in countries with higher power distance. In support of H3b, the results show that there is a positive interaction effect between design time lag and power distance ($\gamma_{22} = .008$, $p < .05$).

H4 maintains that individualism has an interaction effect with the time lag of (1) technological innovation and (2) design innovation on market share. The results did not provide support for H4a or H4b, in that both the

interaction effect with technological innovation time lag (H4a: $\gamma_{13} = .004$, $p > .05$) and design innovation time lag (H4b: $\gamma_{23} = .01$, $p > .05$) were not significant.

According to H5, firms adopting a shorter rollout strategy for (1) technological innovations and (2) design innovations achieve greater market share in countries with higher economic openness. The results show support for H5a and H5b, in that both the interaction effect j with technological innovation time lag (H5a: $\gamma_{14} = -.09$, $p < .05$) and design innovation time lag (H5b: $\gamma_{24} = -.03$, $p < .05$) are significant. Finally, the results indicate that model 3, which includes firm-level and country-level variables, is the best model as showed by several goodness-of-fitness measures presented at the bottom of Table 3.

Robustness check. To test the robustness of our results, a different measure of rollout strategy is employed. Rather than the number of months, the study used the number of countries in which an innovation had been introduced before being introduced in country j. Results did not change as an effect of using a different measure, thus suggesting that the findings are robust.

Discussion

Many companies focus almost entirely on the concept, design, and distribution of a new product, but, as shown by the results of this study, the timing of a product rollout can be just as important to its success, particularly when considering regional competition and strategy. Therefore, an increasing number of companies are evaluating optimal timing strategies for their innovation rollouts. To achieve a successful new product rollout, clear product introduction and adoption strategies are critical. Furthermore, as indicated here, successful new product rollouts are further complicated by innovation types (i.e., technological or design) as well as cultural and economic factors. In sum, this study contributes to the current literature by determining the key dynamics that contribute to successful new product rollouts within a region.

The results of this study demonstrate that the type of innovation plays an increasingly important role for a firm's regional new product rollout strategy. In particular, our empirical findings suggest that a longer regional rollout strategy is more desirable for technological innovations while a shorter regional rollout strategy looks more beneficial for design innovations. Although global competition increasingly pushes firms to opt for a shorter, more simultaneous, rollout strategy, the study demonstrates that certain conditions favor a longer regional rollout strategy. For example, when communication is required for the technical features of the innovation, education is needed for both consumers and channel partners in regard to how to use the new technology, and persuasion is necessary for the superiority of the innovation, a longer regional rollout strategy may be the preferred choice. Thus, the strategic decision on the timing of regional rollout has important implications for firm performance. Firms proceeding cautiously and incrementally into regional markets may face fewer risks and pitfalls compared with rapidly internationalizing firms, and may therefore have higher chance of survival. On the other hand, a shorter regional rollout strategy proves to be very desirable for products that are easily visible and observable to consumers, as is in the case of design innovations. These results, building on the literature pertaining to differences between technological and design innovations (e.g., Talke et al., 2009; Verganti, 2003, 2006, 2008), demonstrate the strategic importance of considering technological and design innovations, and their related strategies, separately for maximizing performance outcomes.

This study also provides new insights on the relationship between national culture and the effectiveness of regional rollout strategies, thus denoting cultural nuances in developing regional strategies. Most notably, the empirical findings from this study indicate that firms implementing a longer regional rollout strategy for technological innovations achieve greater market share than firms implementing a shorter regional rollout strategy in countries with high uncertainty avoidance. This finding is consistent with prior studies (Tellis et al., 2003; Yeniyurt and Townsend, 2003), which uncovered that innovations involved in high levels of risk (e.g., technological innovations) were less likely to be accepted than those involved in low levels of risk (e.g., design innovations) in cultures that are high on uncertainty avoidance. In this case, the markets are entered incrementally providing the advantage of an opportunity to provide more information about the technical aspects of risky innovations (e.g., technical innovations), which helps to lessen uncertainty. In addition, with incremental market entry, the company can improve its market entry strategies and minimize the chance of failure for its innovation as continuous improvements can be made with every new market entry. Furthermore, the results for design innovations, where firms implementing a shorter regional rollout strategy for design innovations achieve greater market share than firms implementing a longer regional rollout strategy in countries with high uncertainty avoidance, are contrary to

the existing literature, once again demonstrating the importance of viewing technological and design innovations uniquely.

