# Radical Innovation in Firms Across Nations

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## Abstract

Radical innovation is an important driver of the growth, success, and wealth of firms and nations. Because of its importance, authors in a variety of disciplines have proposed many theories about the drivers of innovation. These drivers include government policy and labor, capital, and culture at the country level. The authors contrast these theories with a firm-level theory of innovation. Their culture-centric theory of innovation suggests that in the current economic environment in major nations across the world, the internal culture of firms may be the most important driver of innovation. They test their theory on survey and archival data from 759 firms across 17 major economies of the world. Results suggest that: 1) among the factors studied, the internal culture of a firm is the strongest driver of radical innovation across nations, and 2) the commercialization of radical innovations translates into a firm's financial performance; it is a stronger predictor of financial performance than other popular measures such as patents. The authors discuss the implications of these findings for research and practice.



3rd Submission, *JM.*

# Introduction

Radical innovation is crucial to the growth of firms and economies. It merges some markets, creates new ones, and destroys old ones. It can propel small outsiders into industry leaders and can bring down large incumbents that fail to innovate (Chandy and Tellis 2000; Srinivasan, Lilien, and Rangaswamy 2002; Utterback 1994). Firms at the leading edge of radical innovation tend to dominate world markets and promote the international competitiveness of their home economies (Atuahene-Gima 2005; Tellis and Golder 2001). Thus, radical innovation simultaneously drives market growth, firms' success, and the economic growth of nations (Landes 1998; Sood and Tellis 2005; Sorescu, Chandy, and Prabhu 2003). For these reasons, managers and governments throughout the world are realizing the critical importance of radical innovation (e.g., Measuring Innovation in the 21st Century Economy Advisory Committee 2008; Yadav, Prabhu, and Chandy, 2007; Zhou, Yim, and Tse 2005).

What explains differences in radical innovation among firms across nations? This is the primary question this paper addresses. A substantial literature on this topic already exists (e.g. Bartholomew 1997; Fagerberg, Mowery and Nelson 2005; Im et al. 2003; Murtha, Lenway and Hart 2001; Song and Parry 1997). However, researchers have pointed out at least four major limitations of this literature. First, a growing body of cross-national literature on innovation has focused on consumer adoption of innovations and not on firms' commercialization of those innovations (e.g., Chandrasekaran and Tellis 2007; Chandrasekaran and Tellis 2008; Tellis, Stremersch, and Yin 2003).

Second, the literature on firm innovation across nations has mainly focused on comparing the *inputs* of innovation, such as R&D spending, scientific personnel, and patents (Archibugi and Coco 2005; Porter and Stern 1999; Furman, Porter and Stern 2002) across countries. Few studies of innovation across nations have formally examined the *outputs* of innovation such as

commercialized innovations and the financial rewards to such innovations (see Godin 2002). However, inputs do not automatically lead to the creation of new products (Acs and Audretsch 1987; Griliches 1990) or guarantee the financial value firms and governments seek (von Hippel 2005). The key challenge of converting inputs into commercially valuable outputs remains largely unaddressed (see Chandy et al. 2006; Hauser, Tellis, and Griffin 2007). Indeed, as Mairesse (quoted in Kortum 2004, p. 358) noted in a recent round-table of some of the leading thinkers on the topic, "We have exhausted all we can get from our old data sets on R&D, patents, citation counts."

Third, current research on comparing innovation in firms across nations has favored comparisons among firms in the developed economies of North America, Europe, and Japan (see Godin 2002, 2003; Therrien and Mohnen 2003) rather than with firms from emerging economies such as those of East and South Asia. Yet, firms and governments in emerging markets like Korea and Taiwan (Im et al. 2003), India (Economist 2004a) and China (Atuahene-Gima 2005; Song and Parry 1997), among others, increasingly see that their long term future lies in stimulating radical innovation. Given this reality, a broader sampling of countries would be fruitful.

Fourth, past research has either studied the importance of country level drivers (e.g., Archibugi and Coco 2005) or firm level drivers of innovation (e.g., Damanpour 1991; Sethi and Zafar 2008), but has not formally compared the effects of these drivers in the same study (see Kortum 2004). In the absence of such integrated research, policy could be directed at some drivers (e.g., regulation or intellectual property protection) that may well be less powerful than others (e.g., management practice within firms) in spurring innovation (Branstetter and Nakamura 2003; Kortum 2004).

This study is an initial attempt to address these gaps in existing research. By studying the drivers of radical innovation in over 750 public firms of various sizes and sectors across 17 nations, we seek to make four contributions to the study of innovation in firms across nations. First, we

examine a critical output of innovation, the commercialization of radically new products, rather than the inputs of innovation as many existing studies of cross-national innovation tend to do. Both firms and countries can suffer real and opportunity losses by an overemphasis on inputs that do not necessarily translate into outputs. Moreover, we contribute to recent research in marketing on conversion ability by examining which inputs actually yield outputs in the form of innovative products and financial returns (Chandy et al. 2006).

Second, we study radical innovation in a fairly large number of nations, including both developed and emerging economies. In contrast, existing research tends to focus on relatively limited sets of nations (see De Luca and Atuahene-Gima 2007; Im et al. 2003; Song and Parry 1997; Zhou et al. 2005). By doing so, we add greater variance than currently exists to the institutional factors that drive innovation (see Kortum 2004). Thus, we seek to examine whether the drivers of innovation that have so far largely been examined within specific national contexts are generally applicable across national contexts.

Third, we combine insights and data at the macro (national) level with insights and data at the micro (firm) level to examine the relative importance of firm versus country level factors in driving innovation in firms across nations. Researchers in marketing have typically focused on the firm level, whereas researchers in fields such as public policy have examined the national level. We address this gap in the literature by testing the relative importance of both levels. Combining the two levels provides insights into how and to what extent country and firm level factors translate into successful performance (Faber and Hesen 2004; Griliches 1990).

Fourth, and perhaps most importantly, we integrate past research in marketing and management with recent research on trends in the global economy to propose and test a culture-centric theory of radical innovation (see Deshpande and Webster 1989). This theory posits that in today's converging economies, among the many drivers of radical innovation, those based on firm

culture are likely to be primary drivers of such innovation in firms across nations. We refine and extend ideas from recent research on firm-level drivers of radical innovation (e.g., Chandy and Tellis 1998; Govindarajan and Kopalle 2004) that have hitherto been examined in only a few industries and in a single country. We then test our theory against a set of alternate explanations for firm innovation at the firm and country level. Results from our empirical analysis provide initial evidence for the culture centric-theory of radical innovation.

The rest of this paper is structured as follows. The next section introduces the conceptual framework that drives our research and generates informal hypotheses. Subsequent sections describe the models, the method, and results. The final section discusses the implications and limitations of the paper.

## Theory

The disciplinary wellsprings of research on innovation are many (Fagerberg, Mowery and Nelson 2005). Scholars in history, economics, law, engineering, sociology, management, marketing, international business, and public policy have all contributed to our understanding of the drivers of innovation across nations (e.g., Bartholomew 1997; Gagerberg, Mowery and Nelson 2005; Im et al. 2003; Murtha, Lenway and Hart 2001; Song and Parry 1997). Given how many ideas populate the subject of innovation and how dispersed they are, unifying these ideas is a challenging task (see Kortum 2004; Nelson 1993). Within any disciplinary area, researchers tend to examine the drivers of innovation that are most salient to their own discipline. Few existing theories or frameworks integrate both firm-level and national-level drivers of innovation across nations. Cross-disciplinary frameworks that do exist tend to be tailored to fit the unique circumstances of individual industries (e.g., Bartholomew 1997) or individual countries (e.g., Mowery and Rosenberg 1993), and are not easily applied beyond their original contexts (see Nelson 1993; Furman, Porter, and Stern 2002).

The current status of the literature is both a challenge and an opportunity for marketers

interested in the drivers of radical product innovation. Now is an opportune time to integrate the far-flung ideas that are relevant to this topic. Indeed, a "home-grown" theory of the type advocated by Rust (2006, p. 1) has the potential to guide thinking and practice not just in the field of marketing but in associated fields as well. As a first step toward building such theory, we propose a framework linking key drivers of innovation with key innovation outcomes (see Figure 1). The next section uses this framework to build a meta-theory of the drivers and fruits of radical innovation in firms across nations. We first outline some of the potential drivers proposed in the literature on innovation in firms across nations. Next, we introduce our culture-centric theory of radical innovation.

***Drivers of Radical Innovation in Firms across Nations***

A review of the literature on innovation across nations suggests that four factors underlie most explanations for why certain firms in certain nations are more innovative than others: skilled labor, capital, government, and culture (Bartholomew 1997; Demirgüç-Kunt and Levine 2001; Furman, Porter, and Stern 2002; Nelson 1993). The terms to describe these factors and the variables studied within them may differ by discipline (Kortum 2004). Moreover, the boundaries between these factors can be fuzzy. Nevertheless, we believe these factors incorporate most variables that are currently seen as driving radical product innovation in firms across nations in a reasonably coherent way. Of these factors, all except government operate at two levels: 1) the national level, in the context of the entire economy, and 2) the firm level, in the context of the individual firm. In the paragraphs below, we briefly describe the role that each of these factors play in driving radical innovation. For the sake of brevity, and consistent with objectives of this research, we focus on the main effects of these factors in the discussion below.[1]

[1] The literature also suggests that these factors may intersect and interact dynamically with each other (see Bartholomew 1997; Murtha, Lenway, and Hart 2001; Nelson 1993). We test for these intersections and interactions subsequently.

***Labor***

We use the term labor to refer to the skilled workforce accessible to a particular firm in a particular country. A long tradition of research has pointed to the importance of a skilled workforce as a primary driver of innovation, both at the national as well as at the firm level (e.g., Committee on Science, Engineering, and Public Policy 2005; Daniels 1992; Furman, Porter, and Stern 2002; Mowery and Rosenberg 1993). An educated and skilled workforce, especially in scientific and technical fields, is generally viewed as a pre-requisite for the development and commercialization of novel products. For example, at the national level, Freeman (1992, p. 171) traces the emergence of the US and Germany as technology powers in the 19th and 20th centuries and the loss of British technological leadership during this time, to these factors: "It was above all the increasing availability of considerable numbers of professional engineers and other skilled people which gave the decisive advantage to German and American industry."

As with the national level, a skilled workforce is also important at the firm level. Of special importance to firms is the availability within the firm of skilled scientific and technical talent (Zucker, Darby and Armstrong 2002). Regardless of their national context, differences among firms' ability to recruit and retain talented technical personnel is likely to explain differences in their innovation output and the value they capture from this output (Sorescu et al. 2007).

***Capital***

Capital refers to the financial resources that are available in the country as a whole as well as within firms that operate in the country. At the national level, countries with strong and vibrant financial systems are likely to provide greater access to the financial resources needed for innovation (see Huang and Xu 1999; Edquist 2005) than those countries not so well-equipped. Sources of financial inputs include banks, stock markets, and venture capital. While stock markets provide access to equity for established firms, banks serve as a source of finance for private firms as

well as small firms from established sectors (Levine and Zervos 1998). Many countries now have an active network of venture capitalists that support new innovative enterprises. Risky and emerging firms and sectors are likely to benefit from such networks in their drive towards innovation (Kortum and Lerner 2000).

At the firm level, the financial resources available within individual firms are likely to play an important role in driving innovation in these firms. Within any specific country, those firms that have greater access to financial resources are, ceteris paribus, likely to be more innovative and create greater value from their innovations (Sorescu, Chandy, and Prabhu 2003).

The mere availability of capital, however, whether at the national or the firm level, will only translate into innovation if the capital is used to make the right sorts of investments. At the national level, greater investment in R&D is likely to yield greater access to new product ideas for firms in the economy; the spillover of knowledge created by such spending is likely to benefit firms operating throughout the economy (Jaffe, Trajtenberg, and Fogarty 2000). So too, within firms: those firms that spend more on R&D are likely to be more innovative and, ceteris paribus, capture more value from innovation than firms that spend less on such R&D (see Dutta, Narasimhan, and Rajiv 1999).

***Government***

Past literature suggests that several aspects of government policy can help or hurt innovation within firms that operate in a country (Nelson 1993, Edquist 2005). As Nelson (1993, p. 512) notes, "Much of the current interest in national systems of innovation reflects a belief that the innovative prowess of national firms is determined to a considerable extent by government policies." Among the most important aspects of policy are the protection that the government provides for intellectual property, its involvement in technology development through its encouragement of collaboration between universities and industry, and its involvement in the diffusion of innovation through its

procurement of innovative outputs in sectors such as defense, health, and education.

