National Personality Profiles and Innovation: The Role of Cultural Practices

Robert J. Rossberger

This study investigates the relationship between personality factors, cultural practices, and innovativeness on the national level. Hitherto no study has been done which considers these factors simultaneously. We argue that the relationship between national aggregated personality factors and the level of national innovation is mediated by national cultural practices. Our model is based on three arguments: First, Five Factor theory and cultural theory state that the national personality profile of a country influences its cultural practices. Second, person-environment-fit theory argues that personality factors can best manifest themselves in an appropriate environment. Third, in contrast to the individual level, we argue that on the national level cultural practices may not act as a moderator but as a mediator. Based on the triangulation of three datasets, we subsequently test our model on a sample of $N = 33$ countries. Our results demonstrate that innovation-relevant national personality profiles are closely linked with innovation-relevant national cultural practices. Further, we show that national cultural practices mediate the relationship between national personality profiles and national innovativeness. Additionally, we reveal that the recently proposed relationship between nationally aggregated personality profiles and national innovativeness virtually disappears as soon as national cultural practices are integrated into the model.

Introduction

Innovation is widely considered as an important factor for competitiveness and has been a focus of research for decades. This is reflected by the vast amount of knowledge gained about the characteristics and determinants of innovation at the individual, team and organizational levels. However, not only organizations, but also countries differ with regard to their level of innovativeness.

As innovation, competitiveness and wealth in a country correlate, there is a need to investigate whether there are underlying factors and relationships other than economic, institutional or political factors (Stephan & Uhlaner, 2010) to explain these differences. Twenty years ago, Scott Shane assumed that 'national rates of innovation are driven by more fundamental forces than economic conditions' (Shane, 1993, p. 59). Previous research supported this assumption and has shown that national cultural factors are also an important determinant of innovation at the national level (Shane, 1993; Lynn & Gelb, 1996; Steensma et al., 2000; Van Everdingen & Waarts, 2003; Sun, 2009; Taylor & Wilson, 2012). Additionally, a recent study by Steel, Rinne and Fairweather (2012) has shown that personality factors, aggregated on the national level, are also related to the level of innovation present in countries.

Both approaches – one investigating personality factors on the national level, the other national culture – provide a theoretical rationale and empirical support for the existence of the proposed underlying relationships. However, both illuminate only part of the picture. Therefore, we consider both components simultaneously.

Research on the individual level has shown that innovative behaviour is basically a function of personal and environmental contingency factors (Angle, 2000). One could assume that contingency factors also matter at the national level. Therefore, we argue that at the

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national level, a similar relationship must exist for national innovativeness, too. Although this assumption is plausible, it has not yet been theoretically derived and empirically tested.

The absence of a model which integrates both factors may be rooted in the distance between the underlying paradigms and theoretical approaches (cf. Cole, 2000; Church, 2009), and the hitherto missing availability of cross-national data for empirical verification. Therefore, our study and the proposed model aim at integrating perspectives as well as findings and arguments from personality and cultural psychology.

Basically, personality psychology proposes that personality factors are genetically based, relatively immune against cultural and socialization forces (McCrae, 2004), and 'beyond culture' (Hofstede & McCrae, 2004, p. 57). Therefore, according to this point of view, personality influences culture. In contrast, cultural psychology assumes that the expression of human personality is largely shaped by cultural forces (Church, 2009, p. 154). Consequently, according to this point of view, the cultural environment influences the manifestation of personality factors. In this study we aim to combine these two approaches.

Additionally, going beyond the conceptual level has been a difficult endeavour as the national level of analysis makes the sourcing of data a difficult research project. Recently, three major international research projects have provided the data required: the Personality Profiles of Cultures project (McCrae & Terracciano, 2005a, 2005b, 2008; Terracciano et al., 2005), the GLOBE study (House, 2004) and the Global Innovation Index (INSEAD, 2010, 2011). We test our model based on the triangulation of these data.

First, we explain and clarify the attributes and characteristics of nationally aggregated personality factors and national cultural practices. Second, we derive theory-based hypotheses of their relationship with national innovativeness. Based on these hypotheses, we propose our model. We test this model on a sample of 33 countries and show that innovation-relevant national personality profiles are linked with innovation-relevant national cultural practices in most of the countries. The recently proposed direct relationships (Steel, Rinne & Fairweather, 2012) between national personality profiles and national innovativeness vanish when national cultural factors are included in the model. Theoretically and statistically, this supports our model's conceptualization of national cultural practices as a mediator (Baron & Kenny, 1986). Overall, the theoretical integration and empirical analysis in one model helps extend knowledge about the interplay of personality and cultural factors in the context of innovation. Additionally, our study provides practical implications for innovation management, leadership and personnel selection.

Theory

The three fundamental constructs underpinning our study are nationally aggregated personality factors (McCrae & Terracciano, 2005a, 2005b), national cultural practices (House, 2004), and innovation at the national level (INSEAD, 2010, 2011).

Nationally aggregated personality factors are aggregations of the individual-level personality factors to the national level (McCrae & Terracciano, 2008). Attempts to aggregate personality to the national level are not new. The notion of 'Volksseele' (Wundt, 1913) was a common concept, followed by several other national-level psychological concepts throughout the 20th century (cf. Jahoda, 1982; Peabody, 1988; Inkeles, 1997; Bock, 1999; Benedict, 2005). Recent research, based on the factor model of personality (McCrae & Costa, 2001), has shown that 'the constructs represented by the Five Factors are applicable to cultures as well as to people' (McCrae & Terracciano, 2008, p. 252). Aggregations of the factors show that substantial correlations across methods (self-reports vs observer ratings) (McCrae & Terracciano, 2008) are related to Hofstede's dimensions of culture (Hofstede, 2009), have a meaningful geographic distribution (Allik & McCrae, 2004), and are also correlated with other country-level data such as gross domestic product (GDP), life expectancy and mental and physical health factors (McCrae & Terracciano, 2008).

National cultural practice dimensions are measuring 'the way things are done in this culture' (Triandis, 2004, p. xv); they represent observable manifestations of the national cultural environment. In particular, they are more suitable for our study compared to other frameworks of national culture (i.e., Hofstede's) which mix up cultural values and practices in one measure. Empirically speaking, the GLOBE practice dimensions are different from cultural values (Taras, Steel & Kirkman, 2010, p. 1330) and considered as successful predictors of societal outcomes (Stephan & Uhlaner, 2010). National innovativeness is a measure of how innovative a country is in terms of scientific and creative outputs (INSEAD, 2010, 2011).

