The direct and indirect impact of culture on innovation

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Abstract

Innovation’s centrality and importance in international operations has been a subject of enduring debate in the age of globalization. Cross-border knowledge spillovers and the race between nations for increased innovativeness only underscore the importance of innovation. One aspect of this discussion concerns the effect of national culture on the ability to be innovative. Following Shane, 1992. Journal of Business Venturing, 7, 29–46; Shane, 1993. Journal of Business Venturing 8, 59–73 research, the present study aims to examine the impact, both direct and indirect, of culture on the motivation to innovate at the national level over a period of time. The findings support the claim that although some change had occurred in this impact, most cultural aspects still demonstrate strong and lasting impact on the tendency to innovate at the national level.

1. Introduction

In times of economic crisis nations constantly seek new ways and ideas to facilitate their economic rejuvenation. In recent years this search has been shaped in large part by the concepts of the “knowledge economy” and the “information age,” focusing on innovation as the core aspect of new economic models. Both these concepts reflect the shift in recent decades in views of what constitutes an economic asset. While traditional economies have emphasized assets such as labor and machinery, modern economies view knowledge as their major strength (Jaffe and Trajtenberg, 2005). Knowledge, however, is an overly broad, holistic category; its manifestation in the form of innovation is regarded as more measurable and hence as more amenable to study. For this reason, innovation has been the subject of several studies linking it to economic growth (Jaffe and Trajtenberg, 2005; Fagerberg and Srholec, 2008; Freeman, 2002; Thoenig and Verdier, 2003).

No discussion of the knowledge economy or of innovation can be complete without a consideration of their links with globalization. While innovation has a clear and direct impact on economic growth, its relationship with globalization is to some extent circular. Forces of globalization largely rely on innovative products and services; one need only look at the tremendous impact of the internet on global trade to realize how innovation is embedded in and inseparable from globalization (Freund and Weinhold, 2004). At the same time, globalization has led to technological changes which in recent decades have exerted a major influence on the world’s economy, both on the macroeconomic and on the market level (Thoenig and Verdier, 2003). For instance, globalization has given rise to multinational enterprises (MNEs), large corporations that conduct different parts of their activities across national borders. Such firms have promoted homogeneity in customers’ needs by introducing standardized products and services, thereby impacting the adoption rate of new technology-based products (Nachum et al., 2008) in different nations (Freeman, 1995). They have also tapped into various countries either to exploit their high knowledge resources or to benefit from their proximity to world’s knowledge centers (Nachum et al., 2008). But while globalization possesses many advantages for MNEs, some aspects of it may also be viewed as threats. One major aspect that inhibits innovation in MNE’s subsidiaries in foreign countries is national culture. Hofstede (1994) claims that the larger the cultural gap between the home and the host countries, the more MNEs’ managers need to reconsider the way they operate their cross-border operations. In their meta-analysis, Tihanyi et al. (2005) link cultural aspects to innovation by concluding that cultural differences between countries have a negative impact on international diversification in high-technology industries. While MNEs’ operations are clearly impacted by the national culture of the host countries (Dwyer et al., 2005; Steensma et al., 2000), there is evidence for a reciprocal relationship, manifest in the way MNEs’ processes and procedures influence their subsidiaries’ operations and diffuse into local industries. Though this impact occurs at the micro-level, it is bound to resonate at the national level in the long run (Brock et al., 2000; Hofstede, 1994).

In light of this relationship, and in light of the increasing role of MNEs in creating and maintaining innovation at the global level, we must ask “Does national culture still matter?” The main purpose of the present study is thus to investigate the impact of different cultural aspects on countries’ motivation both to innovate and to invest in innovation.
2. Literature review

Schumpeter (1942) has addressed three stages in the process of new technologies entering the market: invention, innovation, and adoption. Inventions represent the core idea or concept facilitating the new technology. Inventions may – but need not – be based on patents. Inventions do not always progress to the next stage: some will remain a mere idea. Innovation, by contrast, is the stage in which invention is commercialized. Firms may base their innovations on the inventions of others. In the third stage, innovation is adopted by firms or individuals. The first two stages occur on the firm/industry level and are based mostly on R&D processes, whereas the last stage occurs on the market/national level and concerns the new technology’s diffusion rate. Nevertheless, for inventions and innovations to occur, a supporting infrastructure on the national level is strongly needed. This type of infrastructure has been termed the national innovation system (NIS) (Balzat and Hanusch, 2004).