The case for intellectual property protection in driving innovation is made strongly by legal scholars and some economists (Gutterman and Anderson 1997; Webster and Packer 1996). The argument is that protection for the ideas behind innovations allows innovators to reap the rewards for developing innovations and undertaking risks in commercializing them. Some proponents suggest that the success of Europe relative to Asia in the post-renaissance period resulted from the former's legal support of intellectual property rights (e.g., North and Thomas 1973; Landes 1999). Others offer the innovativeness of the US over Europe in the last 100 years as being due to its strong patent, trademark, and copyright laws (e.g., Rosenberg and Birdzell 1986).

Many scholars argue that government legislation such as the US Bayh-Dole act that encourages and facilitates collaboration between universities and industry is a likely driver of innovation within firms in the country (Mowery and Sampat 2004; Etzkowitz and Leydesdorff 2000). Such policy may help transform the basic research that occurs at universities to applications that firms can commercialize. In addition, it may yield graduates whose skills are closely attuned to the innovation tasks that face firms. By creating laws that enable universities to engage in such collaboration with firms, as well as by providing incentives that encourage them to do so, governments can help stimulate the innovativeness of firms that operate in their countries.

Governments can also support innovation in firms either indirectly via R&D tax credits or directly via the procurement of new technology (Hall 1993; Hall and van Reenen 2000; Bartholomew 1997). Such support can potentially create markets for products and technologies that otherwise may take many years to materialize or never materialize at all. In recent years, R&D programs targeted toward security, military, and public health needs have been a primary arena for government procurement and tax credits (Nelson 1993). For example, now ubiquitous technologies in semiconductors, telecommunications, energy and computing owe their origins in part to

government-sponsored research with military aims. Nevertheless the actual impact of government procurement and R&D tax policies remains ambiguous with some scholars noting that while such policies might have raised technical development or scientists' wages in certain fields, innovation outputs have been non-existent or slow to follow (Mansfield 1984; Goolsbee 1998).

***Culture***

Culture refers to a core set of attitudes and practices that are shared by the members of a collective entity such as a nation or a firm (Hofstede 2003; Smircich 1983). The definitions of culture are many (for extensive reviews see Denison 1996; Deshpande and Webster 1989; Gregory 1983; Triandis 1996; also see Miles and Snow 1978). However, as Triandis (1996) states, "almost all researchers agree that culture is reflected in shared cognitions and standard operating procedures". Our definition of culture in terms of attitudes and practices is consistent with and analogous to definitions that view culture in other terms such as values (see Deshpande and Webster 1989; Jones, Jimmieson, and Griffiths 2005; Rokeach 1973). As with labor and capital, culture can operate at both the national and firm level.

An extensive literature suggests three related aspects of national culture that may drive innovation: a country's religion, its geographic location, and the values of its citizens (Hofstede 1980). Some analysts argue that religious beliefs can influence the development and adoption of innovations (see Gorski 2003) because some faiths provide believers with a strong rationale to work in and transform their environment while others tend to emphasize the renunciation of worldly pleasures and rewards in the afterlife (Weber 1930; DeLong 1988; Landes 1999).[2] Similarly, some researchers argue that a country's geographical location, specifically its distance from the equator, could reflect attitudes and practices that help or hinder innovation (e.g., Parker 2000; Landes 1999).

[2] However, as an anonymous reviewer notes, the distribution of religious beliefs among decision-makers in a given firm may not reflect the distribution of religious beliefs in the country as a whole.

Warm climates, being more abundant in animal and vegetable life than cold ones, lead to easier lifestyles and fewer incentives for work and innovation, while cold climates, being more hostile, require long term planning and motivate people to action, work, and innovation (Landes 1999). Finally, Hofstede (2003) has shown that countries may differ along specific cultural dimensions such as individualism-collectivism, uncertainty avoidance, power distance, masculinity-femininity, and long-term orientation. Recently, other researchers have updated and refined these dimensions (House et al. 2004) and highlighted their likely impact on innovation (see Dwyer, Mesak, and Hsu 2005; Shane 1994).

As with national culture, recent research suggests the internal culture of a firm may play a role in radical innovation. Firm culture refers to a core set of attitudes and practices that are shared by the members of the firm (Denison 1996; Deshpande and Webster 1989; Detert, Schroeder, and Mauriel 2000; Hatch 1993; Martin 2002; Schein 1999; Schultz and Hatch 1996). A culture that fosters relentless innovation may help ensure that the firm stays constantly at the leading edge of innovation (Govindarajan and Kopalle 2004; Tellis and Golder 2001). The section below highlights the importance of firm level culture in driving innovation and proposes a culture-centric theory of radical innovation in firms.

***A Culture-Centric Theory of Radical Innovation***

Although researchers have proposed labor, capital, government, and culture as drivers of innovation, few have formally examined the relative importance of these factors in contemporary firms. In the next stage of theory development, we propose the thesis that in today's capitalist economies, labor, capital, and government may not be the primary factors that distinguish innovative firms from others. Neither may country culture in itself be the major factor of importance. Rather, we argue that firm culture is likely to be the primary driver of innovation in firms across nations, for three reasons.

First, markets for labor and capital have been evolving in capitalist economies over the last 400 years (Wright, Pruthi, and Lockett 2005; Mannie, Zhang, and Hu 2006). In many capitalist countries, these markets are increasingly mature and reasonably efficient. Thus, innovative firms now have the ability to tap these markets for labor and capital to bring their innovations to fruition. In particular, the presence of markets for venture capital enables entrepreneurs and entrepreneurial firms to gain access to capital for radical innovations, though at a steeper rate than in the stock market (Gompers and Lerner 2001).[3]

Second, recent years have witnessed an increased convergence across developed and emerging nations in the extent to which labor and capital are accessible to firms (Krugman, Cooper, and Srinivasan 1995; Demirguc-Kunt and Levine 2001) and the extent to which government policies are synchronized across nations (Lemola 2002; Hussler 2004; Gong and Keller 2003). Though far from easy, negotiations across governments have led to some agreements on market and capital access across borders. Moreover, our discussions with policy makers in both developed and emerging countries suggest another factor that may be even more important than formal agreements in promoting policy convergence. Policy makers in many countries have learned to keep a close eye on regulatory and technological developments elsewhere and have unilaterally integrated their own countries to international markets (see Baldwin 2006; Krugman, Cooper, and Srinivasan 1995; Naim 2007). Also, though far from frictionless, markets of a reasonably efficient kind exist for both labor and capital in many leading and emerging countries. With the exception of sub-Saharan Africa and certain parts of the Middle East and Central Asia, economies in many parts of the world have seen capital markets flourish (Kumar and Russell 2002). Novel and promising ideas, whether in emerging economies like India and China or in established markets of the OECD, now attract

[3] This said, we acknowledge that the sources of available capital may vary among countries due to historic and systemic reasons. For example, while German and Japanese firms rely more on debt and bank sources, US firms rely more on stock and non-bank sources (see Demirguc-Kunt and Levine 2001). Further, stock markets in some countries like China are more nascent than stock markets in North America or Western Europe.

capital in a manner that is in many ways unprecedented in history. Similarly, developing and developed countries alike see the importance of educational and other labor-related investments. Even in cases such as India and China, where the proportion of qualified technical personnel is not currently large relative to the population of these countries, the sheer number of available personnel makes it possible for firms in these emerging economies to meet their current innovation needs. Increasingly therefore, access to labor is also diminishing in its importance as a factor that explains differentials in innovation in firms across nations. Moreover, multilateral trade agreements and pan-national institutions such as the World Trade Organization have helped promote an increased convergence in government policies across nations on intellectual property protection, government procurement, and collaboration between universities and industry (Baldwin 2006).

Third, culture is a uniquely human product that develops slowly within firms, is tacit and not easily defined, and is not easily transported across firms (Jassawalla and Sashittal 2002; Schein 1999). Indeed, markets for culture are either non-existent or not very efficient. Reporting requirements and the presence of firms (such as Dun & Bradstreet among others) that specialize in corporate information help ensure that the size and type of labor and capital pool employed by a particular firm is often evident to (and thus open to imitation by) its competitors. Firm culture, however, is a much more elusive factor than is labor, capital, and government regulation.

Thus, we posit that capital, labor, and government regulation may be important drivers of radical innovation in firms across nations. However, in today's converging economies, firm culture may be more important than labor, capital, government, and country culture in explaining innovation in firms across nations.

Following prior research, we examine firm culture by studying the core set of attitudes and practices shared by members of the firm (Deshpande and Webster 1989; Smircich 1983). We do so with the recognition that the attitudes and practices that are most relevant to the innovation task are

unlikely to be identical to those for other tasks. For this reason, scholars of firm culture have called for middle-range descriptions of firm culture – descriptions that preserve the holistic aspects of the construct while acknowledging the particulars of the tasks or outcomes being studied (also see Bourgeois 1979). For example, Homburg and Pflesser (2000) examine market-oriented culture by studying the attitudes and practices that the literature suggests are most relevant to market orientation. Hofstede et al. (1999) examine the role of firm culture in employee promotion and dismissal outcomes by studying attitudes and practices that the literature suggests are most relevant to those outcomes. In the same vein, we examine the role of firm culture on radical innovation by studying attitudes and practices that the literature suggests are most relevant to this outcome.

Based on prior research, we identify three firm level attitudes and three firm level practices that may drive innovation (see Chandy and Tellis 1998; Olson, Walker, and Ruekert 1995). The attitudes are the willingness to cannibalize assets, future orientation, and tolerance for risk. These attitudes are likely to be essential drivers of innovation for the following reasons. First, a great hindrance to enduring innovation is the stream of profits that emerge from current products and services. The firm invariably tends to marshal great resources to protect this stream of profits. Any change or innovation which might threaten it is vetoed or frozen. A willingness to cannibalize assets is an attitude that puts up for review and sacrifice current profit-generating assets, including current profitable and successful innovations, so that the firm can get ahead with the next generation of innovations (Chandy and Tellis 1998). Second, a firm that is successful in one generation of technology is under pressure to focus on the many micro problems that it faces in managing its success with that generation. A future orientation forces a firm to realize the limitations of the current technology and the emergence of a new generation of technology that may become dominant in the future (Christensen and Bower 1996; Narver and Slater 1998; Yadav et al. 2007). Third, trading a current sure stream of profits for a future uncertain stream of profits is risky and

does not come naturally to managers. It is vital that a firm foster and promote a tolerance for risk to make that essential tradeoff (Fiegenbaum and Thomas 1988; Gilman 1995; Kuczmarski 1996). Thus, willingness to cannibalize assets, future orientation, and tolerance for risk are three essential attitudes that comprise an innovative culture.

Prior research has also led us to identify three practices that engender and sustain these attitudes. First among these is the empowerment of product champions. By this practice, a firm empowers an individual with resources to explore, research, and build on promising but uncertain, future technologies (Howell and Higgins 1990; Markham and Griffin 1998; Shane 1994). In effect, it embeds within the firm the enterprising spirit that enabled it to initiate the original innovation that brought it success. Second, the firm needs to establish incentives for enterprise (Makri, Lane, and Gomez-Mejia 2006; Zenger and Lazzarini 2004). By this practice, the firm refrains from rewarding only or primarily seniority or management of current products. Rather, it ensures that adequate if not large incentives are reserved for employees who venture to explore or build new enterprises for the firm. A third practice is the creation and maintenance of internal markets (Halal, Geranmayeh, and Pourdehnad 1993). This practice involves two elements: internal autonomy and internal competition (Chandy and Tellis 1998). Internal autonomy refers to the extent of decision making authority that division managers in a firm enjoy, relative to the corporate office (Aiken and Hage 1968; Olson, Walker, and Ruekert 1995). Internal competition requires that divisions or groups of employees within the firm compete among themselves to identify promising technologies and build innovations on those technologies. A firm with an active internal market brings the market place within itself, ensuring that an innovator from outside will not upstage the firm.

In summary, although many variables at the country and firm level can drive radical innovation in firms across nations, our culture-centric theory of radical innovation suggests that in

today's converging economies, firm culture may be the most important driver among all these variables. We next describe the model we use to test our arguments.

## Model

Our empirical model has two equations: Equation 1 tests the effects of various drivers of innovation on radical innovation in firms across nations as suggested by the arguments articulated above. Equation 2 tests the effects of radical innovation (relative to traditional metrics such as patents and R&D) on a firm's financial performance. For both equations, we have repeated measures across many industries; we account for industry heterogeneity using an industry fixed effects model.