Personality and Innovation

The dominant model of personality, the Five Factor Model (McCrae & Costa, 2001), argues

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that human personality can be explained by five factors, each of them consisting of six facets (McCrae & Terracciano, 2005b). These meta-analytically validated five major factors[1] of personality are agreeableness, conscientiousness, extraversion, neuroticism and openness to experience (Barrick & Mount, 1991).

Agreeableness consists of the facets (subfactors) of trust, straightforwardness, altruism, compliance, modesty and tender-mindedness (McCrae & Terracciano, 2005b). Agreeable individuals are concerned with co-operation and social harmony, want to get along with others, tend to have an optimistic view on human nature, and tend to be basically honest, decent and trustworthy. Contrarily, disagreeable individuals tend to place their self-interest above getting along with others and tend to be indifferent to the well-being of others, which often makes them appear unfriendly and uncooperative (cf. McCrae & Costa, 1985; Barrick & Mount, 1991).

Conscientiousness consists of the facets of competence, order, dutifulness, achievement-striving, self-discipline and deliberation (McCrae & Terracciano, 2005b). Individuals with high conscientiousness have a tendency to plan, show higher persistence and are often regarded by others as intelligent and reliable. Individuals with low conscientiousness tend to be unreliable, show lower ambition, and often exhibit more affinity for short-term solutions and pleasures (cf. McCrae & Costa, 1985; Barrick & Mount, 1991).

Extraversion consists of the facets of warmth, gregariousness, assertiveness, activity, excitement-seeking and positive emotions (McCrae, 1982; McCrae & Terracciano, 2005b). Extraverted individuals tend to have a pronounced engagement with the external world, are enthusiastic, full of energy, and tend to experience positive emotions. Contrarily, introverts lack this exuberance, energy and activity, and tend to be quiet, deliberate and disengaged (cf. McCrae & Costa, 1985; Barrick & Mount, 1991).

Neuroticism consists of the facets of anxiety, angry hostility, depression, self-consciousness, impulsiveness and vulnerability (McCrae, 1982; McCrae & Terracciano, 2005b). Individuals scoring high on neuroticism have a tendency to experience negative feelings, to be emotionally reactive, and to emotionally overreact to events which would not affect most people. This often makes them interpret normal situations as threatening and difficult, which can diminish their ability to think clearly, make decisions and cope with stress. Contrarily, individuals who score low on neuroticism are calm, emotionally stable and relatively free of persistent negative feelings (cf. McCrae & Costa, 1985; Barrick & Mount, 1991).

Openness to experience consists of the facets of fantasy, aesthetics, feelings, actions, ideas and values (McCrae, 1982; McCrae & Terracciano, 2005b). Individuals scoring high in openness to experience tend to be intellectually curious, are interested in art, sensitive to beauty, tend to be more aware of their feelings, and to think and act in individualistic, nonconforming ways. Individuals who score low on this trait tend to have a narrow, common sphere of interest and to prefer plain and straightforward issues over complex, ambiguous and subtle subjects. Overall, they have a tendency to prefer familiarity over novelty and conservatism over change (cf. McCrae & Costa, 1985; Barrick & Mount, 1991).

The Five Factor theory states that these personality factors are biologically based (McCrae & Costa, 2001) latent psychological constructs which are transcultural and universal (Paunonen et al., 1996; Church, 2000; McCrae & Terracciano, 2005b). This means that their basic structure as well as the developmental changes from adolescence to adulthood (McCrae et al., 1999) are similar in all cultures (McCrae & Costa, 2001). The Big Five factors are a well-established and useful set of personality dimensions (Hofstede & McCrae, 2004). Initially dedicated to the individual level, they have recently been successfully applied to the national level (McCrae & Terracciano, 2008). The fact that the Five Factors can be meaningfully aggregated at the national level (McCrae & Terracciano, 2006) indicates the existence of an isomorphic relationship between the individual level and the national level concepts (van de Vijver, Hemert & Poortinga, 2008).

Previous research on the relationship between these personality factors and innovation at the individual level has shown that three personality dimensions are significantly related to innovation: agreeableness, extraversion and openness to experience (Kwang & Rodrigues, 2002). However, a recent study by Steel, Rinne and Fairweather (2012) found significant relationships at the national level only for agreeableness and openness to experience.

People who rank high on agreeableness are trustworthy, honest and altruistic (Zhao & Seibert, 2006). At the individual level, several studies reported a negative relationship between agreeableness and innovation (Patterson, 2002), which means individuals with lower agreeableness tend to be more innovative. However, the relationship may be different at societal levels of analysis. Agreeableness largely influences how people conduct their social relationships. As innovations not only consist of creative inventions, but

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also have to be implemented (Huelsheger, Anderson & Salgado, 2009), agreeableness is connected with implementation of innovations. In order to be successful, inventors have to manage social networks and interact with business partners, organizations or governments. Higher levels of agreeableness support these social interactions (Steel, Rinne & Fairweather, 2012). Steel, Rinne and Fairweather (2012) reported a positive relationship between national scores of agreeableness and innovation at the national level.

Openness to experience includes aspects like imagination, intellectual curiosity and the tendency to re-examine traditional values (King, Walker & Broyles, 1996). People who are open to experience are willing to engage in new and novel experiences and ideas and like to challenge philosophies and worldviews. Therefore, this factor is strongly associated with creativity (George & Zhou, 2001; Shalley, Zhou & Oldham, 2004). Creativity is a main component of innovation and especially important in the invention phase of innovations (Amabile, 1996; Miron, Erez & Naveh, 2004). Overall, openness to experience is positively related with innovation, and Steel, Rinne and Fairweather (2012) recently reported a positive relationship between national scores of openness to experience and innovation at the national level. Based on these considerations and in line with previous research (Steel, Rinne & Fairweather, 2012), we assume that:

H1: The nationally aggregated personality factors of agreeableness and openness to experience are positively linked to national innovativeness.

Personality and Culture

Previous research has shown that nationally aggregated personality scores are significantly correlated with national culture (Hofstede & McCrae, 2004, p. 52). Despite controversy about the underlying mechanism, Hofstede and McCrae (2004) pointed out that even though societies are mixes of individuals, differences in the mean level of national personality profiles tend to promote different cultural practices (Hofstede & McCrae, 2004, p. 58; McCrae, 2004, p. 5). This is supported empirically as all five personality factors are at least significantly related with at least one cultural dimension, and all cultural dimensions are related with at least one personality factor (Hofstede & McCrae, 2004, p. 68).