In relation to power distance, the empirical findings suggest that innovations that provide, or at least maintain, high levels of status within an individual's peer group are more likely adopted than those that provide low levels of status in high power distance cultures. Many believe that revolutionary breakthroughs are the ones that change the game. More specifically, it is science and technology that drive truly disruptive innovation, not design that usually focuses on the needs and wants of people. Because technological innovations are traditionally more radical innovations in nature than design innovations, their impact on one's place (i.e., status) in society may be considerably higher than the impact of design innovations. As a direct result of this, consumers are more motivated to quickly adopt technological innovations in high power distance cultures. Therefore, it is to a firm's advantage to introduce their technological innovations in a short period of time into all suitable markets in these cultures.

The nonsignificant interaction effect for the time lag of both technological and design innovations on market share in individualistic cultures was surprising and inconsistent with prior research. Specifically, prior research has found that innovations take off faster in individualist cultures than in collectivistic cultures (Chandrasekaran and Tellis, 2008; Yeniyurt and Townsend, 2003). One possible explanation for this finding could be that the product type (i.e., cell phones), or the specific innovations (e.g., battery life and style of phone), does not allow for one to employ these products or their associated innovations with separating oneself within the society given their widespread adoption. However, the fact that the findings of this study are not consistent with prior findings is suggestive of a need for greater research in this area to better understand the intricacies of individualism and innovation adoption and diffusion.

The results regarding the effects of economic openness also suggest that firms adopting a shorter regional rollout strategy, regardless of certain innovation types, gain greater market share in countries with higher economic openness. Economic openness suggests easier market entry (Johnson and Tellis, 2008). Although higher economic openness makes foreign market entry easier, it also increases competition as easier market entry applies to all other new entrants. Because increased competition will result in reduced success, earlier entrants will benefit from greater success. Alternatively, firms that enter later will face steep competition, and most likely less success. Thus, in countries that have a higher degree of economic openness, firms benefit the most by engaging in a shorter regional rollout. In the end, this enables firms to enter markets earlier and to gain all pioneer advantages, and market entry barriers can be set up accordingly.

Limitations and Further Research

Although the findings present a number of new contributions to the literature, it is important to note that this study has several limitations that should be considered in the interpretations of the findings. First, the generalizability of the results may be seen as limited because the model is only tested in the mobile phone industry operating in eight developed European countries. This limitation is twofold as it places restrictions on the findings not only in relation to product category (as noted in the discussion that may be attributable to our findings related to individualism) but also in relation to the level of economic development in the region explored. Specifically, other regions, such as the Asia-Pacific region, could have provided greater heterogeneity in the level of economic development that could present new insights into regional strategy effectiveness. As such, research expanding upon these issues would be a welcome addition to the international innovation strategy literature.

Second, although the measure of culture used in this study is consistent with the extant literature (e.g., Chandrasekaran and Tellis, 2008; Tellis et al., 2003), national culture for the investigation of innovation may be more appropriately measured at the individual level (e.g., Lam et al., 2009). Specifically, researchers argue that countries can serve as surrogates for culture. However, within each country, variation along each cultural dimension exists among citizens. As such, greater insight into the intricacies of consumer response to aesthetic and technological innovations may be gained by examining culture at the individual level.

Third, a further caution is that firm-level factors, such as the level of investment in manufacturing, R&D, and marketing, are not accounted for in this study. The inclusion of these factors could provide deeper insights into the effectiveness of longer or shorter regional rollout strategies. For example, building on the literature demonstrating advertising firm internationalization timing is contingent upon firm- and market-level factors (e.g., Magnusson, Westjohn, and Boggs, 2009), the study argues that to maximize effectiveness, a firm should base its budgets and strategies on each region's individual promotional environment. Matching the promotional environment to the specific innovation introduced and the regional (and country-specific) market offers the firm the

opportunity to maximize overall rollout effectiveness. As such, more fully accounting for firm-level factors related to rollout strategies could provide greater insights into this important area.

In conclusion, the purpose of this work was to contribute to the innovation literature by demonstrating (1) the effectiveness of different regional new product rollout strategies of technological and design innovations; (2) the specific influences of national culture on the effectiveness of technological and design innovations for regional new product rollout strategies; and (3) the influence of economic openness on technological and design innovations for regional new product rollout strategies. Examining the launch of 14 technological innovations and 12 design innovations across 17 unique firms operating in eight European countries from 2000 to 2007 indicated that a longer regional new product rollout strategy was a more effective strategy for technological innovations, while a shorter regional new product rollout strategy was a more effective strategy for design innovations. The study also indicates significant interaction effects in relation to the cultural dimensions of uncertainty avoidance and power distance as well as a significant effect of economic openness. The findings of the study suggest the importance of differentiating technological and design innovations as well as of exploring regional rollout strategies.

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