2.1. Innovation and the national innovation system (NIS)

Though the term “national innovation system” (NIS) was coined long ago, with origins in the nineteenth century (Freeman, 1995), we still lack a clear definition of it (Lundvall, 2007). Earlier research described the NIS as a “…network of public and private institutions within an economy that fund and perform R&D, translate the results of R&D into commercial innovations, and effect the diffusion of new technologies” (Mowery and Oxley, 1995 p. 80). Etzkowitz and Leydesdorff (2000) describe NIS as a triple helix of state-academia-industry. Several types of organizations participate to create the network-like system: in addition to the national firms which represent the private sector, the network consists of representatives of the public sector (agencies and offices) as well as universities. Collaboration among these organizations is crucial for the system to achieve its goals (Freeman, 1995; Lundvall, 2007; Mowery and Oxley, 1995).

As noted, innovation has been found to have a strong and positive influence on economic growth (Freeman, 1995, 2002; Thoenig and Verdier, 2003; Balzat and Hanusch, 2004; Chell, 2001). As economists’ ideas shifted from dependence on tangible resources to accumulation of intangible resources such as knowledge as a core condition for creating value (Freeman and Soete, 1997), the view that economic growth depends on innovation and on the presence of an NIS received further support from Fagerberg and Srholec’s (2008) finding that the presence of an NIS significantly affects the ability to innovate on the national level and that countries with a stable NIS enjoy significantly higher economic growth than others.

While all studies advocate the establishment of NISs due to their positive impact on the economy, it is nevertheless clear that countries benefit differently from investing in the creation and maintenance of such systems. One conclusion that is becoming clearer as research advances is that innovation differs in scale and in scope in different countries (Fagerberg and Srholec, 2008). Since the concept of an NIS incorporates that of a nation, this conclusion has drawn attention to other conditions on the national level which may divert the impact of investment on innovation. Since the extent to which a nation’s firms tend to innovate has been found to crucially affect the success of a nation’s innovation efforts, we should turn our focus to firms’ motivation to innovate. Such motivation is partly embedded in a firm’s organizational culture (Hurley and Hult, 1998; Ahmed, 1998; Martins and Terblanche, 2003). Since national and organizational cultures seem to be linked (Hofstede, 2001), certain aspects of national culture may well influence the tendency to innovate at the firm level. Whereas a nation’s NIS represents the formal, overt factors involved in motivating innovation on the national level and is largely under the nation’s control, informal cultural aspects may intervene to influence this motivation. Though these latter aspects are not under the nation’s control, it is very important to learn about their potential impact.

2.2. Innovation in a cultural perspective

Other factors besides NISs may influence innovation. Two views concerning such factors are worth noting here. The first, mentioned briefly earlier, argues for the diminishing relevance of national characteristics in the age of globalization (Freeman, 1995). On this view, globalization has led to the rise of MNEs and to knowledge spillover, both of which have contributed to the shift from a nations-based to a corporations-based economy (Hu, 2004; Audretsch and Lehmann, 2005)– hence the non-relevance of national innovation.

The second view suggests that several national aspects may influence the motivation to innovate on the national level (Lundvall, 2007) and on the firm level (Elenkov and Manev, 2005; Mueller et al., 2013). Fagerberg and Srholec (2008) have furnished strong support for this position with their finding that several factors such as the quality of governance, the political system, and openness, all interlinked with the concept of NIS, interact with the ability to innovate. More specifically, their study revealed that certain indicators such as trust, corruption, civic rights, form of governance, and education influence innovation at the national level. All these indicators interact with the cultural dimensions identified by Hofstede (2001). In their discussion of the impact of national culture on MNEs’ decisions about the location of their R&D units, Jones and Davis (2000) argued that while globalization impacts such firms in various ways, national culture still exerts significant influence over the performance of R&D units; MNEs are therefore advised to identify the relevant national aspects and locate their R&D units in innovation-favorable countries. The upshot of this argument is that regardless of how much money is spent on creating innovation, national culture and its ability either to bolster or to undermine innovation must be taken into consideration. Similarly, Hayton et al. (2002) suggested a complex model incorporating national as well as firm-level factors in explaining entrepreneurship.

Shane (1992) has presented strong evidence for the impact of Hofstede’s (1980) cultural dimensions on nations’ tendency to innovate. His positive findings led him to conclude that nations that are inventive would remain so. Two decades after his pioneering research, I set out to learn whether or not globalization has somewhat erased the impact of cultural dimensions by neutralizing the cultural distinctions among nations.