The Hofstede dimension of individualism, which is positively related to national innovation, is significantly related to three personality dimensions (Agreeableness: $r = 0.37$, $p < 0.05$; Extraversion: $r = 0.51$, $p < 0.001$; Openness to experience: $r = 0.33$, $p < 0.05$). The Hofstede dimension of power distance, which is reported to be negatively linked to national innovation, is also related to these three dimensions (Agreeableness: $r = -0.31$, $p < 0.05$; Extraversion: $r = -0.46$, $p < 0.001$; Openness to experience: $r = -0.41$, $p < 0.001$) (McCrae & Terracciano, 2005a, p. 417).

Basically, we argue that the innovation-related national personality profiles of agreeableness and openness to experience are linked to cultural environments, which are reflected by specific cultural practice dimensions. Conceptually speaking, this means that we are interested in the relationship between two higher-order factors: innovation-related national personality factors (reflected in agreeableness and openness to experience) and innovation-related cultural practices (reflected in future orientation, institutional collectivism, in-group collectivism, performance orientation and uncertainty avoidance).

We base our second hypothesis on the synthesis of the following theoretical arguments. First, personality factors are relatively fixed and stable (McCrae & Costa, 2001). Therefore, culture only shapes the manifestation and expression of personality factors. This results in characteristic adaptations. Characteristic adaptations include values, skills, habits, attitudes, interests, roles and relationships (McCrae, 2001, p. 819). Second, personality factors at the national level simultaneously influence culture. The reverse causation hypothesis (Hofstede & McCrae, 2004, p. 76) shows that societal-level personality factors influence manifestations of culture, such as practices and institutions. These cultural manifestations are social adaptations and reflections of the psychological environment which the aggregated distribution of personality factors represents (Hofstede & McCrae, 2004, p. 76).

These two core arguments, the characteristic adaptations and the reverse causation hypothesis, augment each other: the former by supporting culture related to the underlying trait structure, the latter by facilitating the manifestation into cultural practices. Therefore, we assume that countries having innovation-supportive national personality profiles should also have an innovation-supportive national cultural practices environment, and vice versa. Therefore, we hypothesize:

H2: Innovation-related national personality profiles are linked to innovation-related national cultural practices.

Culture and Innovation

At the individual and organizational levels of analysis, research has shown that innovation is

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influenced by a myriad of contextual factors such as: social resources and networks (Balkundi & Harrison, 2006; Perry-Smith, 2006), leader roles, characteristics and behaviours (Krause, 2004; Tierney, 2008), work group autonomy and teamwork (West et al., 2004), diversity (Shin & Zhou, 2007), feedback (Zhou, 2008), work design, job characteristics (Oldham & Cummings, 1996; Shalley, Zhou & Oldham, 2004), organizational structure (King & Anderson, 2002), culture, climate (West & Richter, 2008), size, formalization and complexity (Burns & Stalker, 2001), support (Amabile et al., 2005), organizational ambidexterity (Gibson & Birkinshaw, 2004) and conflict (de Dreu & Nijstad, 2008). Focusing on the individual level, all of the above-mentioned elements represent contextual factors which moderate the relationship between innovation-relevant personality factors and outputs of innovation. At the national level, it is very difficult, if not virtually impossible, to integrate this multitude of environmental factors. Therefore, we use cultural practices, 'the way things are done in this culture' (Triandis, 2004, p. xv), as a measure and proxy for these situational contingencies.

Whereas nationally aggregated personality factors describe tendencies of dispositions in different countries, the GLOBE cultural practice dimensions describe norms of behaviour (Stephan & Uhlaner, 2010) and the interaction between individuals in different nations. Cultural practices act as informal institutions (Peng, 2002), which regulate and often constrain human interactions (North, 1991; Scott, 1999) and represent observable manifestations of the national cultural environment.

The GLOBE study proposes nine dimensions of cultural practices: assertiveness, future orientation, gender egalitarianism, human orientation, institutional collectivism, in-group collectivism, performance orientation, power distance and uncertainty avoidance. Empirically speaking, especially the GLOBE national cultural practice dimensions of future orientation, institutional collectivism, in-group collectivism, performance orientation and uncertainty avoidance are significantly related to innovation at the national level.

Future orientation (practice) is positively related with national innovation as it includes such factors as planning, developing and acting according to strategies as well as the capacity and willingness to imagine future contingencies, to formulate future goals and to develop strategies to reach them (Trompenaars & Hampden-Turner, 2010). High future orientation is associated with the general assumptions of the world as being open and configurable, as opposed to being closed and predetermined. This results in more planning and goal-setting. These goals tend to be of higher valence, resulting in more generation and implementation of new ideas.

In-group collectivism (practice) is negatively related with national innovation. This is explained by the strong interdependence of group members and goals, which makes it difficult to generate and implement new ideas (Gelfand et al., 2004). High in-group collectivism societies have more rigid group structures and hierarchies, which makes the exchange of ideas difficult (Shane, 1993, p. 62), lowers the willingness to change, and increases the danger of group thinking.

Institutional collectivism (practice) is positively related with national innovation. This is because it influences the 'degree to which organizational and societal institutional practices encourage and reward collective distributions of resources and collective action' (House, 2004, p. 12). Conceptually speaking, this form of collectivism can be regarded as a form of patriotism that may foster innovation when it encourages society-wide efforts in science and technology. This assumption is strengthened by a recent study by Taylor and Wilson (2012) on the two GLOBE collectivism dimensions and national innovation. They showed that the impact of collectivism on innovation depends on the 'kind of collectivism' and reported negative effects for in-group collectivism, but positive effects for institutional collectivism.

Performance orientation (practice) is positively related with national innovation. It comprises such elements as a higher need for achievement, which leads to a positive disposition towards challenges and improvements. High performance-oriented societies tend to desire to do things better and tend to be more innovative (Javidan, 2004). This achievement orientation is related to concepts such as knowledge, progress, work, freedom, taking the initiative (Osgood, May & Miron, 1975), personal success, competency (Schwartz & Bilsky, 1987) and a higher internal locus of control (Smith, Trompenaars & Dugan, 1995).

Uncertainty avoidance (practice) is positively related with national innovation. Traditionally, high uncertainty avoidance has been associated with seeking structure and orderliness, sticking to formalized procedures, and trying to decrease uncertainty by laws, accounting, planning and extended usage of control systems (Hofstede, 2009). This leads to low tolerance for new and different ideas (De Luque & Javidan, 2004, p. 607), which is detrimental to innovation. However, this consideration is based on the Hofstede dimension which

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is conceptually close to the GLOBE value dimension. The GLOBE practice dimension measures conceptually oppose behavioural norms. High GLOBE uncertainty avoidance (practice) countries tend to have established rules and laws, which results in a more stable environment and decreases the need for inhabitants to focus too much on basic needs. This provides freedom to experiment (Venaik & Brewer, 2010, p. 1308), to be creative, and to take the risk of trial and error. This increases freedom of innovation and supports national innovation.