Based on our theory, we specify Equation 1 as follows:

$$Radical\ Innovation_{fci} = \delta_0 + \sum_l \delta_{jl} Labor_{cl} + \sum_l \delta_{jl} Labor_{fl} + \sum_l \delta_{jl} Capital_{cl} + \sum_l \delta_{jl} Capital_{fl} + \sum_l \delta_{jl} Government_{cl} + \sum_l \delta_j Culture_{cl} + \sum_l \delta_{jl} Culture_{fl} + \sum_l \delta_{jl} Controls_{fcil} + \nu_i + \varepsilon_{fci} \quad (1)$$

Where, f, i, and c, are indices for firm, industry, and country; the $\delta_j$s are parameters to be estimated for the $j^{th}$ variable; Radical Innovation is a measure that captures the radical innovation of a firm f; Labor is a set of variables that measure skilled labor related drivers of innovation at the country or firm level; Capital is a set of variables that measure capital related drivers of innovation at the country or firm level; Government is a set of variables that measure government policy related drivers of innovation; Culture is a set of variables that captures country and firm level culture; $\nu_i$ are industry-specific error terms, and $\varepsilon_{fci}$ is the remaining error term (initially assumed to independently and identically follow a normal distribution). Finally, Controls is a set of variables likely to also influence firms' radical innovation; these include firms' citation-weighted patents and the country's population and GDP.[4]

Equation 2 assesses the effect of radical innovation on financial performance:

[4] Other firm-level factors such as leadership quality and cross-functional integration may also drive innovation. Due to resource constraints, we do not cover these factors in this research.

$$Value_{fci} = \beta_0 + \beta_j RadicalInnovation_{fci} + \beta_j Patents_f + \beta_j R\&D_f + \sum_l \beta_{jl} Controls_{cil} + \nu'_i + \varepsilon'_{fci} \quad (2)$$

Where, f, i, and c, are indices for firm, industry, and country; the $\beta_j$s are parameters to be estimated for the $j^{th}$ variable; Value is the market-to-book ratio of firm f; Radical Innovation is a measure that captures the radical innovation of firm f; Patents is the citation-weighted patents owned by firm f; R&D is % of sales spent on R&D by firm f; $\nu'_i$ are industry-specific error terms, and $\varepsilon'_{fci}$ is the remaining error term (initially assumed to independently and identically follow a normal distribution). Controls is a set of variables likely to also influence firms' financial performance; these include firm size and country GDP, population, inflation, and credit rating. We do not include country culture in Equation 2, as there is little literature to support the effects of these variables on firms' financial performance. However, including these variables in the estimation does not substantially change the results of the financial impact of radical innovation.

We estimate both equations (1) and (2) using industry-level fixed-effects regression models. Further, we estimate equations (1) and (2) separately because: a) the two equations form a recursive system: while Radical Innovation influences Value, Value (which is forward looking and measured later in time than Radical Innovation) does not influence Radical Innovation, b) an analysis of the correlation between the error terms of each of the equations indicates that these errors are uncorrelated, and c) recursive systems with uncorrelated errors do not require joint estimation of their constituent equations (see Land 1973 for a formal proof).

# Method

This section describes the sampling, procedure, and measures of the empirical study.

## Sampling

Resources at our disposal limit our study to 17 countries. To ensure we capture a large fraction of the world economy, we chose the 8 largest economies in the world on the basis of purchasing power parity: USA, China, Japan, India, Germany, UK, France, and Italy. To capture the role innovation may have played in propelling countries' recent progress, we chose four countries

that have recently developed rapidly: Taiwan, Hong-Kong, Korea, and Singapore. We also chose five countries with known major innovative or multinational firms: Canada, Switzerland, Netherlands, Sweden, and Australia.

We selected a sample of publicly listed firms only. Doing so allows us to integrate our survey data with data from archival sources on these firms. We also chose only firms within the manufacturing sector that are primarily local to their country of origin. In other words we excluded local subsidiaries of multinationals because those entities confound the role of parent firm and local country culture (see Bartlett and Ghoshal 1995; Prahalad and Doz 1987). We sampled between 62 and 848 firms from each country to reflect the size of these countries' economy as well as the extent of public listings within them (see Table 1 for sample sizes by country). We used stratified sampling by firm size; 15% of our sample consists of all the very largest firms in the country and the remaining 85% consists of a third each of large, medium, and small firms.

## Procedure

*Survey data:* We used the following procedure to develop our questionnaires and conduct the survey. First, we developed a preliminary questionnaire based on discussions with managers and using scales and items from past academic research as well as innovation surveys conducted by the OECD and the EU; for the latter, we drew on both the OECD's Oslo Manual (OECD 2005) as well as the EU's Community Innovation Survey (Eurostat 1997, 2000). Second, in the questionnaire, we took care to provide respondents clear definitions of our key terms such as firm, industry and radical product innovation. We also provided examples of each of these types of innovations. We used multiple items for each construct and negative and positive valenced items to minimize demand bias and yeah-saying (Baumgartner and Steenkamp 2001, 2006). Third, we pretested this questionnaire by sending it to a sub-sample of 100 firms from four English-speaking nations in our sample (US, Canada, UK and Australia). Fourth, after checking for the validity and reliability of the scales, we

translated the original English language questionnaire into the other 7 languages in our sample (French, German, Italian, Japanese, Korean, Mandarin Chinese, and Simplified Chinese). We used independent experts to back translate and re-translate these questionnaires to ensure accuracy and consistency. In some cases, we cross-checked the translated surveys face to face with managers from the country in question (Germany, Switzerland, Japan, and Korea).

Fifth, we obtained the names of firms to make up our sample from the OSIRIS and Worldscope databases, phoned these firms to identify the Vice President for innovation or technology or the equivalent at each firm, and mailed the surveys out to all firms in all countries over a 6 month period. We sent a reminder letter to each firm 10 to 14 days after we mailed them the survey. Sixth, we performed relevant validity and reliability checks on the survey data to develop the metrics we used in our analysis. Finally, we controlled for yea- and nay-saying, mid-point bias and extreme response bias across firms and countries by applying the correction procedure used by Triandis (1994) and House et al. (2004). By subtracting the mean and dividing by the standard deviation across all responses per firm, this method corrects for the four types of biases stated above. All survey-based items used in subsequent analyses are corrected for these biases.

*Archival data*: In addition to survey data on firm-level innovation inputs, outputs and drivers of innovation, we also collected data from multiple archival sources (see Table 2). We collected two types of **firm-level** secondary data: patent data from Delphion and firm financials from OSIRIS and Worldscope. We also collected several types of **country-level** secondary data. First, we collected ratio scale data from the OECD and perceptual data from the World Economic Forum and the IMD World Competitiveness Report on various measures of country level labor, capital, and government policy. Second, we collected data on religion from the CIA World Factbook and data on geographical location from Parker (2000) and worldatlas.com. Finally, we collected data on country

culture from Hofstede (2003) and the GLOBE leadership survey (House et al. 2004).

We linked the survey and archival data at the firm and country level to assemble a pooled database that we use in all subsequent analysis. See Table 1 for response rates to the survey.

## Measures

This subsection describes the measures for the dependent, independent, and control variables.

### *Dependent Variables*

We collected data on two dependent variables of interest: firm-level financial performance and radical innovation outputs. We measured each of these as follows (see Table 2).

*Radical Innovation*. We used a three item scale to measure radical innovation (Chandy and Tellis 1998; Nijssen et al. 2005). These items are all 7-point Likert items measuring the extent of radical innovation within the firm. We combined these items into a three-item additive scale. We found this scale to be fairly reliable (Cronbach alpha=.62). We also found it to have validity: it correlates well ($\rho$=.38, p<.0001) with a fourth 7-point item that measures the percentage of sales based on radical innovations by the firm in the previous three years (see Appendix 1 for details).[5]

*Financial Performance*. We measured financial performance using individual firms' market to book ratio (Barber and Lyon 1997; Fama and French 1992, 1995), the ratio of a firm's stock market value to the book values of its assets. We used this measure for three reasons. First, market-to-book values represent investors' valuation of a firm based on all of its activities and potential. Second, this measure is future oriented, because stock prices represent the net present value of expected current and future cash flows. Third, the ratio provides a measure of the intangible value of the firm over and above its assets, due to such factors as innovation. We collected financial data for each firm at the end of 2003 from Worldscope and OSIRIS.

[5] We also created an alternative scale that uses all four items; our results are robust to the use of this 4-item additive scale instead of the three-item scale we used for the results reported in this paper.

***Independent Variables***

We discuss each of our key firm- and country-level predictors of radical innovation and financial performance below (also see Table 2).

*Firm Culture*. We collected data through the questionnaire on a number of organizational drivers of innovation: willingness to cannibalize, future focus, risk tolerance, product champions, the use of incentives, and internal markets. Willingness to cannibalize refers to the extent to which a firm is prepared to reduce the value of its own past investments. Future market orientation is the extent to which a firm emphasizes, in its market research activities, customers and competitors who are not currently in the markets it serves. Tolerance for risk refers to the extent of risk a firm tends to take in order to fulfill a desired goal. The key practices we examine are incentives, empowerment of product champions, and internal markets (see Howell and Higgins 1990; Quinn and Rivoli 1991). Incentives refer to the monetary and non-monetary rewards a firm has in place to reward innovation. Empowerment of product champions refers to the extent to which a firm promotes the activities of individuals who aggressively pursue new product ideas. Internal markets refer to the level of internal autonomy and internal competition that exists among business units in a firm.

We developed items for these measures (see Appendix 1 for details) based on existing research (e.g., Chandy and Tellis 1998; Mols 2001). We combined these items to develop additive scales for each of the variables of interest, after controlling for response biases as discussed above.

*Country Culture*. We used two sources of data on country culture. Consistent with past research, we used Hofstede's measures of country culture on the following dimensions: power distance, uncertainty avoidance, individualism, masculinity, long term orientation (Hofstede 2003; also see Mitra and Golder 2002). We also collected data from the GLOBE Study of Culture, Leadership and Organizations (House et al. 2004) on the following dimensions: performance orientation, future orientation, gender egalitarianism, assertiveness, individualism and collectivism, power distance,

humane orientation, uncertainty avoidance. The results that we report in this paper use the Hofstede measures. Our results are robust, however, to the use of the GLOBE measures instead. We measured country-level religion by collecting data on the percent of people within a country who belong to the following religious groups: Protestant, Catholic, Jewish, Hindu, Buddhist, and Muslim. We obtained this information from the CIA World Factbook. We measured geographical location using the latitude of the capital city of the country.[6] We obtained this data from Parker (2000) and worldatlas.com.

*Country Labor, Capital and Government Policy*. We collected and coded archival data on labor, capital and government policy for each country in our sample. To measure labor, we collected data on five variables: the availability of scientists and engineers, the quality of scientific research institutions, the quality of management schools (all from the World Economic Forum's World Competitiveness Report), R&D personnel per 1000 people nationwide and the total public expenditure on education as a percentage of GDP (from the IMD World Competitiveness Report). All five of these variables load on one factor and we used the factor score as a summary measure of country level labor.

To measure capital we collected data on five variables: financial market sophistication, soundness of banks, ease of access to loans, venture capital availability (all from the World Economic Forum's World Competitiveness Report) and the country's per capita R&D spending (from the IMD World Competitiveness Report). Again, all five variables load on one factor, and we used the factor score as a summary measure of country level capital.

Finally, to measure government policy, we collected data on intellectual property protection, university/industry research collaboration, government subsidies and tax credits for firm-level

[6] We also used an alternate measure based on the squared latitude of the capital city. The results are robust to this measure.

R&D, and government procurement of advanced technology products (all from the World Economic Forum's World Competitiveness Report). Again, all four variables load on one factor. So we used the factor score as a summary measure of country level capital.

*Firm Labor and Capital.* We also collected and coded data on skilled labor and capital for each firm in our sample. We measured skilled labor using the percentage of the total number of employees that are employed in R&D in the year prior to our survey. We measured capital using the firm's R&D spending as a percentage of sales in the year prior to our survey.

***Control Variables***

The control variables in Equation 1 include the country level GDP and population and the firm's citation-weighted US patent outputs and its size in sales revenue. Patents represent codified know-how that, as intermediate outputs of the innovation process, may in turn be embodied in final outputs such as radical innovations. Some researchers and policy makers consider the registration of patents to be so important that they equate patents to innovation and sometimes measure the latter with the former (Archibugi and Coco 2005; Furman, Porter, and Stern 2002; Porter and Stern 1999). This line of thinking suggests that patents would be an important driver of radical innovation. Also, if markets value patents as highly as many researchers do, then patents should have a major influence on financial returns of a firm. We used patents granted in the US as our metric of patents because a) most firms that seek patents tend to patent their significant innovations in the US, b) patent laws vary considerably across countries, patents in the US is one reasonable standard for cross-country comparisons, and c) US patents are the most widely accepted measure of patents used in cross-national studies of patenting (see Furman, Porter & Stern 2002). We weighted the patents by their forward citations as doing so captures the importance of the patents rather than merely their volume (Griliches 1984; Jaffe, Trajtenberg, and Henderson 1993).[7] We collected the patent and

[7] We also ran our models with patent counts only and find that our results are robust to this measure.

citation data from Delphion for the year prior to the survey.

The measures of the control variables in Equation 2 include the country level GDP, population, inflation and country credit rating and the firm's citation-weighted US patent output and its size in sales revenue.