Shane (1992) based his research on Hofstede’s (1980) cultural dimensions, namely power distance, individualism, masculinity, and uncertainty avoidance, overall, conceptualizing for the ability of each dimension for predicting the level of a nation’s innovativeness.

Power distance (PDI) measures the distribution of power within a society in terms of the degree to which its members expect and accept inequality. High PDI scores translate into hierarchical national or organizational structure. In high-PDI countries, organizational structure tends to be more centralized and rigid: decision-making information is the preserve of those in authority. The key concepts in such organizations are supervision and rules (Hofstede, 2001). Shane (1992) describes several characteristics of low-PDI countries that interact with the tendency to innovate. In low-PDI countries, he claims, new organizations tend to be smaller and more organic, with high information-processing capabilities and informal communication between superiors and subordinates. Such organizations are further characterized as power-decentralized, with control systems based mainly on trust.
Indeed, Shane (1992) found that high-PDI countries displayed lower per-capita returns on inventions. Further support for these findings has been found in connection to employees’ reward systems. Hofstede (2001) links low PDI both to the use of management by objectives and to fair wages. Chandler et al. (2000) found that employees who perceived the organization reward system as rewarding innovation tended to be more strongly committed to innovation. According to Ahmed (1998), certain cultural norms, such as trust and openness, awards and rewards, and autonomy and flexibility, facilitate an innovative climate in organizations. Hofstede (2001) has shown all these norms to be closely associated with low PDI. In their discussion of the determinants of organizational culture which support creativity and innovation, Martins and Terblanche (2003) identify five such categories, three of which – structure, support mechanisms, and communication – incorporate elements related to low PDI (Hofstede, 2001). Shane et al. (1995) describe how PDI can impact one’s perceptions and hence one’s innovativeness.

H1a. Low-PDI countries will invest more in facilitating innovation.

H1b. Low-PDI countries will evince higher rates of innovation.

Individualism (IDV) refers to the degree to which, for each individual in a given group, his or her interests prevail over the group’s; in other words, IDV measures the balance between an “I”—centered and a “We”—centered consciousness in a given society. In high-IDV countries each individual is expected to take care of himself or herself and his or her immediate family. Such societies emphasize individual initiative and achievements. High-IDV countries have a strong entrepreneurial orientation which enables and motivates invention and innovation, both within and without formal organizational borders or existing networks (Hofstede, 2001). IDV and PDI share many similar characteristics in terms of facilitating innovation. Martins and Terblanche (2003) found that elements such as structural flexibility and employees’ freedom, which translate into autonomy, empowerment, and decision making, are all determinants of innovation. Similar findings are presented in Ahmed (1998), where cultural elements responsible for a climate of innovation include freedom, trust, and awards and rewards. Hofstede (2001) demonstrates a strong correlation between IDV and PDI, with low-PDI countries usually receiving high IDV scores, and vice versa.

In conclusion, Shane’s (1992) findings are consistent with the hypothesis that high-IDV countries will have higher national innovation rates.

H2a. High-IDV countries will invest more in facilitating innovation.

H2b. High-IDV countries will evince higher rates of innovation.

Uncertainty avoidance (UAI) refers to the levels of anxiety, the need for protection, and the concomitant desire for rules and laws felt in a society. Whereas low-UAI societies tend to be more open to change and new ideas, members of high-UAI societies tend to perceive novelty as dangerous and hence to resist it. While technology is perceived as a means for creating order and therefore has appeal for members of high-UAI societies, innovation is regarded as the carrier of change and is viewed with suspicion. In high-UAI countries, organizational culture favors a highly formalized conception of management and a hierarchical organizational structure, both of which contribute to a sense of order and control (Hofstede, 2001). But whereas findings on the impact of PDI and IDV on innovation have been conclusive, studies on UAI have yielded conflicting results (Shane, 1993; Kedia et al., 1992; Nakata and Sivakumar, 1996). This can be put down to an ambivalent perception of technology. On the one hand, technology is seen as one of the three pillars supporting high-UAI societies in their attempt to maintain order and a sense of predictability; by increasing standardization and thus outcome certainty, technology helps firms carry out their missions and perform their tasks (Hofstede, 2001). On the other hand, technology rests on innovation, which, as noted earlier, depends on such conditions as flexibility, informal communication, employees’ empowerment, trust, and openness (Ahmed, 1998; Martins and Terblanche, 2003), which are inconsistent with the need for stability and predictability at the core of UAI. On the basis of these characteristics of UAI and the interaction between UAI and PDI, I hypothesize that low UAI levels will contribute to innovation. UAI correlates strongly with PDI, suggesting the presence of similar elements in both (Hofstede, 2001). Previous findings on the climate for innovation (Martins and Terblanche, 2003; Shane, 1995) support a possible linkage between low UAI and innovation.