At the core we propose that innovation-friendly cultural practices constitute an environment that is characterized by low hierarchies and less rigid structures, high individualism, little groupthink, a certain degree of patriotism and collective action, and the tendency to plan, have and set goals emerging from an internal locus of control. This is combined with achievement orientation, a positive disposition towards challenges and improvements and a stable environment with cultural practices, which makes it possible to take risks and provides freedom for trial and error.

Therefore, and in line with previous research (Shane, 1993; Taylor & Wilson, 2012), we posit that such an environment will be beneficial to the national level of innovation, whereas the opposite cultural scenario would be detrimental:

H3: Innovation-related GLOBE cultural practice dimensions are linked to national innovativeness.

Mediation Effect of Culture

National cultural practices not only influence the relationship between national personality factors and national innovativeness; they are also influenced by national personality factors themselves. This makes them a mediator. In the literature, there is frequent confusion considering the differences between moderator and mediator effects, which results in an improper interchangeable usage[2] of these terms. Therefore, we briefly explain what constitutes a mediation effect and why national cultural practices act as a mediator in our model. The reason why the moderator–mediator differentiation is of particular importance in the context of our study is that national cultural practices change from a moderator to a mediator when changing the level of analysis from the individual to the national level.

At the individual level, cultural practices moderate the relationship between individual personality factors and innovative behaviour. That is because the individual can hardly influence national cultural practices. In contrast, at the national level, cultural practices may act as a mediator as they are influenced by national dispositions in personality (Hofstede & McCrae, 2004). Conceptually speaking, this argument is supported by the consideration that in statistics, moderators should not be correlated with the independent variable, but mediators must (Baron & Kenny, 1986, p. 1174). The first is more likely the case when investigating the personality–culture relationship at the individual level, the second when investigating it at the national level.

In addition to the existence of the mediation effect, the characteristics of the underlying mechanisms are of interest, too. For our considerations we refer to the person-environment-fit theory (Muchinsky & Monahan, 1987; Edwards, 1996; Kristof, 1996). The person-environment-fit theory states that the congruence between person and environment positively influences behavioural outcomes, for example creativity (Choi, 2004). Kristof (1996) identified two basic types of fit between people and their environment: supply–values fit, and demands–abilities fit. Supply–values fit is present when the environment supplies attributes that are desired or valued by the persons; demands–abilities fit occurs when people have skills, knowledge and other resources that are required by their environment (Edwards, 1996).

We argue that person-environment-fit theory also works on the societal level. In accordance with our first hypothesis, on the aggregated level, environmental factors depend on the individuals: the people make the place (Schneider, 1987). In the context of national innovativeness, supply-fit occurs when national cultural practices contain innovation-related attributes and characteristics which are desired by the citizens. Consequently, demand-fit occurs when there is congruence between what is demanded by the environment and what is possessed by the citizens.

Concretely, this means that if an innovation-friendly constellation of national personality factors (high agreeableness and high openness to experience) and cultural practices (low in-group collectivism, high institutional collectivism, future orientation, performance orientation and uncertainty avoidance) exists in a country, good supply-fit (environment supplies attributes which are desired by the people) as well as good demand-fit (people provide attributes which are desired by the environment) is enabled (Edwards, 1996), which in turn relates to national innovativeness. In contrast, if national cultural practices are to the contrary, innovative national personality

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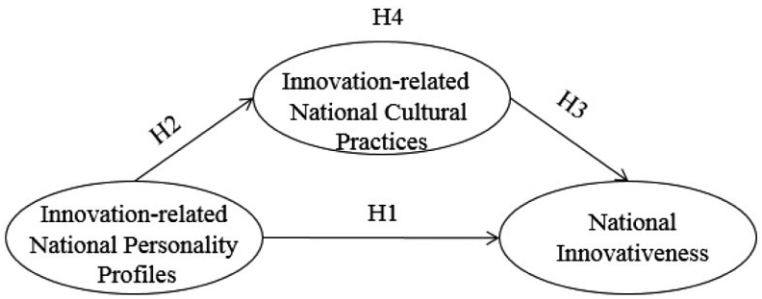

Figure 1. Model and Hypotheses

factors cannot manifest themselves and will not relate to innovativeness.

Therefore, we hypothesize the indirect effect between national personality profiles and national innovativeness via national cultural practices to be higher than the direct effect, which means mediation.

> *H4: Innovation-related national cultural practices mediate the relationship between national personality profiles and national innovativeness.*

Figure 1 illustrates our model of national innovativeness.

Method and Empirical Data

Empirical Data

We investigate the relationship between culture, personality and innovation at the national level. This requires operationalizing all constructs on an equal level of analysis, that is, the national level. Switching the levels would lead to either ecological fallacy or reversed ecological fallacy. Ecological fallacy occurs when analysing individuals based on societal data; reversed ecological fallacy occurs when investigating societies based on individual-level data (Hofstede & McCrae, 2004, p. 65; Adamopoulos, 2008). We avoid this by employing national-level data only.

To test our model, we triangulate three different and independent datasets. To be included into our sample, the required data had to be reported in all employed data sources. That is, the Personality Profiles of Cultures Project, the GLOBE study, as well as from two editions (2010 and 2011) of the Global Innovation Index.

The criteria of selection result in a sample of $N = 33$ countries. Moreover, by choosing three separate and independent data sources, we eliminate the danger of common method bias and common source bias (see Podsakoff, MacKenzie & Lee, 2003). Table 1 provides an overview of the countries analysed in this study, ranked by their level of innovativeness based on scientific and creative outputs, the number of participants of the Personality Profiles of Cultures Project per nation and the standardized indicator data for innovation-related national personality factors and national cultural practices.

Measurement of Aggregated Personality, National Cultural Practices and National Innovation

For measuring aggregate personality factors, we use data reported by the Personality Profiles of Cultures project. The project used the Revised NEO Personality Inventory (NEO-PI-R; Costa & McCrae, 1992) to collect aggregate personality data from 51 cultures representing six continents (McCrae & Terracciano, 2005a, p. 410). The NEO-PI-R is the most widely used measure of the Big Five factors. It measures 30 sub-factors and consists of 240 items overall. It is a well-validated and reliable instrument (McCrae, 1982; Costa & McCrae, 1992, 2008).