We control for industry in both Equation 1 and 2 as follows. We identified the 2-digit SIC code for the primary industry in which each firm operates and used this information to run industry-level fixed-effects estimations of Equation 1 and 2.

# Results

We describe the results in four parts: response to the survey, validity and reliability of the measures, the drivers of radical innovation, and the financial impact of radical innovation. In addition, Appendix 2 explores the robustness of our results, including the potential for mediating and moderating effects on the dependent variables.

## Survey Response

The response rates to our survey vary between 9% and 34% across countries with an overall average response rate of 19% (see Table 1). These rates compare well with those in other large-scale international studies (e.g., Baim 1991). Nevertheless, we also checked for non-response bias as follows. First, we compared means on the number of employees and total assets (standardized across our sample frame) for respondents and non-respondents. We found no significant difference between respondents and non-respondents on these demographic measures. This pattern also holds for most comparisons at other levels of analysis (within countries, across the four strata of firm size in our sampling plan, and across strata within each country). Second, we compared means on important variables in the survey for respondents in the first versus last quartile in terms of date of response after mailout. We performed this analysis across countries and find no significant difference in means for most of our variables in most countries. These results provide some

assurance that our data do not suffer from non-response bias.

Respondents to the survey have substantial experience (average 17.4 years of experience in their industry and 12.4 years experience in their firm) and are closely involved in innovation activities (average level of personal involvement in innovation activities is 5.8 on a 1-7 Likert scale anchored on "not at all involved" and "highly involved").

After cleaning the survey data and accounting for missing values, we have a sample size of 772. We then integrate the archival firm- and country-level data with the survey data and achieve a sample size of 759. To our knowledge, this is the largest sample among multi-continent studies of firm innovation (see Table 3 for descriptive statistics and Tables 4 and 5 for pairwise correlations across variables). We first present the results of the estimation of our measurement model and then present the results of our formal tests and additional analyses.

## Reliability and Validity

Following Anderson and Gerbing (1988), we assessed the measurement model before estimating the research model. To obtain reliable and valid measures of our focal variables, we first examined the face validity, inter-item, and item-to-total correlations to arrive at the scales described above. All scales show satisfactory reliabilities, with Cronbach's alphas above the acceptable cut-off of 0.60 (except willingness to cannibalize which has an alpha of 0.58).

Next, we used confirmatory factor analysis to examine the unidimensionality of the constructs, i.e., the extent to which a single construct underlies a set of measures (items). The overall fit of the measurement model provides the necessary information to determine whether unidimensionality is satisfied (Gerbing and Anderson 1988; Steenkamp and Van Trijp 1991). The overall fit of the full model is satisfactory (Browne and Cudeck 1993).

To check for discriminant validity of the latent constructs, we constrained the correlation between each pair of latent constructs to 1; the constrained models show evidence of poor fit

relative to the freely estimated equivalent. Lagrange-multiplier tests indicated no significant cross-loadings, thus providing further evidence of discriminant validity. The preceding tests provide support for the psychometric adequacy of our measures.

We next present tests of the drivers and financial impact of radical innovation.

## Drivers of Radical Innovation

Recall that our theory suggests that firm culture would be a primary driver of radical innovation, in addition to the effect of government, firm, and country level labor, capital, and culture. Equation 1 specifies the model that captures this theory. The results (standardized coefficients) of the test of this model are in Table 4. To show robustness of the results to multi-collinearity, we present the results via six nested versions of Equation 1. We highlight the key results below.

Model 5 shows that most of the traditional variables from the literature have little effect on radical innovation once we account for firm culture. Model 5 also shows that five of the six measures of firm culture (all except internal markets) have effects that are significantly greater than zero. Based on standardized coefficients and t-statistics, the effects of future market orientation, willingness to cannibalize, and tolerance for risk are particularly strong. While the effects of incentives and product champions are relatively weaker, they are still significantly larger than zero. Other important results that emerge from Table 4 are that citation-weighted patents do not affect radical innovations. On the other hand, firms' R&D activities, measured as the percentage of R&D employees to all employees, have a significant positive effect on radical innovation.

Note that none of the measures of religion have an impact on radical innovation (Model 4 and 5). However, the measures of religion correlate with country culture measured by the Hofstede variables causing multicollinearity between those two sets of variables. To examine if this multicollinearity affects the other results, we drop the religion variables from the full model (see

Model 6) and find that significance levels and standardized coefficients of the other variables remain essentially unchanged.

Thus, for our sample of firms and countries, few of the country level variables are significant drivers of radical innovation. However, two broad drivers of radical innovation emerge as very important: firms' internal culture and their investments in skilled labor.

### Financial Impact of Radical Innovation

An additional objective of this research is to establish the financial value of radical innovation. Table 5 presents results of the impact of radical innovation on financial performance as measured by firms' market-to-book ratio. Model 1 in Table 5 reveals that radical innovation has a significant effect on the market-to-book ratio, even after controlling for industry fixed effects. Further, Model 2 in Table 5 reveals that radical innovation continues to have a significant effect on the market-to-book ratio in the full model, which includes other firm- and country-level variables. This model also indicates that at the firm level, skilled labor measured as R&D employees as a ratio of all employees is a strong predictor of market-to-book ratios, while patents – a commonly used measure of innovation – are not. At the country level, we find that country capital and country population have a significant impact on the market-to-book ratio. In sum, our results suggest that: 1) markets strongly reward radical innovation over and above any returns to patents, R&D, and other control variables; and 2) radical innovation is a more powerful metric of commercial value/performance than patents.

## Conclusions

This study leads to two important conclusions. First, a number of factors do not seem to be as important drivers of radical innovation in firms across nations as many researchers believe. Among these are some frequently emphasized metrics of country level labor, capital, government regulation, and culture. In contrast, internal firm culture is a very important driver of radical

innovation. The reasons we propose for this pattern of results are as follows. The current economic environment is characterized by increasing globalization and the lowering of barriers to mobility of labor and capital. This "flattening" is often accompanied by the rapid adoption of best practice and policy by governments. The rapid progress of India and China presents some evidence of these factors in operation. In such an environment, country level drivers are unlikely to be major discriminators of firms' performance, at least in the 17 countries we sample. Additionally, firm-level and country-level factors have different levels of sensitivity – this is because firm-level factors reflect the unique features of each firm, while country-level factors are common across all firms in the country. Indeed, firm culture is a factor that is unique, intangible, sticky, and very difficult to change. Moreover, success in one generation of technology can breed attitudes of complacency and invulnerability with a focus on managing current products and protecting current profits that brought that success. These cultural traits can blind a firm to radical innovations on the frontier. Thus, maintaining a culture of relentless innovation is tough.

Examples may illustrate the main results we obtain. A traditionally innovative country such as the US can be home to innovative firms such as Apple or FedEx and lumbering ones such as Kodak and Kmart. Innovative firms such as Samsung (Korea) and Infosys (India) in traditionally lagging economies can leapfrog ahead of slumbering giants in traditionally advanced economies. Indeed, the internal culture in some of these innovative firms develops precisely to overcome aspects of their home economies that would otherwise hinder them. Thus, country level factors such as government, culture, labor, and capital are not unimportant. Rather, in the current environment among the 17 economies in our sample, internal culture seems more important than these traditional country drivers in predicting radical innovation in firms across nations.

Second, we find that radical innovations translate into financial value to the firm. The importance of this finding lies in the fact that we measure radical innovations via a survey but

financial value via archival, publicly available data. Thus, the result underscores the validity and importance of our measure of radical innovation: such innovation significantly increases market-to-book value even after controlling for patents, R&D, and other variables. Significantly, patents--a measure of innovation widely used in previous research--are not as important in influencing financial value as are radical innovations in firms.

## Implications

The prior analysis and findings lead to some important implications for managers, researchers, and policy makers. First, our study suggests that firms are special forms of organization that increasingly transcend national boundaries, constraints, and systems. Innovative firms, it would seem, are similar: they share the same cultural practices and attitudes regardless of where they are located. Yet, this culture is tough to observe, measure, and develop. We have provided a diagnostic tool that can assess the relevant dimensions of culture and enable firms to benchmark themselves against others of their size, history, or industry. Thus, managers can be attuned to these cultural factors, measure them, and foster them to maintain a culture of relentless innovation. Such a focus may bear more tangible fruit than one that relies on government to invest in or protect markets. Indeed, the appeal for government relief and intervention by firms may well be a cover for cultural deficiencies in their organizations that they may have hitherto overlooked.

Second, we identify specific attitudes and practices within innovative firms that make them special and foster a culture that helps drive radical innovation. The attitudes include a willingness to cannibalize, future market orientation, and risk tolerance while the practices include empowering product champions and providing incentives for enterprise. Firms like Apple that have such cultural attitudes and practices are distinct and excel at radical innovation (Golder and Tellis 2001). They do not have to count patents and engineers! Indeed, Apple's "best feat may be the culture that helps generate so many folks who've gone on to create great products elsewhere" (BusinessWeek 2005).

Third, our study highlights the usefulness in a cross-national context of an output based measure of radical innovation (i.e., radically new products) over surrogates like patents and country level scientific talent used in the past (Acs and Audretsch 1987; von Hippel 2005). Measuring radical innovation directly allows firms and nations to gauge where they really stand on the ultimate outputs that count, rather than on inputs or intermediate outputs which reflect costs. This measure can enable firms and governments to channel resources toward drivers that matter and to ensure that the entire process of innovation is efficient and productive.

Fourth, patents, a measure often used as a surrogate for radical innovation, turn out not to significantly affect firm capitalization and radical innovation. These results are quite robust and not due to model design or multicollinearity. Firms and policy makers have probably used patents either because they are easily measured, seem to be a pre-condition for innovation, or seem to offer protection to intellectual property. However, many high-tech firms now realize that patents provide only partial protection for their inventions and firms can be highly innovative without patenting. In this context, a senior Vice President of research at a Fortune 50 firm in the US said to us, "We have many technologies and patents sitting on the shelf. Our problem is getting them out to market!" So, firms and countries need to focus primarily on outputs such as radical innovation, rather than primarily on inputs such as patents; or they should at least focus on converting inputs to outputs. This conversion is not obvious as our results and many contemporary examples show. For example, innovative Apple with a little over a hundred patents stole Sony's market for mobile music, while Sony with thousands of patents refrained from cannibalizing its successful Walkman and music businesses.

In sum, our results question some long held premises about radical innovation, suggest a direct measure for the construct, and outline the attitudes and practices within a firm that support innovation. Authors who debate country labor, capital, culture or government policy, may be under-

appreciating the innovative revolution within firms. Policy makers who rely exclusively on the plausible metrics of scientific talent, patents, and IP protection may be missing the real battle taking place. The battle is within. It is a cultural one: between glorifying the past or being paranoid about the future (Grove 1996); between protecting one's successes or cannibalizing them (Chandy and Tellis 1998); between averting risk or embracing it. The battle is for the soul of the firm. Innovative firms are those that clearly understand this battle and adopt decisive practices to win it.

## Limitations and Future Research

Limitations of this study suggest several avenues of research that could be quite productive. First, we do not explore whether radical innovation leads to national wealth in addition to firm value. Current studies of the wealth of nations attribute such wealth either to natural resources, economic capital, talent, or favorable regulation. Future research could ascertain whether innovation is an important driver of national wealth in addition to the above factors.

Second, consumer innovativeness and firm innovation have been topics of extensive research in marketing. To date, research has not attempted to join these two fields of inquiry. Future research could ascertain whether innovativeness of consumers in a country drives or is influenced by the innovation of firms in that country.

Third, we do not study subsidiaries of multinational firms. An interesting extension of this study is to explore whether internal culture is strong enough to hold across various subsidiaries located thousands of miles apart in widely different countries and cultures. This topic is of special importance as firms rush to establish innovation centers in distant locales.

Fourth, our measures of firm culture are from self-reports, as are those in many comparable studies. A major challenge for researchers is to develop and gather hard measures of culture such as the ones we use for patents, R&D expenditures, and financial returns (Rindfleisch et al. 2007). Such measures would obviate the concern that some of our results may be affected by measurement error.

Fifth, recent research (Wong, Rindfleisch, and Burroughs 2003) has shown that mixed-worded scales can cause problems in reliability and factor loading. In this research we use mixed-worded scales to reduce the systematic bias due to the use of a particular response style within a particular country (Baumgartner and Steenkamp 2001). Use of such scales might account for why the Cronbach alphas of our scales are sometimes lower than the more desirable cutoff of .70.

Sixth, we restrict our sample to 17 countries. These results may not hold for countries wracked by political instability or riddled with corruption, nepotism, or war. On the other hand, small, highly innovative countries such as Israel or highly populous countries such as Indonesia and Brazil may hold special lessons that future research can uncover. In particular, research on these countries might shed more light on the ways in which firm and country level factors are likely to interact and intersect in driving innovation.