H3a. Low-UAI countries will invest more in facilitating innovation.

H3b. Low-UAI countries will evince higher rates of innovation.

While PDI, IDV, and UAI have received some attention as determinants of varying levels of innovation in different countries (Shane, 1992, 1993; Kedia et al., 1992), a fourth cultural aspect, masculinity, has largely been neglected.

Masculinity (MAS) refers to the dominant gender-role patterns. In more masculine societies the emphasis is on ego, money, performance, and achievements, while in more feminine societies there is a greater balance between men’s and women’s roles (Hofstede, 2001). According to previous studies, high-MAS societies display a greater tendency towards invention and innovation based on achievement triggers (Shane, 1993). One of the core aspects of MAS, success (as manifested in financial rewards or other means of acknowledgement), is highly appreciated in high-MAS societies and is also a strong motivator of innovation (Ahmed, 1998; Chandler et al., 2000; Morris et al., 1994). There are thus solid grounds for proposing a link between MAS and innovation Fig. 1.

H4a. High-MAS countries will invest more in facilitating innovation.

H4b. High-MAS countries will evince higher rates of innovation.

3. Method

The current paper examines whether in the age of globalization cultural aspects can still predict a country’s level of innovation. The paper examines data for 1998, 2003, and 2007 in 35 countries:
33 OECD nations (Iceland was excluded for lack of cultural data), Singapore, and Hong Kong. I aimed to control for the level of economic development, in line with previous findings which suggest a strong linkage between countries’ level of economic development and rate of cultural change (Freeman, 2002). Therefore, only countries regarded as economically developed were included in the study. The three aforementioned years were likewise chosen to control for the potential influence of economic factors. Economic changes, no less than the level of economic development, are known to have a potential impact on the tendency to innovate (Inglehart and Baker, 2000). Since one of my goals was to learn whether globalization has influenced innovation by eliminating the impact of national culture, cultural aspects were examined over a decade. Two of the years for which data were studied were chosen in order to avoid any economic influences: 2003 because that year witnessed the end of the economic changes that followed the high-tech downturn of 1999–2001; and 2007 because that was the final year clear of any of the economic pressures associated with the present economic crisis. Since the study investigated the longitudinal impact of cultural aspects, I marked 1998 as the first year on the continuum, giving us a decade of data. One issue is worth clarifying in this regard. Culture tends to change at a very slow rate (Hofstede, 2001). Also, by controlling for the potential impact of economic changes, cultural foundations in terms of norms and values tend to be long lasting (Inglehart and Baker, 2000). In choosing to examine these specific three years on the continuum, I was aiming to identify significant cultural impacts, such that would be manifested in all three years, not to examine differences in cultural impact between the three years.

The current study is based on a variety of secondary sources.

### 3.1. Measures of Innovation Inputs

As noted earlier, NIS has a major impact on a country’s ability to innovate (Fagerberg and Srholec, 2008; Balzat and Hanusch, 2004). NIS represents the national systems dedicated to enhancing firms’ and individuals’ abilities to turn thoughts and ideas into solid products and services. These systems are funded by national organizations. The amount of national funds invested in creating innovation must therefore be considered a predictive variable. Data on national investments in innovation were retrieved from the World Bank database (2010) as presented in its website. Three measures were used for each country in the present study. The first, used as a control variable, is gross national income (GNI) per capita (in US dollars) divided by the midyear population. The second is the amount of money invested in innovation as a percentage of the country’s GDP (see Appendix for complete data on each country). The second group of factors, representing national culture, consists of the cultural dimensions discussed earlier: PDI, IDV, UAI, and MAS. Updated national scores for these dimensions were taken from The Hofstede Center website (2013) (see Table 1 for descriptive statistics and correlations).

### 3.2. Measures of Innovation Outputs

Three measures were used to capture innovation, each referring to a different aspect of innovation: patents, scientific and technical journal articles, and high-technology exports. All three measures were also obtained from the World Bank database. The selected variables represent the reciprocal interaction between industry and academia that lies at the core of innovation (Etzkowitz and Leydesdorff, 2000). Scientific articles represent one end of this scale, being pure products of academia, whereas high-technology exports represent the opposite end measured in terms of the industry’s output. Patents are located in-between, generated partly by academia and partly by industry. Incorporating all three aspects of innovation fully captures in my view the cultural impact on innovation.