Personality profiles of cultures and aggregate personality factors 'characterize cultures in terms of the assessed mean personality trait level of culture members' (McCrae & Terracciano, 2005a, p. 408). Standard measures of personality traits can be administered to a representative sample from each culture to be compared and mean profile levels can be computed. However, there are some methodological requirements to make cross-cultural comparison of personality profiles of cultures meaningful: the same construct must exist in each culture, the measuring instrument must maintain construct validity in all cultures to be compared, and the scales have to show scalar equivalence, which means that the raw score has the same absolute interpretation in each culture (van de Vijver & Leung, 1997; McCrae, 2001). The results of the Personality Profiles of

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Table 1. Countries Analysed and Indicator Data

Rank	Country	*N*	Agreeable	Openness	Future orientation	In-group collectivism	Institutional collectivism	Performance orientation	Uncertainty avoidance	Scientific outputs	Creative outputs
1	Switzerland	479	1.93968	2.22594	2.18547	–1.63425	–0.07712	2.53852	2.21573	1.82	1.39
2	Hong Kong	207	–1.6435	–1.19579	0.17026	0.22407	–0.48568	1.63451	0.08522	0.34	2.34
3	Denmark	153	1.72251	2.31481	1.72548	–2.22488	1.67726	0.88546	2.04529	1.02	1.18
4	United States	918	–0.4491	0.18179	0.71787	–1.37495	–0.05309	1.01461	0.05113	1.35	0.50
5	Canada	167	–0.0148	–0.70697	1.30929	–1.37495	0.3074	1.04044	0.71585	0.92	1.02
6	New Zealand	200	0.09378	0.04848	–0.74973	–2.29691	1.74935	2.0736	1.26126	1.47	0.65
7	United Kingdom	194	0.14807	1.55937	1.11215	–1.57663	0.18724	0.26557	0.98856	1.12	0.47
8	Japan	191	–0.612	0.5373	1.06834	–0.65467	2.39823	0.42054	–0.08522	1.10	0.23
9	Germany	593	1.1796	2.1815	0.92596	–1.15166	–0.99036	0.60135	1.96007	0.84	0.90
10	Ireland	106	1.34247	–1.10691	0.27978	–0.07845	0.81208	0.62718	0.22157	0.87	0.08
11	South Korea	196	0.20236	0.40398	0.21407	0.77149	2.32614	1.22124	–1.02264	1.44	0.29
12	Austria	158	0.36523	0.22623	1.46262	–0.40977	0.25933	1.06627	1.67032	0.12	0.81
13	Australia	206	0.03948	0.31511	–1.53829	0.48337	–1.37488	–1.10337	–0.83516	0.24	0.30
14	France	274	0.74527	0.62617	–0.13641	–0.7411	–0.07712	0.96295	0.92038	0.48	0.50
15	Slovenia	209	–0.5034	–0.52922	–0.53069	0.45456	–0.34148	–1.1292	–0.61359	–0.05	0.27
16	Malaysia	289	0.96243	–1.15135	1.28739	0.42575	0.52369	0.26557	0.80107	0.19	–0.22
17	Spain	200	0.79956	–0.52922	–0.6183	0.51219	–0.8702	–0.14769	–0.28975	–0.15	0.10
18	China	177	–0.7206	0.04848	–0.26783	0.98757	1.05241	0.80798	1.17604	1.05	1.51
19	Portugal	198	0.63669	0.58173	–0.07069	0.67065	–0.50971	–1.05171	–0.27271	–0.59	0.10
20	Italy	195	–0.9921	1.02611	–1.01258	–0.26572	–1.15859	–1.02588	–0.46019	–0.42	0.07
21	Kuwait	468	0.5824	–1.06247	–1.36306	0.75708	0.21127	–0.6901	–0.17044	–0.01	–0.45
22	Poland	197	–0.7749	–0.61809	–1.25353	0.541	0.66789	–0.25101	–0.69881	–0.74	–0.41
23	Thailand	209	–0.1777	–0.66253	–1.16592	0.78589	–0.84617	–0.56096	–0.56245	–0.83	–0.38
24	Brazil	597	0.20236	–0.44034	0.21407	–0.02082	–0.70197	0.13642	–0.64768	–0.56	–0.22
25	Russia	320	0.20236	–0.12927	–1.62591	0.94435	0.81208	–1.36166	–1.75554	–0.24	–0.87
26	India	185	0.96243	–0.52922	0.52073	0.91554	0.04304	0.13642	–0.17044	–0.78	–0.34
27	Turkey	208	0.5824	–0.79584	–0.13641	0.88673	–0.50971	–0.61262	–0.76698	–1.15	–0.23
28	Argentina	204	0.36523	–1.72904	–1.53829	0.48337	–1.37488	–1.10337	–0.83516	–0.91	–0.10
29	Mexico	173	–1.3178	0.09292	–0.1145	0.64184	–0.67794	–0.22518	–0.10226	–0.92	–0.89
30	Philippines	197	–1.3721	0.35954	0.25788	1.39093	0.33143	0.39471	–0.7329	–0.49	–1.17
31	Indonesia	196	–0.5034	–0.48478	–0.42116	0.46897	0.09111	0.21391	–0.34088	–1.10	–1.09
32	Morocco	171	–2.0779	–0.66253	–0.66211	1.72226	–0.12519	–0.22518	–0.10226	–1.23	–1.29
33	Nigeria	184	–1.915	–0.3959	0.32359	0.23848	–0.55777	–0.6901	0.03409	–1.23	–0.28

Notes: *N* = Personality profiles of cultures project sample size per country and standardized indicator values.
Sorted by national innovativeness.

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Table 2. Measurement of Constructs

Construct	Components	Measurement model	Source
Innovation-related national personality profiles	1. Agreeableness 2. Openness to experience	Reflective	McCrae and Terracciano (2005a, 2005b)
Innovation-related national cultural practices	1. Future orientation 2. In-group collectivism 3. Institutional collectivism 4. Performance orientation 5. Uncertainty avoidance	Reflective	House (2004)
National innovativeness	1. Scientific outputs 2. Creative outputs	Reflective	INSEAD (2010, 2011)

Cultures Project showed that this is the case (McCrae & Terracciano, 2005a, p. 407), and that thus the NEO-PI-R can be used to measure personality profiles of cultures (McCrae, 2004, p. 10). The authors reported aggregated personality[3] data for 51 countries, of which we could use 33 in our analysis.