Seventh, our sample of firms is restricted to publicly listed firms in each country. In countries such as China, where the population of publicly listed firms isn't very large, our sample frame is necessarily small. Generalizations beyond such firms should be made with caution, care, and much further research.

**Table 1: Sample and Responses Rate by Country**

| *Country* | *Sample* | *Responses* | *Resp. Rate (%)* |
|---|---|---|---|
| *Total* | 4074 | 772 | 18.9% |
| Australia | 128 | 35 | 27.3% |
| Canada | 154 | 25 | 16.2% |
| China | 183 | 31 | 16.9% |
| France | 242 | 39 | 16.1% |
| Germany | 315 | 81 | 25.7% |
| Hong Kong | 167 | 15 | 9.0% |
| India | 139 | 28 | 20.1% |
| Italy | 99 | 32 | 32.3% |
| Japan | 409 | 57 | 13.9% |
| Korea | 333 | 87 | 26.1% |
| Netherlands | 62 | 17 | 27.4% |
| Singapore | 176 | 24 | 13.6% |
| Sweden | 113 | 26 | 23.0% |
| Switzerland | 80 | 23 | 28.8% |
| Taiwan | 243 | 83 | 34.2% |
| UK | 383 | 67 | 17.5% |
| USA | 848 | 102 | 12.0% |

## Table 2: Sources and Measures of Constructs

| *Conceptual Variable* | *Measure* | *Data Source* |
|---|---|---|
| **Radical innovation** | • 3-item additive scale with GLOBE correction | • Global Innovation Survey |
| **Firm-level financial performance** | • Market-to-book ratio | • Worldscope, OSIRIS |
| **Labor** | **Country level**<br>• Availability of scientists and engineers<br>• Quality of scientific research institutions<br>• Quality of management schools<br>• Total public expenditure on education as a percentage of GDP<br>• R&D personnel nationwide per capita<br>**Firm level**<br>• R&D employees as a percentage of total employees | • World Economic Forum World Competitiveness Report<br>• IMD World Competitiveness Report<br>• OECD Science and Technology Indicators<br>• Global Innovation Survey |
| **Capital** | **Country level**<br>• Financial market sophistication<br>• Soundness of banks<br>• Ease of access to loans<br>• Venture capital availability<br>• R&D expenditure per capita<br>**Firm level**<br>• Sales revenue<br>• R&D spending as a percentage of sales | • World Economic Forum World Competitiveness Report<br>• OECD Science and Technology Indicators<br>• Global Innovation Survey |
| **Government** | • Intellectual property protection<br>• University/industry research collaboration<br>• Government subsidies and tax credits for firm-level R&D<br>• Government procurement of advanced technology products | • World Economic Forum World Competitiveness Report |
| **Culture** | **Country level**<br>• Religion: % of population belonging to major world religions: Catholic, Protestant, Buddhist, Muslim, Hindu-Sikh, Non-affiliated and Other<br>• Geographic location: Latitude (degrees) of country's capital city | • CIA World Factbook<br>• Parker (2000) and worldatlas.com |

| | | |
|---|---|---|
| | • Values: Hofstede measures of power distance, uncertainty avoidance, individualism, masculinity and long term orientation<br><br>**Firm level**<br>• Willingness to cannibalize<br>• Future market orientation<br>• Risk tolerance<br>• Product champions<br>• Incentives<br>• Internal markets | • Hofstede website<br><br>• Global Innovation Survey |
| **Control variables** | **Country level**<br>• Gross domestic product<br>• Population<br>• Inflation<br>• Country credit rating<br><br>**Firm level**<br>• Citation-weighted patents<br>• Primary industry | • World Economic Forum World Competitiveness Report<br><br>• Delphion<br>• OSIRIS, Worldscope |

## Table 3: Descriptive Statistics

| *Conceptual Variable* | *Level of Analysis* | *Variable* | *Mean* | *Standard Deviation* | *Minimum* | *Maximum* |
|---|---|---|---|---|---|---|
| Radical Innovation | Firm | Radical Product Innovation | 12.39 | 3.87 | 3 | 21 |
| Financial Performance | Firm | Market to Book Ratio | 0.90 | 1.21 | $3 \times 10^{-4}$ | 11.93 |
| Labor | Country | Country Labor | $-2.91 \times 10^{-9}$ | 0.97 | -2.20 | 1.53 |
| | Firm | R&D Employees/All Employees | 3.60 | 1.39 | 0 | 7 |
| Capital | Country | Country Capital | $-6.66 \times 10^{-9}$ | 0.98 | -2.18 | 1.33 |
| | Firm | R&D Spending/ Sales Revenue | 3.27 | 1.16 | 1 | 7 |
| Government | Country | Government | $-2.18 \times 10^{-9}$ | 0.91 | -2.56 | 1.80 |
| Culture | Country | Religion: % Catholic | 19.06 | 25.12 | 0 | 85.5 |
| | | Religion: % Protestant | 17.01 | 23.88 | 0 | 94 |
| | | Religion: % Buddhist | 20.56 | 34.08 | 0 | 93 |
| | | Religion: % Muslim | 2.60 | 3.65 | 0 | 14.9 |
| | | Religion: % Hindu-Sikh | 3.25 | 15.38 | 0 | 82.4 |
| | | Religion: % Non Affiliated | 18.94 | 21.45 | 0 | 95 |
| | | Geographic Location: Distance from Equator | 1926.57 | 585.99 | 56.84 | 3038 |
| | | Values: Power Distance | 49.90 | 14.65 | 31 | 80 |
| | | Values: Individualism | 57.26 | 28.96 | 17 | 91 |
| | | Values: Masculinity | 56.45 | 18.40 | 5 | 95 |
| | | Values: Uncertainty Avoidance | 58.78 | 21.33 | 8 | 92 |
| | | Values: Long-Term Orientation | 47.50 | 31.875 | 0 | 118 |
| | Firm | Attitude: Willingness to Cannibalize | 12.49 | 3.34 | 3 | 21 |
| | | Attitude: Future Market Orientation | 16.40 | 3.95 | 4 | 28 |
| | | Attitude: Risk Tolerance | 15.42 | 4.27 | 4 | 28 |
| | | Practice: Product Champions | 10.40 | 2.26 | 2 | 14 |
| | | Practice: Incentives | 7.64 | 2.73 | 2 | 14 |
| | | Practice: Internal Markets | $3.91 \times 10^{-4}$ | 0.79 | -1.75 | 2.64 |
| Control Variables | Country | Country GDP | 2363.09 | 3308.48 | 90.24 | 10445.63 |
| | | Country Population | 167.23 | 304.36 | 4.2 | 1294.4 |
| | | Inflation | 1.39 | 1.51 | -3 | 4.3 |
| | | Country Credit Rating | 82.60 | 12.29 | 46.7 | 95.3 |
| | Firm | Citation-Weighted Patents | 5.21 | 44.429 | 0 | 1046 |
| | | Firm Size | 1431539 | 5641951 | -111669 | $6.40 \times 10^{7}$ |

## Table 4: Estimates of Independent Variables on Radical Innovation (Equation 1)

| *Conceptual Variable* | *Level of Analysis* | *Independent Variable* | *Model 1: Country Culture Only* | *Model 2: Firm Culture Only* | *Model 3: Firm & Country Culture* | *Model 4: All Alternate Hypotheses* | *Model 5: Full Model* | *Model 6: Model 5 without Religion* |
|---|---|---|---|---|---|---|---|---|
| Labor | Country | Country Labor | | | | -.12 | -.01 | .01 |
| | Firm | R&D Employees/All Employees | | | | .13 [a] | .11 [b] | .11 [b] |
| Capital | Country | Country Capital | | | | -.14 | -.17 | -.10 |
| | Firm | R&D Spending/ Sales Revenue | | | | .10 | .04 | .04 |
| Government | Country | Government | | | | .12 | .08 | .05 |
| Culture | Country | Religion: % Catholic | | | | .11 | .13 | |
| | | Religion: % Protestant | | | | .01 | -.08 | |
| | | Religion: % Buddhist | | | | .26 | .12 | |
| | | Religion: % Muslim | | | | -.11 | -.15 | |
| | | Religion: % Hindu-Sikh | | | | .15 | .16 | |
| | | Religion: % Other | | | | -.02 | -.00 | |
| | | Geographic Location: Distance from Equator | | | | .17 | .13 | .01 |
| | | Values: Power Distance | -.09 | | -.09 | .10 | .04 | -.01 |
| | | Values: Individualism | -.07 | | -.10 | .05 | -.04 | .03 |
| | | Values: Masculinity | .02 | | .01 | -.01 | -.02 | .01 |
| | | Values: Uncertainty Avoidance | -.03 | | .001 | -.28 | -.28 | -.07 |
| | | Values: Long-Term Orientation | -.03 | | .01 | -.15 | -.01 | .05 |
| | Firm | Attitude: Willingness to Cannibalize | | .11 [a] | .11 [a] | | .10 [a] | .10 [a] |
| | | Attitude: Future Market Orientation | | .11 [a] | .10 [a] | | .13 [a] | .12 [a] |
| | | Attitude: Risk Tolerance | | .25 [a] | .27 [a] | | .23 [a] | .24 [a] |
| | | Practice: Product Champions | | .10 [a] | .10 [a] | | .10 [a] | .10 [a] |
| | | Practice: Incentives | | .10 [a] | .10 [a] | | .09 [a] | .10 [a] |
| | | Practice: Internal Markets | | .06 | .06 | | .03 | .04 |
| Control Variables | Country | Country GDP | | | | .04 | .07 | -.03 |
| | | Country Population | | | | -.11 | -.17 | -.08 |
| | Firm | Citation-Weighted Patents | | | | .03 | .02 | .02 |
| | | Firm Size | | | | .06 | .04 | .05 |
| | | $R^2$ overall | 0.05 | 0.25 | 0.26 | 0.13 | 0.29 | 0.29 |
| | | Adjusted $R^2$ | 0.00 | 0.22 | 0.22 | 0.05 | 0.23 | 0.23 |
| | | AIC | 3424.7 | 3243.1 | 3247.6 | 3398.5 | 3247.5 | 3245.4 |

**Note: [a] $p < 0.01$, [b] $p < 0.05$**

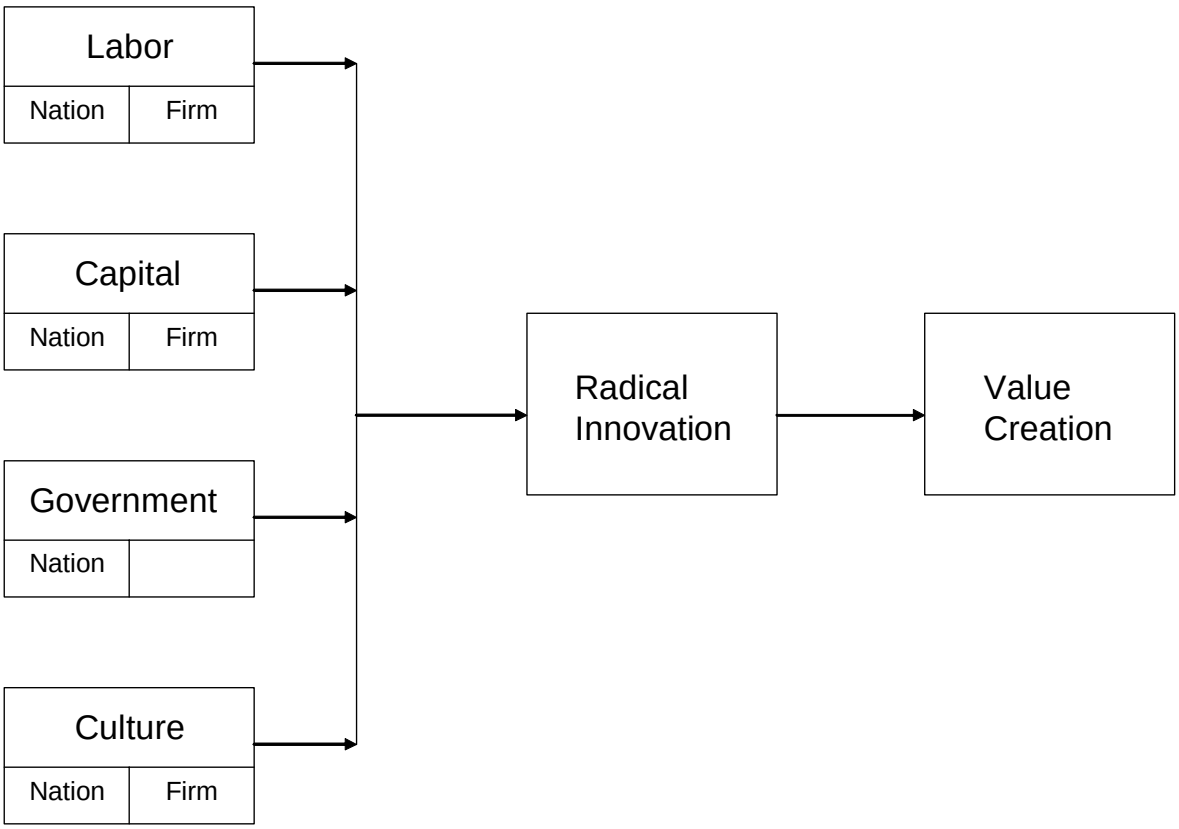
All survey measures are corrected for mid-point and extreme response bias. All coefficients are standardized values.