Previous studies have used patents as a measure of innovation (Jaffe and Trajtenberg, 2005; Hu, 2004; Shane, 1993; Acs et al., 2002; Acs and Audretsch, 1988; Seltzer and Bentley, 1999). In line with previous studies, the patent variable is measured as the ratio between the total number of patents granted in a country and the country’s population.

Previous studies have also used scientific and technical journal articles as a measure of innovation (Chen et al., 2007; Fagerberg et al., 2005). Here, again, the current study measures the ratio of the total number of articles published by a country’s researchers to the country’s population.

The third measure is given by a country’s high-technology exports as a percentage of its total exports. Again, previous studies have used this indicator as a measure of innovation (Kedia et al., 1992; Fagerberg et al., 2005; Atuahene-Gima, 1996; Song and Parry, 1997).

### 4. Results

I tested the hypotheses using structural equation modeling (SEM) analysis with AMOS software. The flexibility of SEM analysis

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**Table 1**

Descriptive statistics and correlations of the variables.

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<th>Mean (s.d.)</th>
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<tr>
<td>1. PDI</td>
<td>48.54 (20.72)</td>
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<td>2. IDV</td>
<td>58.03 (21.65)</td>
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<td>3. UAI</td>
<td>65.54 (24.83)</td>
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<td>4. MAS</td>
<td>51.26 (24.15)</td>
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<tr>
<td>5. R&amp;D Invest. (98)</td>
<td>1.49 (.83)</td>
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<td>6. R&amp;D Invest. (03)</td>
<td>1.68 (1.02)</td>
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<td>7. R&amp;D Invest. (07)</td>
<td>1.82 (1.09)</td>
<td>.07</td>
<td>.24</td>
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<td>8. High-tech exp. (98)</td>
<td>17.22 (12.39)</td>
<td>.17</td>
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<td>9. High-tech exp. (03)</td>
<td>17.41 (11.05)</td>
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<td>10. High-tech exp. (07)</td>
<td>15.32 (9.34)</td>
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<td>11. Patents (98)</td>
<td>63.54 (72.6)</td>
<td>.04</td>
<td>.12</td>
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<td>.41*</td>
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<td>12. Patents (03)</td>
<td>67.51 (76.6)</td>
<td>.08</td>
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<td>.53**</td>
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<td>13. Patents (07)</td>
<td>695.78 (91.5)</td>
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<td>14. Articles (98)</td>
<td>465.96 (326.9)</td>
<td>.57</td>
<td>.99**</td>
<td>.53**</td>
<td>.28</td>
<td>.71**</td>
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<td>15. Articles (03)</td>
<td>512.28 (303.6)</td>
<td>.63**</td>
<td>.49**</td>
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<tr>
<td>16. Articles (07)</td>
<td>567.51 (207.6)</td>
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<td>.46**</td>
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<td>.92**</td>
<td>.98**</td>
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(PDI = Power distance; IDV = Individualism; UAI = Uncertainty avoidance; MAS = Masculinity).

*p < .05, **p < .01
makes it more suitable to explaining the relationships among multiple variables. The three models tested, one for each year, were significant. All fit indices were very good (see Table 2).

All the hypotheses were examined for each of the three years (1998, 2003, 2007). Results for all three years are presented below.

I first examined the potential mediating impact of the investment in innovation on the three chosen aspects of innovation. H1a suggested that investment in innovation mediates the impact of PDI on innovation. PDI was found to have a negative impact on the investment, while investment in innovation was positively correlated with all three aspects of innovation, therefore confirming H1a.

None of the other three cultural dimensions were found to have any impact on investment in innovation. H2a, H3a, and H4a were thus not supported.

I then turned to examine the direct impact of each of the four cultural aspects on the three innovation indicators.

The model for the year 1998 explained 48% of the variance in high-technology exports, with UAI (β = −.62, p < .01) acting as a strong predictor. As for patents, the model explained 39% of the variance, with IDV (β = −.42, p < .05), MAS (β = .25, p < .10), and UAI (β = −.39, p < .01) significantly impacting innovation. The model also explained 84% of the variance in the third innovation indicator (scientific articles), with IDV (β = .43, p < .01), MAS (β = −.28, p < .01) and UAI (β = −.19, p < .05) strongly impacting innovation (For detailed results see Table 3).