As a measure of cultural practices, we use data reported in the GLOBE study. The GLOBE study is also a long-term research project, which was initiated in 1994 by Robert House (House, 2004). The GLOBE study collected data from more than 17,300 middle managers of 951 local (non-multinational) organizations from three industries covering 62 societies (Triandis, 2004, p. xv). The three industries analysed were food processing, financial services and telecommunication services (Triandis, 2004, p. xv). These industries were chosen because they existed in all the investigated countries and because they are distinct from each other, which increases generalizability. In contrast to the well-known study by Hofstede, the GLOBE study explicitly differentiates between cultural values and practices and reports separate data for the two manifestations of national culture. We use GLOBE practice dimensions as proxies for the present cultural environment in our study, as they represent observable manifestations of national culture (Taras, Steel & Kirkman, 2010) and because recent research has shown that cultural practice dimensions are more closely related to national level outputs such as the national level of innovation than are values (Stephan & Uhlaner, 2010). Combining these arguments suggests using the data from the GLOBE practice dimensions in our study.

Finally, we use data from the Global Innovation Index as a measure of national innovativeness. The Global Innovation Index was launched by INSEAD to find metrics, measurements and approaches to capture the 'whole picture of innovation' (INSEAD, 2011, p. 3). It integrates 'hard and soft data' (INSEAD, 2010, p. 7), that is, economic data and survey results from international organizations such as the World Bank and the United Nations. Conceptually, methodically and statistically speaking, the index is regarded as the most comprehensive measure of innovation at the country level. We segmented the index and extracted two of the seven components which are the most accepted and frequently used in innovation research: scientific outputs, consisting of knowledge creation, knowledge impact and knowledge diffusion (INSEAD, 2011, p. 344); and creative outputs, consisting of creative intangibles and creative goods and services (INSEAD, 2011, p. 346).[4] Additionally, we calculated standardized composite measures of these two indicators using the Global Innovation Index for 2010 and 2011 in order to increase stability (see Table 2).

We test our hypotheses and our model by using partial least squares (PLS) equation modelling. Two main arguments support using this approach in this study. First, the PLS approach has lower requirements considering the distributional assumptions (Schwarz et al., 2009) and quantity of data. This allows for reliable estimation of complex theoretical models with a small sample size (Chin, 1998; Schloderer & Balderjahn, 2005; Tenenhaus et al., 2005). The small sample size of 33 countries thus suggests employment of the PLS approach. Second, the PLS approach is particularly recommended for the analysis of aggregated data (Schloderer & Balderjahn, 2006, p. 67). As all indicators used are national-level

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Table 3. Correlations between First- and Second-Order Factors

First-order factors	1	2	3	4	5	6	7	8	9	10	11
1. Agreeableness	–										
2. Openness to experience	0.31	–									
3. Future orientation	0.33	0.49**	–								
4. In-group collectivism	0.41*	–0.58***	–0.56**	–							
5. Institutional collectivism	0.11	0.16	0.31	–0.25***	–						
6. Performance orientation	0.23	0.34	–0.65***	–0.59***	0.47**	–					
7. Uncertainity avoidance	–0.40*	0.56**	0.70***	–0.71***	0.19	0.68***	–				
8. Scientific outputs	0.42*	0.51**	0.51**	–0.70***	0.54***	0.71***	0.58***	–			
9. Creative outputs	0.28*	0.34	–0.46**	–0.60***	0.13	0.61***	0.62***	0.70***	–		
Second-order factors (final model)											
10. Innovation-related national personality profiles	0.78***	0.84***	0.52**	–0.62***		0.35*	0.60***	0.57***	0.38*	–	
11. Innovation-related national cultural practices	0.40*	0.58**	0.85***	–0.83***		0.85***	0.91***	0.73***	0.66***	0.61***	–
12. National innovativeness	0.38*	0.46**	0.52**	–0.70***		0.71***	0.65***	0.92***	0.92***	0.52***	0.75***

Notes: Pearson correlations. Two-tailed significance. Sample size is $N = 33$ countries.
Correlations between second-order factors based on PLS latent variable scores of the final model (without institutional collectivism).
* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

aggregates, this further recommends the using this approach. Combining these arguments, the application is justified. We use the software SmartPLS (Ringle, Wende & Will, 2005) to test our model.

Results

Similar to covariance structure analysis, the PLS approach allows extensive model testing. However, the process of model evaluation is primarily divided into two steps: evaluation of the outer and the inner model. The outer (measurement) model specifies the relationships between the indicator variables (innovation-related national personality profiles and innovation-related national cultural practice dimensions) and the second-order factors, whereas the inner (structural) model specifies the relationships among the second-order factors themselves. The overall quality of the model is derived from both measurements and a two-step approach of reporting is recommended (Chin, 2010; Götz, Liehr-Gobbers & Hildebrandt, 2010). Table 3 shows the correlations between the first- and second-order factors.

Evaluation of the Measurement Model

We operationalized our three latent variables as reflective constructs. All indicator loadings, except institutional collectivism, are above the recommended value of 0.70. The low indicator loading (0.46) of institutional collectivism and the requirement of model parsimony (Blalock, 1979; Chin, 2010) motivated us to remove this indicator. Rejection of institutional collectivism resulted in slight increases in composite reliability (CR; $\Delta = 0.02$) and the coefficient of determination (R^2; $\Delta = 0.01$) of innovation-related national cultural practices and a slight decrease of R^2 ($\Delta = -0.02$) of national innovativeness.

All indicator loadings in the model were also significant, at least to the 1% level running 1,000 bootstrap samples; therefore, indicator reliability can be assumed. For all constructs the CR is between 0.74 and 0.92, that is above the recommended threshold of 0.70; therefore construct reliability can be assumed (see Table 4).

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Table 4. Result of the Fit of Measurement Model and R^2 for the Endogenous Construct of the Final Model

Composite	Components	Factor loadings	*t*-values	AVE	CR	R^2
Innovation-related national personality profiles	1. Agreeableness	0.74	4.54	0.65	0.78	
	2. Openness to experience	0.87	9.84			
Innovation-related national cultural practices	1. Future orientation	0.83	9.44	0.73	0.74	0.39
	2. In-group collectivism	–0.85	21.20			
	3. Performance orientation	0.85	15.31			
	4. Uncertainty avoidance	0.91	23.13			
National innovativeness	2. Scientific outputs	0.91	33.13	0.85	0.92	0.58
	3. Creative outputs	0.93	45.41			

Notes: AVE: Average variance extracted; CR: Composite reliability; R^2: Coefficient of determination

Discriminant validity is measured with the average variance extracted (AVE) parameter. The AVE values of our model are between 0.65 and 0.85, that is, well above the recommended threshold of 0.5. To ensure discriminant validity, we employed two widely accepted measures in PLS modelling: the Fornell and Larcker criterion (Fornell & Larcker, 1981) and the cross-loading criteria (Henseler, Ringle & Sinkovics, 2009).