## Table 5: Estimates of Radical Innovation on Market-to-Book Ratio (Equation 2)

| ***Conceptual Variable*** | ***Level of Analysis*** | ***Variable*** | ***Model 1: Radical Innovation Only*** | ***Model 2: Full Model*** |
|---|---|---|---|---|
| Radical Innovation | Firm | Radical Product Innovation | .10 [a] | .06[b] |
| Labor | Country | Country Labor Factor | | .001 |
| | Firm | R&D Employees/All Employees | | .14 [a] |
| Capital | Country | Country Capital Factor | | .23 [a] |
| | Firm | R&D Spending/ Sales Revenue | | .05 |
| Government | Country | Government Factor | | .07 |
| Control Variables | Country | Country GDP | | .07 |
| | | Country Population | | .27 [a] |
| | | Inflation | | -.06 |
| | | Country Credit Rating | | .03 |
| | Firm | Citation-Weighted Patents | | .03 |
| | | Firm Size | | -.03 |
| | | $R^2$ overall | 0.15 | 0.27 |
| | | Adjusted $R^2$ | 0. | 0.21 |
| | | AIC | 2066.8 | 1989.9 |

**Note: [a]p < 0.01, [b]p < 0.05**
All survey measures are corrected for mid-point and extreme response bias. All coefficients are standardized values.

**FIGURE 1: Framework of the Drivers of Radical Innovation and Value Creation**



# References


Acs, Zoltan and David Audretsch (1987), "Innovation, Market Structure, and Firm Size," *The Review of Economics and Statistics,* 69 (4), 678-690.

Aiken, Michael, and Jerald Hage (1968), "Organizational Interdependence and Intra-Organizational Structure," *American Sociological Review*, 33(6), 912-930

Anderson, J.C. and D.W. Gerbing (1988), "Structural Equation Modeling in Practice: A Review and Recommended Two-step Approach," *Psychological Bulletin*, 103, 411-423.

Archibugi, Daniele and Alberto Coco (2005), "Measuring Technological Capabilities at the Country Level: A Survey and a Menu for Choice," *Research Policy*, 34 (2), 175-194.

Atuahene-Gima, Kwaku (2005), "Resolving the Capability—Rigidity Paradox in New Product Innovation," *Journal of Marketing*, 69 (4), 61-83.

Baim, J. (1991), "Response Rates: A Multinational Perspective," *Marketing and Research Today,* 19, 114-119.

Baltagi, Badi H. (2005), *Econometric Analysis of Panel Data,* John Wiley & Sons.

Barber, Brad and John Lyon (1997), "Firm Size, Book-to-Market Ratio, and Security Returns: A Holdout Sample of Financial Firms," *Journal of Finance*, 52 (2), 875-83.

Baron, Reuben. M., and David A, Kenny (1986), "The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic and Statistical Considerations," *Journal of Personality and Social Psychology*, 51, 1173-1182

Bartlett, Christopher and S. Ghoshal (1995), *Transnational Management*, Boston, MA: Irwin.

Bartholomew, S. (1997), "National Systems of Biotechnology Innovation: Complex Interdependence in the Global System," *Journal of International Business Studies*, 28(2), 241-266

Baumgartner, Hans and Jan-Benedict E.M. Steenkamp (2001), "Response Styles in Marketing Research: A Cross-National Investigation," *Journal of Marketing Research*, 38(2), 143-157.

Baumgartner, Hans and Jan-Benedict E. M. Steenkamp (2006), "Response Biases in Marketing Research," *Handbook of Marketing Research,* ed. Rajiv Grover, forthcoming.

Bourgeois, L. J., III (1979), "Toward a Method of Middle-Range Theorizing," *Academy of Management Review*, 4(3), 443-447.

Branstetter, Lee and Yoshiaki Nakamura (2003), "Is Japan's Innovative Capacity in Decline?" National Bureau of Economic Research Working Paper 9438, Cambridge MA: NBER.

*Business Week* (2005), "Apple's Other Legacy: Top Designers," *BusinessWeek Online,* September 6, 2005, www.businessweek.com/technology/content/sep2005/tc2005096_1655_tc210.htm.

Byrne, B., R.J. Shavelson, and B. Muthen (1989), "Testing for the Equivalence of Factor Covariance and Mean Structures: The Issue of Partial Measurement Invariance," *Psychological Bulletin*, 105 (May), 456- 466.

Chandrasekaran, Deepa and Gerard J. Tellis (2008), "The Global Takeoff of New Products: Culture, Wealth, or Vanishing Differences" forthcoming *Marketing Science.*

Chandrasekaran, Deepa and Gerard J Tellis (2007), "Diffusion of New Products: A Critical Review of Models, Drivers, and Findings, *Review of Marketing*, 39-80.

Chandy, R., and G. Tellis (1998), "Organizing for Radical Product Innovation: The Overlooked Role of Willingness to Cannibalize," *Journal of Marketing Research*, 35(4), 474-88.

---- and ---- (2000), "The Incumbent's Curse? Incumbency, Size and Radical Product Innovation," *Journal of Marketing*, 64 (July), 1-17.

Chandy, Rajesh, Brigitte Hopstaken, Om Narasimhan and Jaideep Prabhu (2006), "From Invention to Innovation: Conversion Ability in Product Development," *Journal of Marketing Research*, 43(3), 494-508

Christensen, Clayton and Joseph L. Bowen (1996), "Consumer Power, Strategic Investment, and the Failure of Leading Firms," *Strategic Management Journal,* 17(3), 197-218.
Committee on Science, Engineering, and Public Policy (2005), *Energizing and Employing America for a Brighter Economic Future*, Washington, DC: National Academies Press.
Damanpour, Fariborz (1991), "Organizational Innovations: A Meta-Analysis of Effects of Determinants and Moderators," *Academy of Management Journal*, 34 (3), 555-91.
Daniels, P. (1993), "Research & Development, Human Capital and Trade Performance in Technology-Intensive Manufactures: A Cross-country Analysis," *Research Policy*, 22 (3), 207-41.
DeLong, J. Bradford (1988), "Productivity Growth, Convergence, and Welfare: Comment," *American Economic Review,* 78 (5), 1138-1154.
De Luca, Luigi M. and Kwaku Atuahene-Gima (2007), "Market Knowledge Dimensions and Cross-Functional Collaboration: Examining the Different Routes to Product Innovation Performance," *Journal of Marketing*, 71(1), 95-112.
Demirgüç-Kunt, Asli and R. Levine (2001), *Financial Structure and Economic Growth: A Cross-Country Comparison of Banks, Markets, and Development*, Cambridge, MA: MIT Press.
Denison, D.R. (1996), "What *Is* The Difference Between Organizational Culture And Organizational Climate? A Native's Point of View on a Decade of Paradigm Wars," *Academy of Management Review*, 21(3), 1-36.
Deshpande, R. and F. E. Webster, Jr. (1989), "Organizational Culture and Marketing: Defining the Research Agenda," *Journal of Marketing*, 53(1), 3–15.
Detert, J, R. Schroeder and J. Mauriel (2000), "A Framework for Linking Culture and Improvement Initiatives in Organizations," *Academy of Management Review*, 25(4), 850-863.
Dutta, Shantanu, Om Narasimhan, and Surendra Rajiv, (1999), "Success in High-Technology Markets: Is Marketing Capability Critical?" *Marketing Science* 18(4), 547–568.
Dwyer, S., H. Mesak, and M. Hsu (2005), "An Exploratory Examination of the Influence of National Culture on Cross-National Product Diffusion," *Journal of International Marketing*, 13(2), 1-27.
Economist (2004a), "Innovative India," April 1, 371(8369), 65-67.
---- (2004b), "Plasma Power," May 20, 371(8376), 57-58.
Edquist, Charles (2005), "Systems of Innovation: Perspectives and Challenges," *The Oxford Handbook of Innovation*, Fagerberg, J., Mowery, D.C., Nelson, R.R. (eds.), Oxford University Press.
Etzkowitz, Henry and Loet Leydesdorff (2000), "The Dynamics of Innovation: From National Systems and "Mode 2" to a Triple Helix of University-Industry-Government Relations," *Research Policy*, 29 (2), 109-23
Eurostat (1997), *The First Community Innovation Survey*, Eurostat: Luxemburg.
---- (2000), *Second Community Innovation Survey*, Eurostat: Luxemburg.
Faber, Jan and A. Hesen (2004), "Innovation Capabilities of European Nations: Cross-National Analyses of Patents and Sales of Product Innovations," *Research Policy*, 33, 193–207.
Fagerberg, Jan, David C. Mowery and Richard Nelson (2005), *The Oxford Handbook of Innovation,* Oxford, UK: The Oxford University Press.
Fama, Eugene, and Kenneth French (1992), "The Cross-Section of Expected Stock Returns," *Journal of Finance*, 47 (2), 427-65.
---- and --- (1995), "Size and Book-to-Market Factors in Earnings and Returns," *Journal of Finance*, 50 (1) 131-55.
Fiegenbaum, Avi, and Howard Thomas (1988), "Attitudes toward Risk and the Risk-Return

Paradox: Prospect Theory Explanations," *Academy of Management Journal*, 31(1), 85-106
Freeman, Christopher (1992), "Formal Scientific and Technical Institutions in the National System of Innovation," in *National Systems of Innovation*, (ed. Bengt-Ake Lundvall), London: Pinter Publishers, 169-187.
Furman, J. L., Porter, M.E. and S. Stern (2002), "The Determinants of National Innovative Capacity," *Research Policy*, 31, 899–933.
Gerbing, D.W. and J.C. Anderson (1988), "An Updated Paradigm for Scale Development Incorporating Unidimensionality and its Assessment," *Journal of Marketing Research*, 25 (May), 186-192.
Gilman, John J., (20050, "Risk was his friend: Edison's legacy to innovation leaders." *Research Technology Management*, 38(4), 8-10
Godin, Benoit (2002), "The Rise of Innovation Surveys: Measuring a Fuzzy Concept," Working Paper, The Center for Innovation Studies, Edmonton, Canada.
---- (2003), "The Emergence of Science and Technology Indicators: Why Did Governments Supplement Statistics with Indicators?" *Research Policy*, 32, 679-691.
Gompers, Paul, and Josh Lerner (2001), *The Money of Invention*, Cambridge, MA: Harvard.
Gong, Guan, and Wolfgang Keller (2003), "Convergence and Polarization in Global Income Levels: A Review of Recent Results on the Role of International Technology Diffusion," *Research Policy*, 32: 1055-1079.
Goolsbee, Austan (1998), "Does Government R&D Policy Mainly Benefit Scientists and Engineers?" *American Economic Review*, 88(2), 298-302
Gorski, Phillip (2003), *The Disciplinary Revolution: Calvinism and the Rise of the State in Modern Europe*, Chicago: University of Chicago Press.
Govindarajan, V. and P. Kopalle (2004), "How Legacy Firms Can Introduce Radical and Disruptive Innovations: Theoretical and Empirical Analyses," working paper, Dartmouth College.
Gregory, Kathleen (1983), "Native-View Paradigms: Multiple Cultures and Culture Conflicts in Organizations," *Administrative Science Quarterly*, 28(September), 369-278.
Griliches, Zvi. (1990), "Patent Statistics as Economic Indicators," *Journal of Economic Literature*, 28, 1661-1707.
---- (1984), *R&D, Patents, and Productivity*, Chicago: University of Chicago Press.
Grove, Andy (1996), *Only the Paranoid Survive,* New York: NY: Random House.
Gutterman, Alan S. and Bentley J. Anderson (1997), *Intellectual Property in Global Markets*, Cambridge, Massachusetts: Kluwer Academic Publishers.
Halal, William E., Ali Geranmayeh, and John Pourdehnad (1993), *Internal Markets: Bringing the Power of Free Enterprise Inside Your Organization*. New York: Wiley.
Hall, Bronwyn (1993), "R&D Tax Policy during the 1980s: Success or Failure?" In *Tax Policy and the Economy*, Jim Poterba ed., pp. 1-35. MIT Press: Cambridge.
Hall, Bronwyn H., and John Van Reenen (2000), "How Effective Are Fiscal Incentives for R&D? A New Review of the Evidence," *Research Policy*, 29: 449-469.
Harkness, J. A., F. J. R. Van de Vijver, and P. Mohler (2003), *Cross-Cultural Survey Methods*, Hoboken, NJ: Wiley.
Hatch, Mary Jo (1993), "The Dynamics of Organizational Culture," *Academy of Management Review*, 18(4), 657-697.
Hauser, John, Gerard Tellis and Abbie Griffin (2007), "Research on Innovation and New Products: A Review and Agenda for Marketing Science," *Marketing Science,* 25(6), 687-717.
Hofstede, Geert (1980), Culture's Consequences, International Differences in Work-Related Values (Cross Cultural Research and Methodology, Newbury Park, CA: Sage.