Similar findings were obtained for 2003, where high-technology exports (R² =.36) were significantly influenced by UAI (β = −.50, p < .01); patents (R² =.39) with IDV (β = −.37, p < .05), MAS (β = .35, p < .05), and UAI (β = −.26, p < .10); and scientific articles (R² =.51) with IDV (β = .24, p < .05), MAS (β = −.19, p < .05), and UAI (β = −.23, p < .01).

The findings for 2007 largely followed this pattern. The model was significant for high-technology exports (R² =.39) with respect to UAI (β = −.55, p < .01); for patents (R² =.42) with respect to IDV (β = −.46, p < .01), MAS (β = −.31, p < .05), and UAI (β = −.23, p < .10); and for scientific articles (R² =.74) with respect to IDV (β = .28, p < .05), MAS (β = −.26, p < .01) and UAI (β = −.28, p < .01) (see Table 3 for detailed results).

In terms of the hypotheses, the results were as follows. H1b was not substantiated, as PDI did not explain any of the innovation factors examined. H4b was substantiated, as UAI was found to have a negative impact on innovation. As for H2b, the impact of IDV on innovation was ambivalent: its impact on scientific articles was as expected, but its impact on patents was contrary to the hypothesis. Precisely the opposite results were found for MAS (H3b): the impact of MAS on patents was as expected, but its impact on scientific articles was contrary to the hypothesis.

Post-hoc analysis: With the above results in place, I conducted a post-hoc analysis to check for potential interactions between the various cultural dimensions. The three modified models (1998, 2003, and 2007) showed very good fit indices (see Table 4 for results).

As noted earlier, UAI was found to have a consistently negative impact on the various aspects of innovation, while IDV and MAS were more ambivalent. In light of these results, I created two new constructs based on the interaction between UAI and IDV (Construct 1), and between UAI and MAS (Construct 2). I then ran the three models, one for each year, using the two new interaction constructs. The results were interesting. As mentioned earlier, patents were impacted negatively by UAI and IDV and positively by MAS. When using the interaction constructs, however, I found that the interaction between UAI and MAS eliminated the negative influence of UAI, resulting in a positive impact of Construct 2 on patents. A similar result was obtained with regard to scientific articles. As noted earlier, scientific articles were impacted negatively by UAI and MAS and positively by IDV. The interaction between UAI and IDV eliminated, however, the negative impact of UAI, resulting in a positive impact of Construct 1 on scientific articles (see Table 5 for detailed results).

5. Discussion

The present study had two main parts. First, almost two decades after Shane (1992, 1995), I set out to examine whether the impact of

### Table 2

Results of model fit indices for the path analysis models.

<table>
<thead>
<tr>
<th>Model Year</th>
<th>CMIN (Chi-square)</th>
<th>DF</th>
<th>P</th>
<th>CFI</th>
<th>NFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>2.996</td>
<td>6</td>
<td>.392</td>
<td>1.00</td>
<td>.980</td>
<td>.000</td>
</tr>
<tr>
<td>2003</td>
<td>2.982</td>
<td>6</td>
<td>.811</td>
<td>1.00</td>
<td>.979</td>
<td>.000</td>
</tr>
<tr>
<td>2007</td>
<td>4.356</td>
<td>6</td>
<td>.629</td>
<td>1.00</td>
<td>.968</td>
<td>.063</td>
</tr>
</tbody>
</table>

(CFI = Comparative fit index; NFI = Norm fit index; RMSEA = Root square error of approximation).

### Table 3

Constructs weights.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Export (R² =.48)</td>
<td>Patents (R² =.39)</td>
<td>Articles (R² =.84)</td>
</tr>
<tr>
<td>R&amp;D expense</td>
<td>.32***</td>
<td>.45***</td>
</tr>
<tr>
<td>UAI</td>
<td>−.62***</td>
<td>−.39***</td>
</tr>
<tr>
<td>IDV</td>
<td>−.42***</td>
<td>.43***</td>
</tr>
<tr>
<td>MAS</td>
<td>.25</td>
<td>−.27***</td>
</tr>
</tbody>
</table>

* p < .1.  
** p < .05.  
*** p < .01.
certain aspects of national culture on the motivation to innovate were mediated by the investment in innovation, bearing in mind that these two decades have witnessed rapid globalization. The second part, which follows from the first, was to explore differences in cultural influence on several elements of innovation. This was followed by a post-hoc analysis establishing potential interactions between the various aspects of national culture.