According to the Fornell and Larcker criterion, the square roots of the AVE values have to be greater than the values in the corresponding rows and columns of the correlation matrix of the latent constructs (Henseler, Ringle & Sinkovics, 2009). According to the cross-loading criteria, all indicators should load highest on their corresponding construct and every construct should load highest on its own items (Henseler, Ringle & Sinkovics, 2009). Tables 3 and 5 show that our model fulfils both criteria; therefore discriminant validity can be assumed.

Table 5. Correlation Matrix of the Latent Constructs with Root of AVE in the Diagonal

Composite	(1)	(2)	(3)
1. Innovation-related national personality profiles	**0.81**		
2. Innovation-related national cultural practices	0.62	**0.86**	
3. National innovativeness	0.53	0.76	**0.92**

Evaluation of the Structural Model

The R^2 measure of the endogenous construct on national innovativeness is 0.58, which is good to substantial (Henseler, Ringle & Sinkovics, 2009; Schloderer, Ringle & Sarstedt, 2009). Significance of the path models has been tested by running 1,000 bootstrap samples. The path coefficient between the second-order factors of innovation-related national personality profiles and innovation-related national culture is significant ($\beta = 0.62$; $p < 0.001$). The path coefficient between the second-order factors of innovation-related national culture and national innovativeness is also significant ($\beta = 0.71$; $p < 0.001$). However, the path between the second-order factors of innovation-related national personality profiles and national innovativeness does not reach statistical significance ($\beta = 0.09$; n.s.) (see Figure 2).

These findings support three of our four hypotheses. In particular, the finding that the direct path between national personality profiles and national innovativeness is not statistically significant (which leads to rejection of Hypothesis 1) when including national culture in the model supports our conceptualization of national culture as a mediator (Baron & Kenny, 1986) (see Table 6).

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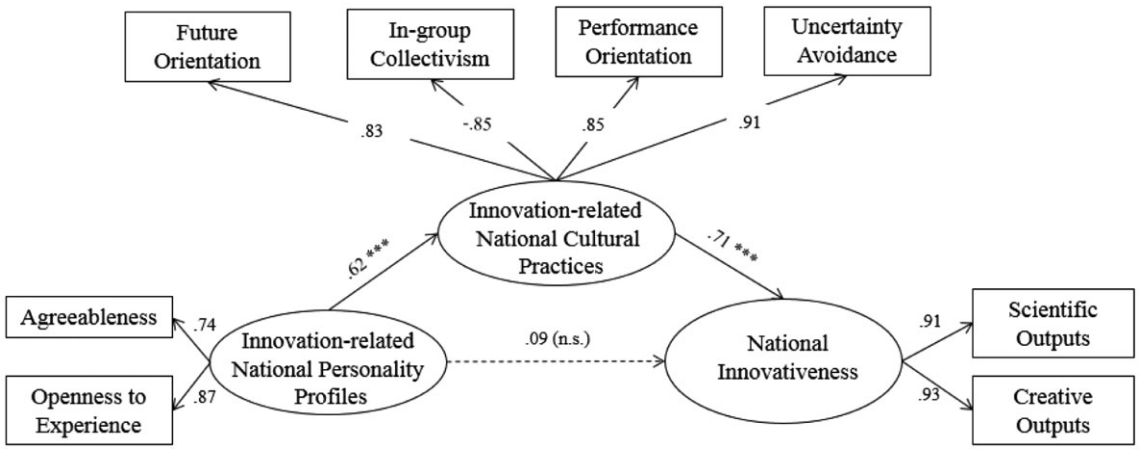

Figure 2. Structural Model

Table 6. Model Results and Significance

	Path	*t*-value
Innovation-related national personality profiles → National innovativeness	0.09	0.47 (n.s.)
Innovation-related national personality profiles → Innovation-related national cultural practices	0.62	4.40***
Innovation-related national cultural practices → National innovativeness	0.71	5.19***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; n.s.: not significant

Discussion

In this study, we proposed a model which includes national personality and cultural factors. In doing so, we have extended current research as these two factors have not yet been considered in one single model as antecedents of innovation.

We demonstrated that two of the Big Five dimensions (agreeableness and openness to experience) are positively linked to innovation-supportive national cultural practices (high future orientation, performance orientation, uncertainty avoidance and low in-group collectivism). Moreover, despite theoretically reasonable argumentation and related results of recent research (Taylor & Wilson, 2012), we found out that institutional collectivism does not seem to be a major influence on innovation-supportive national cultural practices. Removing this indicator from the model did not significantly decrease model quality. Additionally, we showed that these national cultural practice dimensions act as strong mediators between the national personality profiles and the level of national innovation such that the direct relationship between national personality profiles and national innovation loses statistical significance. Methodologically speaking, this is analogous to controlling the direct relationship for the effect of a third variable, namely national cultural practices (Baron & Kenny, 1986). Concretely, this means that national innovativeness is more closely related to cultural factors than to national personality profiles and that national personality profiles rather could be considered as antecedents of cultural factors.

We did not hypothesize or test causal directions in our model. However, based on the characteristics of the nationally aggregated personality factors and national cultural practices and in congruence with previous research, it is more reasonable to assume that personality and cultural factors influence innovation (Shane, 1993; Taylor & Wilson, 2012) than the other way around.

Our model also carries important practical implications. As national cultural practices is influenceable, this opens up the possibility of intervention at the societal level. In the case of Australia, for example, our model would suggest that the greatest advances in national innovativeness would be possible if national policies focused on interventions which would positively affect innovation-supportive cultural practices. For Malaysia, China and Hong Kong, the opposite applies. In these three countries, the overall cultural practices foster national innovativeness; however, the

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innovation-relevant aggregated personality factors do not. Therefore, interventions would be most efficient if the focus was put on facilitating the manifestation of innovation supporting aggregated personality factors. Finally, in countries such as Morocco, Nigeria, Russia or Thailand, it would be ideal if the focus was put on both factors simultaneously. Personality factors are biologically-based, stable latent psychological constructs that cannot be influenced (McCrae & Costa, 2001). However, culture can shape the expression of personality factors via characteristic adoptions (McCrae & Costa, 2001). Essentially, national cultural practices seem to be the only reasonable and to a certain degree adjustable screw on the national level. This is a difficult, long-term topic that might be approached by national policies and regulations.

One possible way to do so is based on the consideration that interventions in the formal institutional framework can counteract shortcomings of a country's informal institutional framework. For example, in order to influence uncertainty avoidance, political interventions that have the potential to increase security should be considered. This can be done by introducing laws, especially in innovation-related fields, such as property rights, or by legislating other kinds of regulatory safety. This strategy could influence the cultural predisposition to deal with uncertainties by eliminating their cause. Or, as another example, increasing security at the societal level also affects in-group collectivism. If overall security is increasing, there is less need to focus on smaller groups and collectives (Gelfand et al., 2004, p. 487), allowing for higher autonomy and tolerance.