---- (2003), Culture's Consequences, Comparing Values, Behaviors, Institutions, and Organizations Across Nations, Newbury Park, CA: Sage Publications.
Hofstede, Frenkel Ter, Jan-Benedict E.M. Steenkamp, and Michel Wedel, (1999), "International Market Segmentation Based on Consumer-Product Relations," *Journal of Marketing Research*, 36(1), 1-17.
Homburg, Christian and Christian Pflesser (2000), "A Multiple-Layer Model of Market-Oriented Organizational Culture: Measurement Issues and Performance Outcomes," *Journal of Marketing Research*, 37, 449–462.
Horn, John L., Jack McArdle, and Ralph Mason (1983) "When is Invariance not Invariant: A Practical Scientist's Look at the Ethereal Concept of Factor Invariance," *The Southern Psychologist,* 1 (Summer-Fall), 179-188.
House, Robert, P. Hanges, M. Javidan, P. Dorfman and V. Gupta (2004), *Culture, Leadership and Organizations: The GLOBE Study of 62 Societies*, Sage Publications, Thousand Oaks CA.
Howell, Jane M. And Christopher A. Higgins (1990), "Champions of Technological Innovation," *Administrative Science Quarterly*, 35, 317-341.
Huang, Haizhou and Chenggang Xu (1999), "Financial Institutions and the Financial Crisis in East Asia," *European Economic Review*, 43: 903-14.
Hussler, Caroline (2004) "Culture and Knowledge Spillovers in Europe: New Perspectives for Innovation and Convergence Policies?" *Economics of Innovation and New Technology*, 13 (6), 523–541.
Im, Subin, Cheryl Nakata, Heungsoo Park, and Young-Won Ha (2003), "Determinants of Korean and Japanese New Product Performance: An Interrelational and Process View," *Journal of International Marketing*, 11(4), 81-112.
Jaffe, Adam B., M. Trajtenberg and R. Henderson (1993), "Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations," *Quarterly Journal of Economics*, 108(3), 577-98.
Jaffe, Adam, M. Trajtenberg, and M. Fogarty (2000), "Knowledge Spillovers and Patent Citations: Evidence from a Survey of Inventors," *American Economic Review*, 90(2), 215-218.
Jassawalla, Avan R. and Hemant C. Sashittal (2002), "Cultures that Support Product-Innovation Processes," *Academy of Management Executive*, 16(3), 42–54.
Jones, Renae A., Nerina L. Jimmieson, and Andrew Griffiths (2005), "The Impact of Organizational Culture and Reshaping Capabilities on Change Implementation Success: The Mediating Role of Readiness for Change," *Journal of Management Studies*, 42(2), 361-386.
Kirca, Ahmet, Satish Jayachandran and William Bearden (2005), "Market Orientation: A Meta-Analytic Review and Assessment of Its Antecedents and Impact on Performance," *Journal of Marketing*, 69(2), 24-41.
Kortum, Samuel S. (2004), "An R&D Roundtable," *Economics of Innovation and New Technology*, 13(4), 349-363.
Kortum, Samuel and Josh, Lerner (2000), "Assessing the Contribution of Venture Capital to Innovation," *RAND Journal of Economics*, 31(4), 647-692.
Krugman, P., R.N. Cooper, and T.N. Srinivasan (1995), "Growing World Trade: Causes and Consequences," *Brookings Papers on Economic Activity*, 25th Anniversary Issue, 327–77.
Kuczmarski, Thomas D. (1996), "What is Innovation? The Art of Welcoming Risk," *Journal of Consumer Marketing*, 13(5), 7-11
Kumar, Subodh and R. Robert Russell (2002), "Technological Change, Technological Catch-up, and Capital Deepening: Relative contributions to Growth and Convergence," *American Economic Review*, 92(3), 527-548

Land, K. C. (1973), "Identification, Parameter Estimation, and Hypothesis Testing in Recursive Sociological Models," in *Structural Equation Models in the Social Sciences*, A. S. Goldberger & O. D. Duncan, eds., New York, NY: Seminar Press, 39-49.
Landes, David (1999) *The Wealth and Poverty of Nations: Why Some Are So Rich and Some So Poor*, New York: W.W. Norton.
Lemola, Tarmo (2002), "Convergence of National Science and Technology Policies: The Case of Finland," *Research Policy*, 31, 1481-1490.
Levine, Ross and Sara Zervos (1998), "Capital Control Liberalization and Stock Market Development," *World Development*, 26(7), 1169-1183
Makri, Marianna, Peter J. Lane, and Lusi R. Gomez-Mejia (2006), "CEO Incentives, Innovation, and Performance in Technology-Intensive Firms: A Reconciliation of Outcome and Behavior-based Incentive Schemes," *Strategic Management Journal*, 27(11), 1057-1080
Mannie Manhong Liu, Jiang An Zhang, Bo Hu (2006), "Domestic VCs Versus Foreign VCs: a Close Look at the Chinese Venture Capital Industry," *International Journal of Technology Management*, 34(1-2), 161-184
Mansfield, Edwin (1984), "Comment on Using Linked Patent and R&D Data to Measure Interindustry Technology Flows," In Zvi Griliches, ed., *R&D, Patent, and Productivity*, Chicago: University of Chicago Press, 462-464.
Markham, Stephen K., and Griffin, Abbie (1998), "The Breakfast of Champions: Associations Between Champions and Product Development Environments, Practices and Performance," *Journal of Product Innovation Management*, 15(5), 436-454.
Martin, Joanne (2002), *Organizational Culture: Mapping the Terrain*, Thousand Oaks, CA: Sage.
Measuring Innovation in the 21st Century Economy Advisory Committee (2007), Meeting Transcript, www.innovationmetrics.gov.
Miles, R.E. and Snow, C.C. (1978), *Organizational Strategy, Structure, and Process*, New York: McGraw Hill.
Mitra, Debanjan and P. Golder (2002), "Whose Culture Matters? Near-Market Knowledge and Its Impact on Foreign Market Entry Timing," *Journal of Marketing Research*, 39 (3), 350-366.
Mols, Niels Peter (2001), "Organizing for the Effective Introduction of New Distribution Channels in Retail Banking," *European Journal of Marketing*, 35 (5/6), 661-86.
Mowery, David C. and Nathan Rosenberg (1993), "The US National Innovation System," in Richard Nelson (ed.), *National Innovation Systems: A Comparative Analysis*, New York, NY: Oxford University Press.
Mowery, David C. and Bhaven N. Sampat (2004), "Universities in National Innovation Systems", in J. Fagerberg, D.C. Mowery and R.N. Nelson (eds.), *The Oxford Handbook of Innovation*, Oxford: Oxford University Press.
Murtha, T., S. Lenway, and J. Hart (2001), *Managing New Industry Creation: Global Knowledge Formation and Entrepreneurship in High Technology*, Palo Alto: Stanford University Press.
Naim, Moises (2007), "The Free-Trade Paradox," *Foreign Policy*, 162 (Sept/Oct), 95-96.
Narver, John C. and Stanley Slater (1990), "The Effect of Market Orientation on Business Profitability," *Journal of Marketing*, 5, 20–35.
Nelson, Richard R. (1993), *National Innovation Systems: A Comparative Analysis,* Oxford University Press, Oxford, UK.
Nijssen, E., B. Hillebrand and P.A.M. Vermeulen (2005), "Unraveling Willingness to Cannibalize: A Closer Look at the Barrier to Radical Innovation," *Technovation*, forthcoming.
Nolan, P. (2001), *China and the Global Business Revolution*, Houndsmill: Palgrave.
North, Douglass C. and Robert P. Thomas (1973), *The Rise of the Western World: A New Economic*

*History,* Cambridge: Cambridge University Press.
OECD (2005), *The Measurement of Scientific And Technological Activities: Proposed Guidelines For Collecting And Interpreting Innovation Data*, Oslo, Norway: OECD.
Olson, Eric M., Orville C., Walker, Jr., Robert W. Ruekert, (1995), "Organizing for Effective New Product Development: The Moderating Role of Product Innovativeness," *Journal of Marketing*, 59(1), 48-62
Parker, Philip (2000), *Physioeconomics*, Cambridge, MA: MIT Press.
Podsakoff, Philip M., Scott B. MacKenzie, Jeong-Yeon Lee and Nathan P. Podsakoff (2003), "Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies," *Journal of Applied Psychology*, 88 (5), 879-903.
Porter, M.E. and S. Stern (1999), *The New Challenge to America's Prosperity: Findings from the Innovation Index*, Council on Competitiveness, Washington, DC.
Prahalad, C. K. and Yves L. Doz (1987), *The Multinational Mission,* New York, NY: Free Press.
Quinn, Dennis, and P. Rivoli (1991), "The Effects of American- and Japanese-Style Employment and Compensation Practices on Innovation," *Organization Science*, 2(4), 323-341
Rindfleisch, Aric, Alan Malter, Shankar Ganesan, and Christine Moorman (2007), "Cross-Sectional Versus Longitudinal Survey Research: Concepts, Findings, Guidelines," ISBM Working Paper 2-2007, Penn State University.
Rokeach, Milton (1973), *The Nature of Human Values*, New York: The Free Press.
Rosenberg, Nathan, and L. E. Birdzell, Jr. (1986), *How the West Grew Rich: The Economic Transformation of the Industrial World*, New York: Basic Books.
Rust, Roland T. (2006), "From the Editor: The Maturity of Marketing as an Academic Discipline," *Journal of Marketing*, 70(3), 1-2,
Schein, Edgar (1999). *The Corporate Culture Survival guide: Sense and Nonsense about Culture Change*. San Francisco: Jossey-Bass Publishers.
Schultz, Majken, and Mary Jo Hatch (1996), "Living With Multiple Paradigms: The Case of Paradigm Interplay In Organizational Culture Studies," *Academy of Management Review*, 21 (2), 529-557.
Shane, Scott (1994), "Uncertainty Avoidance and the Preference for Innovation Championing Roles, *Journal of International Business Studies*, 26(1), 47-68.
Smircich, L. (1983), "Concepts of Culture and Organizational Analysis," *Administrative Science Quarterly*, 28(3), 339-358.
Srinivasan, Raji, Gary L Lilien, and Arvind Rangaswamy (2002), "Technological Opportunism and Radical Technology Adoption: An Application to E-Business," *Journal of Marketing*, 66 (3), 47-60.
Song, X. Michael and Mark E. Parry (1997), "A Cross-National Comparative Study of New Product Development Processes: Japan and the United States," *Journal of Marketing,* 61(2), 1-18.
Sood, Ashish and Gerard J. Tellis (2005), "Technological Evolution and Radical Innovation," *Journal of Marketing*, 69(3),152-168.
Sorescu, Alina, R. Chandy, and J. Prabhu (2003), "Sources and Financial Consequences of Radical Innovation: Insights from Pharmaceuticals," *Journal of Marketing*, 67 (4), 82-101.
----, ----, and --- (2007), "Why Some Acquisitions do Better than Others: Product Capital as a Driver of Long-Term Stock Return," *Journal of Marketing Research*, 44(1), 57-72.
Steenkamp, J.-B.E.M. and H.C.M. van Trijp (1991), "The Use of LISREL in Validating Marketing Constructs," *International Journal of Research in Marketing*, 8, 283-299.
Tellis, Gerard J. and Peter Golder (2001), *Will and Vision: How Latecomers Grow to Dominate Markets*, New York: McGraw-Hill.

Tellis, Gerard J., Stefan Stremersch and Eden Yin (2003), "The International Takeoff of New Products: Economics, Culture and Country Innovativeness," *Marketing Science,* 22, 2 (Spring), 161-187.

Therrien, Pierre and Pierre Mohnen (2003), "How Innovative Are Canadian Firms Compared to Some European Firms? A Comparative Look at Innovation Surveys," *Technovation*, 23, 359-369.

Triandis, Harry C. (1996), "The Psychological Measurement of Cultural Syndromes," *American Psychologist*, 51(4), 407-506.