Before I discuss the results, one issue regarding cultural aspects must be addressed. The use of Hofstede’s cultural dimensions may be seen as controversial (Venaik and Brewer, 2010). The main points presented by its critics concern (1) the use of quantitative measures, (2) the fact that Hofstede’s data were collected from the workers of a particular organization (IBM), raising questions about the study’s generalizability, and (3) the time elapsed since the first round of data collection. In their comprehensive work, Magnussen et al. (2008) compare Hofstede’s cultural dimensions with other cultural frameworks. Observing that culture may be even more stable than Hofstede himself had argued, they conclude that Hofstede’s framework has a strong convergent validity compared to more contemporary cultural frameworks such as Schwartz (1994) and House et al. (2004). Hence, Hofstede’s cultural dimensions are often used to explain either direct or mediated relationships (Mueller et al., 2013; Tihanyi et al., 2005).

Let us turn to the results, starting with the first part of the study. Of the four cultural aspects, only PDI was found to be mediated by investment in innovation, indicating that investing in innovation in high-PDI countries will neutralize the potentially negative impact of PDI on innovation. This in itself is an important finding. While this finding helps establish investment in innovation as the foundation of enhanced innovativeness, it does not, in itself, entail that culture is of no importance, but rather confirms that PDI coincides and interacts with other forces which influence the tendency to innovate at both the firm and the national level (Grinstein, 2008).

Turning to the second part of the study, though cultural dimensions proved to impact innovativeness, the present study revealed some shifts in this impact over time. Overall, three of the four cultural aspects were shown to impact the three dimensions of innovation. My hypothesis expected low-PDI characteristics to have a positive effect on innovation, following some strong empirical evidence in support of this expectation (Shane et al., 1995, 1993; Grinstein, 2008). But despite consensus in the literature, the findings revealed no such impact, suggesting that the relevance of PDI has diminished over time. One possible explanation has to do with the shift from a nation-based to a corporations-based economy and with organizational techniques to facilitate innovation. In earlier research, many high-PDI characteristics were linked to barriers to innovation at the national level (Ahmed, 1998; Martins and Terblanche, 2003; Shane, 1993). One major change in recent years has been the growing prominence of MNEs in the global arena (Fiegenbaum and Lavie, 2000). Whereas in the past innovation was measured at the national level, nowadays MNEs provide the necessary basis for its creation. PDI characteristics measured at the national level are therefore no longer suitable for understanding barriers to innovation. Furthermore, since most countries examined in the present research – most of them OECD members – share similar regime principles, the differences among them with respect to PDI are relatively insignificant.

Other hypotheses referred to the impact of IDV and MAS on innovation. In brief, I conjectured that high IDV and high MAS would favor innovativeness. The findings were quite surprising, however: while some aspects of innovation were found to be higher in cultures scoring high on IDV or MAS, others were higher in low-IDV and low-MAS cultures.

With respect to IDV, these findings may resemble previous findings (Morris et al., 1994, 1993; Eisenberg, 1999) which suggest a curvilinear relationship between entrepreneurship and individualism/collectivism, whereby a high level of individualism hinders innovation. The mean IDV score for the countries in the present study was 58 – higher than the mean of 43 reported by Hofstede (2001) in his original survey – indicating a relatively high level of individualism in the countries in our survey. The present findings support the conjecture presented earlier that a certain level of collectivism will encourage innovation.

Another issue that can further our understanding of collectivism’s impact on innovation is networks, which can be understood as a byproduct of globalization. The need to survive and to outperform competitors, on the one hand, and the diminishing relevance of geographical borders, on the other, have led to the growth of networks. Networks have proven to facilitate innovation by sharing resources such as unique knowledge (Chen, 2004; Ritter and Gemunden, 2004). Networks by their nature emphasize the centrality of sharing and collaboration, two foundations of collectivism. Since networks have been gaining a foothold in the global arena – shifting the spotlight to the advantages of collaboration, especially in terms of producing innovation – it is only a matter of time before a similar shift on the spectrum of individualism/collectivism occurs.