A more directly applicable approach and concrete suggestions could be derived from our model for the management of organizations operating in specific countries. We demonstrate this with regard to personnel selection and leadership.

The general approach to aggregate personality scores could be criticized, as nations and societies are mixtures of individuals, which means that there are many dispersions, decreasing the explanatory power of society-wide aggregations of personality factors. This criticism holds true, but it is also true that significant differences exist in those national personality dispositions (Hofstede & McCrae, 2004; McCrae & Terracciano, 2006; McCrae et al., 2007). In combination, these two arguments support the notion that focusing on personnel selection if employees with innovation-relevant personality structure are needed is of higher importance in countries with a tendency to innovation-adverse national personality profile. At the organizational level, such an innovation-related focus on personnel selection would not only impact the subset of personality dispositions which enters the organization, but would also regulate the inflow of national cultural factors into the organization (Schneider, 1987).

Leadership is another possible area of intervention at the organizational level. Leadership behaviour cannot influence personality factors, only their manifestation in observable behaviour. Increasing degrees of freedom and autonomy (delegative-participative leadership) and of tolerance and openness in decision-making processes (Krause, 2005) as aspects of leadership behaviour are likely to increase the chance that even lower levels of openness to experience may find their way to innovation. Participative leadership behaviour raises consensus and involvement of employees (Bass & Bass, 2008; Huang, Rode & Schroeder, 2011) and may therefore have positive effects on the manifestation of agreeableness. This is of particular importance if the level of agreeableness in society is low. Those behaviours also positively impact the national cultural practices mediator: autonomy and degrees of freedom (tending to decrease effects on in-group collectivism), error tolerance (decreasing uncertainty avoidance) and participation and openness in decision-making processes (increasing performance and future orientation).

However, the results also suggest that leadership approaches that violate cultural and societal norms may be necessary if innovation is the goal. This implies that in countries with innovation-detrimental cultural practices and innovation-detrimental national personality profiles, focusing particularly on innovation as an important organizational goal is a delicate matter. The ambiguity of the need to act against cultural endorsement while promoting innovation, which requires trust and acceptance, suggests that a sensitive and well-balanced approach must be adopted. However, in countries with low levels of innovation, this approach promises to be especially worthwhile and profitable.

Like every study, our study has several limitations. The inherent limitation is that it is not possible to extract distinct cause-and-effect relationships at the national level of analysis due to the many and interrelated factors involved. However, our approach was to provide a theoretically sound, comprehensive model which simultaneously includes personality and cultural factors. We hope that our model will be conceptually used for investigations on lower levels of aggregation, that is for investigations in particular countries and

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organizational contexts in order to see if the model's basic mechanics hold true.

Another limitation of our study is the sample size. Again, this limitation is inherent in our study's level of analysis, which is countries. Although common rules concerning the required sample size (e.g., in psychology) do not apply to country-level analysis, as data on this level tend to be more stable and reliable[5] than individual-level data (Hemert, van de Vijver & Poortinga, 2008, p. 420), we tried to approach this limitation by choosing the statistical approach which best fits these requirements: covariance-based structural equation modelling. Additionally, we based our study on three independent and elaborate datasets. However, these data sources are not free from criticism either. The GLOBE study was criticized for over-distinguishing cultural dimensions (Hofstede, 2006). We believe that this point does not influence our study as we used a higher-order factor of the innovation-relevant GLOBE dimensions, which eliminates these problems. Aggregating the Big Five personality factors to the national level and investigating their linkage with society-level outcomes such as innovation is also an issue which may appear exotic to personnel psychologists (McCrae & Terracciano, 2008). However, it should not be forgotten that the acceptance of 'personality traits at the individual level has had a very stormy history' (McCrae & Terracciano, 2008, p. 269), too. Until Barrick and Mount's meta-analysis (1991) was published, most industrial and organizational psychologists derided trait measures as such as useless in their area. In line with McCrae (2004), we therefore argue that aggregated personality factors are a reasonable criterion for indicating a profile of disposition on the national level. Finally, the Global Innovation Index has also been criticized for methodological and over-aggregation issues (Wiebe, 2011). We tried to overcome these problems by not using the final index score but those components of the index that correspond most to the innovation management literature. Doing so increases validity by focusing on the most accepted indicators and decreases the threat of over-aggregation by being more specific.

We would like to suggest that our model is not limited to national innovation only. In contrast, the underlying mediation mechanism would provide a fruitful path for investigating other national-level phenomena. Additionally, as another possibility for further research, we encourage other scientists to test our model in countries that were part of the GLOBE study and the Personality Profiles of Countries Project. The instruments for measuring cultural practices are available online on the GLOBE website (The GLOBE Foundation) and the NEO-PI-R is available from several providers in already validated forms in different languages.

Finally, we would suggest considering the basic mechanism underlying our model for future studies on innovation management, even when the focus of the studies is not the national one. This would help to focus on and integrate omnipresent national-level factors, such as national personality profiles and cultural factors, that may be difficult to recognize.

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Notes

1. The Five Factors were already identified in 1961 by Tupes and Christal (1992 [1961]) and have been replicated by later researchers (Norman, 1963; Goldberg, 1981; McCrae & Costa, 1985; Digman, 1990). The Five Factor Model gained superiority over competing systems which argued in favour of 3, 10 or 16 main factors of personality (Hofstede & McCrae, 2004).
2. For a discussion on the differences between moderators and mediators, see Baron and Kenny (1986).
3. For further information on the statistical aggregation of individual personality factors and cultural level factor analysis (ecological factor analysis), see Hofstede (2009) and McCrae and Terracciano (2005a, 2005b).
4. Dividing the index has advantages and disadvantages: on the one hand, splitting up the index increases criteria validity of the dependent variable national innovation at least insofar as it has been operationalized in previous research. However, this increase in specificity occurred at the cost of neglecting other variables, which are also important in the context of national innovation, especially the ones of the index's input pillars. As both arguments (using the overall index scores and splitting up the index) have their justification, we calculated an alternative model using the overall index scores of the Global Innovation Index 2010 and 2011 as indicators for the dependent variable. This calculation exhibited only minor differences between the two approaches.
5. See note 3.

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Robert J. Rossberger (robert.rossberger@th-deg.de) holds a PhD in social and economic sciences from the University of Klagenfurt, Austria, and is the head of the Graduate Program of the Deggendorf Institute of Technology, Germany. His research interest focuses on international and inter-cultural aspects of management with a specific focus on innovation management.

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