---------- (1994), "Cross-Cultural Industrial and Organizational Psychology," in H. C. Triandis, M. D. Dunnette and L. M. Hough (Eds.), *Handbook of Industrial and Organizational Psychology*, 2nd ed., Palo Alto, CA: Consulting Psychologists Press.

Utterback, J. (1994), *Mastering the Dynamics of Innovation*, Cambridge, MA: HBS Press.

von Hippel, Eric (2005), *Democratizing Innovation*, Cambridge, MA: MIT Press.

Weber, Max (1930), *The Protestant Ethic and the Spirit of Capitalism*, Translated by Talcott Parsons, New York: Charles Scribner's Sons.

Webster, Andrew and Kathryn Packer (1996), *Innovation and the Intellectual Property System*, Cambridge, Massachusetts: Kluwer Law International.

Wong, Nancy, Aric Rindfleisch and James E. Burroughs (2003), "Do Reverse-Worded Items Confound Measures in Cross-Cultural Consumer Research? The Case of the Material Values Scale," *Journal of Consumer Research*, 30 (1), 72-91.

Wright, Mike, Sarika Pruthi and Andy Lockett (2005), "International Venture Capital Research: From Cross-Country Comparisons to Crossing Countries," CMBOR Occasional Paper.

Yadav, M., Jaideep C. Prabhu, Rajesh K. Chandy (2007), "Managing the Future: CEO Attention and Innovation Outcomes," *Journal of Marketing*, 71(4), 84-101

Zenger, Todd R. and Sergio Lazzarini (2004), "Compensating for Innovation: Do Small Firms Offer High-powered Incentives that Lure Talent and Motivate Effort?" *Managerial & Decision Economics*, 25 (6/7), 329-345.

Zhou, Kevin Zheng, Chi Kin (Bennett) Yim, and David K. Tse (2005), "The Effects of Strategic Orientations on Technology- and Market-Based Breakthrough Innovations," *Journal of Marketing*, 69(2), 42-60.

Zucker, Lynne G., Michael R. Darby, and Jeff S. Armstrong (2002), "Commercializing Knowledge: University Science, Knowledge Capture, and Firm Performance in Biotechnology," *Management Science* 48 (1), 138–53.

## Appendix 1: Key Measures in Survey

Items marked with an * are reverse coded. All items are 7-point Likert-type "Strongly Disagree"-"Strongly Agree" unless indicated otherwise.

| | Std. Factor Loadings | t-value | CR |
|---|---|---|---|
| **Radical Product Innovation** | | | |
| Primary measure: | | | .73 |
| 1. Our firm rarely introduces products that are radically different from existing products in the industry* | .70 | | |
| 2. Our firm lags behind others in introducing products based on radically new technologies* | .74 | 12.94 | |
| 3. We have no difficulty in introducing products that are radically different from existing products in the industry | .37 | 8.37 | |
| Alternate measure: | | | |
| % of total sales revenue from **radical product innovations** introduced by our firm in the last 3 years (2001-2003) (1=0%, 2=0-1%, 3=1-5%, 4=5-10%, 5=10-20%, 6=20-30%, 7=Over 30%) | | | |
| **Willingness to Cannibalize** | | | .65 |
| 1. We are very willing to sacrifice sales of our existing products to improve sales of our new products | .71 | | |
| 2. We tend to oppose new projects that could take away from sales of our existing products* | .32 | 8.17 | |
| 3. We will not aggressively pursue a new technology that causes existing investments to lose value* | .56 | 8.13 | |
| **Future Market Focus** | | | .66 |
| 1. Our firm gives more emphasis to customers of the future relative to current customers | .38 | 7.13 | |
| 2. Market research efforts in our firm are aimed at obtaining information about customers' needs in the future, relative to their current needs | .50 | 8.49 | |
| 3. We are slow to detect fundamental shifts in our industry (e.g. competition, technology, regulation)* | .52 | 9.01 | |
| 4. Our firm is oriented more toward the future than the present | .57 | | |
| **Risk Tolerance** | | | .72 |
| 1. Managers in our firm rarely take risky decisions* | .71 | 11.29 | |
| 2. Relative to other firms, we tend to favor higher-risk, higher-return investments | .57 | 10.47 | |
| 3. We are reluctant to engage in untested business ventures* | .54 | | |
| 1. We believe it is often necessary to take calculated risks | .44 | 8.82 | |
| **Product Champions** | | | .56 |
| 1. Employees with new product ideas receive no support in our firm* | .70 | 6.77 | |
| 2. Top managers in our firm strongly support champions of ideas for new products | .39 | | |
| **Incentives for Enterprise** | | | .77 |
| 1. We provide generous monetary rewards to innovative employees | .66 | 9.25 | |
| 2. We provide many non-monetary rewards (e.g., recognition, autonomy etc.) to innovative employees | .82 | | |
| **Autonomy** | | | .74 |
| 1. All new product and process decisions in our firm require the approval of the corporate office* | .88 | 9.23 | |
| 2. Few strategic actions can be taken in divisions in our firm until the corporate office approves these actions* | .72 | | |
| **Internal Competition** | | | .68 |
| 1. Divisions in our firm frequently enter markets served by other divisions | .64 | 6.54 | |
| 2. Divisions in our firm actively compete with each other to gain new markets | .84 | | |

## Appendix 2: Tests of Robustness

In this section, we present the results of several tests to examine the validity and robustness of our results.

*1. Are our results driven by common method bias?* Common method bias is irrelevant when testing Equation 2, since the dependent variable in this equation (market-to-book ratio) uses data from a set of secondary sources that are entirely independent of the sources of data for virtually all the independent variables in this equation (see Podsakoff et al. 2003). Indeed, the results for this equation help validate our survey-based measures, since they demonstrate that our survey-based measure of radical innovation is a powerful predictor of financial outcomes measured in a future period by independent sources.

To check if common method poses problems in Equation 1, we conduct two additional analyses. First, we employ Harmon's one-factor test for common method bias. Specifically, we perform a confirmatory factor analysis (see Podsakoff et al. 2003) in which we link all items in our firm culture (independent) variables as well as our radical innovation (dependent) variable to a single latent factor. The results of this analysis strongly reject the single-factor hypothesis, thus alleviating some concerns about common-method bias.

Second, to further alleviate concerns regarding common methods in Equation 1, we examine the correlations between two nomologically related constructs—radical innovation and patents. In our survey, we ask respondents to report on both radical innovation in their firm as well the number of US patents granted to their firm in the previous year (2003). If common methods bias is pervasive in our data (say due to social desirability), firms would respond similarly on both radical innovation and patents. We find that this is not the case. None of the items that make up our measure of radical innovation correlate with our measure of patents granted. Moreover, the information from the survey-based measure of patents matches closely with that from Delphion, an independent (secondary) source of patent data. All of these analyses indicate that our results are not driven by common-method bias.

*2. Do the results change if country factors are modeled as fixed effects?* An alternate approach to the theory-based approach that we use to model country-level factors is to simply use country-specific dummy variables to account for the unobserved heterogeneity that is due to each country in our sample (see Baltagi 2005). Results from such an analysis (available from the authors upon request) indicate that the effects of firm culture are generally consistent with those in the results presented earlier.

*3. Does firm culture mediate the effect of country culture on radical innovation?* A key question is whether country culture affects firm culture or whether the latter mediates the effect of the former on radical innovation (cf. Kirca, Jayachandran, and Bearden 2005). To address these questions, we carry out a formal test of mediation. Baron and Kenny (1986) list three conditions that have to hold for mediation to exist. We test for the existence of each of these conditions in our data and find that none are satisfied. As such, the effects of country culture on innovation are not mediated by internal (firm) culture.

Specifically, Condition 1 states that the exogenous variables and the proposed mediator must each be significantly related to the dependent variable, when considered separately. In our case this condition requires that the country and firm culture variables should, taken separately, each have a significant impact on innovation. We find that this condition does not hold true. The coefficients of firm culture (in the regression which does not include country culture) are significant (see Model 2 in Table 4). However, the coefficients of the country culture variables (in the regression which does not include firm culture) are not significantly different from zero (see Model 1 in Table 4).

Similarly, Condition 2 states that the exogenous variables should be significantly related to the proposed mediator. In our case this would suggest that the country culture variables should have a significant impact on firm culture. This condition, which is crucial for mediation, does not hold. The results of a regression of firm culture on the country culture variables indicate that none of the country culture variables has a significant impact on firm culture.

Finally, Condition 3 states that the relation between the exogenous variables and the dependent variable should be weaker (for partial mediation) or non-significant (for full mediation) when the proposed mediator is included in the model, relative to when the mediator is not in the model. In our case this condition requires that the coefficients of the country culture variables on innovation should be significantly smaller when firm culture is included in the model, relative to when it is not in the model. This condition for mediation also does not hold. The coefficients of the country culture variables in the regression which does not include firm culture are identical to those in the regression which does include firm culture (both sets of coefficients are not significantly different from zero).

Thus not only does firm culture not mediate the effect of country culture on radical innovation but its effect does not arise from country culture. In our sample of publicly held firms in 17 leading economies, the latter does not affect radical innovation at all.

*4. Do firm and country factors interact to drive radical innovation?* Some authors have suggested that firm and country level factors may interact to drive innovation (see Bartholomew 1997; Murtha, Lenway, and Hart 2001; Nelson 1993). To test for this possibility, we ran a number of models that included first-order interactions between the key firm and country level factors in our model in addition to including all the main effects about which we theorize. We find that most of the interaction coefficients are not significantly different from zero; moreover, the pattern of results is not consistent with any systematic effects that would be predicted by the literature. Given these results, we conclude that further study of the interaction between country and firm-level drivers of innovation would be a promising avenue for theoretical and empirical work.

*5. Do the effects of firm culture vary by country?* To examine this question, we first run random coefficient regression models (Raudenbush and Bryk 2003) that allow the coefficients of each firm culture variable to vary across countries. We find that the full model, in which all firm culture coefficients vary by country, does not converge. We then run separate random coefficient regressions, such that a single firm culture coefficient varies randomly across countries in each regression equation. In each of these equations, we find that none of the firm culture coefficients vary significantly across countries. We also run a random-intercept regression, whereby random variations from the intercept reflect country-level unobserved heterogeneity. We find that the intercept for the radical innovation equation does not vary significantly across countries, and that all

effects of the firm culture variables remain substantively similar to those reported earlier. Finally, a model which incorporates heterogeneity via latent class analysis also yields similar results. All these analyses indicate consistency, across the countries in our sample, in the effects of firm culture on radical innovation.

*6. Do our survey measures have cross-cultural equivalence?* Our survey measures rely on respondents interpreting key constructs such as radical innovation in a consistent manner across countries. To ensure this, we take several steps (see Harkness, van de Vijver, and Mohler 2003): 1) translation and back translation to ensure consistency in the meaning of constructs and items across different languages, 2) a clear definition of radical innovation while anchoring it in two universal examples (the compact disc player relative to cassette tapes and record players, and the microwave oven relative to conventional ovens), and 3) in-depth, face-to-face interviews with managers from different cultural contexts (Germany, UK, Korea, India, Japan and China).

In addition, we test our data for metric equivalence across countries. Since testing for metric invariance in 8 constructs across 17 countries would require a far larger sample size than ours, we create four groups of countries, which share a similar cultural and economic background. The group "English speaking" includes Canada, US, UK, Australia. All European countries (Italy, Germany, Netherlands, France, Switzerland, and Sweden) are grouped together. The group "emerging countries" includes China, India, Taiwan, Korea, Singapore, Hong Kong. Japan is a fourth group, because it does not fit with any other group. Following Steenkamp and Baumgartner (1998), we first test the hypothesis of full metric invariance by constraining the matrix of factor loadings to be invariant across groups. Since there is a significant increase between the configural model and the full metric model invariance ($\Delta\chi^2$ (42) = 76.966, p=.001), we do not find support for full metric invariance.

However, past research suggests that "full measurement invariance is particularly unlikely" (Steenkamp and Baumgartner, 1998, p.81) and should be considered scientifically unrealistic (Horn, McArdle, and Mason 1983), whereas partial metric invariance can be regarded as sufficient to establish cross-cultural equivalence (Byrne, Shavelson, and Muthen 1989). In order to identify the source of lack of full metric invariance, we look at the difference between each pair of factor loadings. We find that only 23% (13 out of 57) of the pairs of factor loadings are significantly different across countries; moreover, there are no clear patterns in these differences. These findings are largely consistent with Steenkamp and Baumgartner (1998). In order to test for partial metric invariance, we next free up the constraints on the model parameters and find that the partial metric invariance model is not significantly different from the configural model ($\Delta\chi^2$ (34) = 32.192, p=.566). Further, the partial metric invariance model shows better fit than the configural model because RMSEA and CAIC, which take into account both goodness of fit and model parsimony, are lower. Hence, we find support for partial metric invariance in our data. Overall, these results provide some evidence of cross-cultural equivalence in our survey measures.