The counter-hypothetical results of the MAS dimension can also be explained as related to collaboration and networking. As noted earlier, collaboration and networking have both become central aspects of management theories, especially in connection with innovation, and are both motivated by forces of globalization (Dahli and De Clercq, 2004; Marino et al., 2002; Vecchi and Brennan, 2009; Kali and Reyes, 2007; Rycroft and Kasch, 2004). Both features appear to be highly important in the global arena, granting a competitive advantage to firms that have them and enhancing their innovative capabilities (Coviello and Munro, 1997). Both can also be linked with femininity as described by Hofstede (2001). Femininity values relationships as a means to achieving cooperation and well-being; relationships, on this view, help us meet present goals by creating an environment more

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**Table 5**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Export (R² = 41)</td>
<td>Export (R² = 31)</td>
<td>Export (R² = 33)</td>
<td></td>
</tr>
<tr>
<td>Patents (R² = 39)</td>
<td>Patents (R² = 38)</td>
<td>Patents (R² = 38)</td>
<td></td>
</tr>
<tr>
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<td>Articles (R² = 79)</td>
<td>Articles (R² = 67)</td>
<td></td>
</tr>
<tr>
<td>UAI–IDV interaction construct</td>
<td>– .49***</td>
<td>– .49***</td>
<td>– .43***</td>
</tr>
<tr>
<td></td>
<td>– .62***</td>
<td>– .52***</td>
<td>– .53***</td>
</tr>
<tr>
<td></td>
<td>.36***</td>
<td>.21**</td>
<td>.26**</td>
</tr>
<tr>
<td>UAI–MAS interaction construct</td>
<td>– .02</td>
<td>– .02</td>
<td>– .04</td>
</tr>
<tr>
<td></td>
<td>.33**</td>
<td>.41***</td>
<td>.34**</td>
</tr>
<tr>
<td></td>
<td>– .57***</td>
<td>– .47**</td>
<td>– .60***</td>
</tr>
</tbody>
</table>

* p < .1  
** p < .05  
*** p < .01
Conducive to achieving them. Networks can be viewed as a progressive form of relationships, aimed at creating value for their participants. Previous findings support this explanation by concluding that femininity is linked to the tendency to form alliances (Marino et al., 2002) and to the ability to produce decision-support systems (Vecchi and Brennan, 2009). Since the ability to form partnerships is associated with femininity, and since these collaborations have proven to contribute to innovation, the MAS dimension had a significant impact on innovation. Its impact varied, however, with respect to different aspects of innovation. Femininity was strongly related to scientific articles but inversely related to patents. This can be explained by the different motivations associated with each of the two aspects of innovation. Patents often involve higher levels of innovation, namely disruptive innovation or at times even innovation breakthroughs; they therefore possess little resemblance to previous innovation. Such innovation is strongly associated with the characteristics of masculinity. By contrast, scientific papers must rely on previous findings and existing knowledge frameworks. In addition, they more often involve collaboration between several scholars (Emrouznejad et al., 2008).

As for the final hypothesis concerning uncertainty avoidance: as predicted, this dimension had a negative impact on some aspects of innovation, suggesting higher rates of innovation in low uncertainty-avoiding countries. The rationale presented earlier therefore holds, substantiating the claim that certain constructs embodied in the cultural foundation of low-UAI countries – openness to change, willingness to take risks, abilities prevailing over seniority – become operational in an innovative climate.

Turning finally to the post-hoc results: My aim in the post-hoc analysis was to identify any potential interaction between the various cultural aspects. Such interaction was indeed found. UAI alone had a negative influence on all aspects of innovation, but a positive impact when combined with either one of the other two cultural dimensions, IDV and MAS. This suggests that while the impact of UAI is probably consistently negative, its impact is weaker than that of each of the other two dimensions. Any assessment of the impact of UAI should therefore consider IDV and MAS as well.

6. Conclusion

The present study aims to answer the question whether today, deep into the age of globalization and following the shift from nation-based to firm-based innovation motivators, culture still matters. The findings show that while investment in innovation is a major facilitator of innovation, cultural aspects, specifically Individualism, Masculinity, and Uncertainty Avoidance, still motivate innovation. This impact appears to have been stable and firm across cultural dimensions, IDV and MAS. Therefore, an assessment of innovation should consider these cultural influences in any future study.
three points in time spanning one decade. In addition, PDL, once a strong indicator of innovation, diminished in its influence. In sum, my findings suggest that national culture still possesses a substantial influence on the ability of firms, either local or foreign, to create and maintain innovation in specific locations. Furthermore, the present study establishes a synergetic relationship between the different dimensions of culture: dimensions which impact innovation negatively when operating individually may impact it positively when combined with others. Firms should therefore take national culture into account when determining the location of organizational units involved in creating any type of innovation. More specifically, they should consider national culture when establishing their expectations regarding the units’ outputs and when planning the management of such units.

Appendix

See appendix Table A1 here.

References


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