

Personality, Culture and Innovation

A National Level Analysis

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Abstract - This study investigates the relationship between personality factors, cultural practices, and innovativeness at the national level. It is shown that the relationship between the nationally aggregated personality factors of openness to experience and agreeableness and national innovation is mediated by the national cultural practice dimensions of future orientation, institutional collectivism, in-group collectivism, performance orientation, and uncertainty avoidance.

Keywords - Innovation, personality factors, personality profiles, agreeableness, openness to experience, cultural practices, national level, GLOBE, Global Innovation Index

I. INTRODUCTION

This study focuses on innovation at the national level. In the past decades, different scientific disciplines have explored the concepts of national culture and innovation, approaching them from different perspectives and focusing on different aspects, thereby obtaining different results. Twenty years ago, Shane already assumed that “national rates of innovation are driven by more fundamental forces than economic conditions” [1], pointing out the importance of cultural factors. Previous studies which investigated the relationship between culture and innovation at the national level [1–7], showed that national cultural factors are an important determinant of national level innovation. Additionally, recent research has shown that personality factors, aggregated at the national level, are also related to the level of innovation present in countries [8].

Both approaches – one investigating personality factors at 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 a part of the picture. Therefore, we consider both components simultaneously. Research at the individual level has shown that innovative behavior is basically a function of personal and environmental factors [9]. One could assume that environmental contingency factors also matter at the national level. Therefore, we argue that a similar relationship must exist at the national level. Although this

assumption is plausible, it has not yet been theoretically derived and empirically tested.

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 $N = 33$ countries and show that innovation-relevant national personality profiles are linked with innovation-relevant national cultural practices in most of the countries. Additionally, the recently proposed direct relationships [8] 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 [10]. Additionally, our study provides practical implications for innovation management, leadership, and personnel selection.

II. THEORETICAL BACKGROUND

The three fundamental constructs underpinning our study are nationally aggregated personality factors [11], national cultural practices [12], and innovation at the national level [13]. Nationally aggregated personality factors are aggregations of the individual-level personality factors to the national level [14]. National cultural practice dimensions are measuring “the way things are done in this culture” [15]; they represent observable manifestations of the national cultural environment. National innovativeness is a measure of how innovative a country is in terms of scientific and creative outputs [13].

A. Personality and Innovation

The dominant model of personality, the Five Factor Model [16], argues that human personality can be explained by five factors, each of them consisting of six facets. These five meta-analytically validated major factors of personality are extraversion/introversion, emotional stability, agreeableness, conscientiousness, and openness to experience. The Big Five factors are a well-established and useful set of personality

dimensions [17], which, initially dedicated to the individual level, have recently been applied to the national level with some success [14]. The fact that the five factors can be meaningfully aggregated at the national level [18] indicates the existence of an isomorphic relationship between the concepts at the individual and the national level [19]. Recent research found significant relationships for openness to experience and agreeableness at the national level [8].

Openness to experience includes aspects like imagination, intellectual curiosity, and the tendency to re-examine traditional values [20]. 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 [21, 22]. Creativity is a main component of innovation and especially important in the invention phase of innovations [23, 24]. Overall, openness to experience is positively related with innovation, and Steel et al. [8] recently reported a positive relationship between national scores of openness to experience and innovation at the national level.

People who rank high in terms of agreeableness are trustworthy, honest, and altruistic [25]. At the individual level, several studies reported a negative relationship between agreeableness and innovation [26], which means individuals with lower agreeableness tend to be more innovative. However, the relationship may be different at the societal level of analysis. Agreeableness largely influences how people conduct their social relationships. As innovations not only consist of creative inventions, but also have to be implemented [27], agreeableness is connected with the 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 [8]. Steel et al. reported a positive relationship between national scores of agreeableness and innovation at the national level [8]. Based on these considerations and in line with previous research we assume that:

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

B. Personality and Culture

Basically, we argue that the innovation-related national personality profiles of openness to experience and agreeableness are linked to cultural environments, which are reflected by specific cultural practice dimensions.

We base our second hypothesis on the synthesis of the following theoretical arguments: First, personality factors are relatively fixed and stable [28]. 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 [28]. Second, personality factors at the national level influence culture simultaneously. The reverse causation

hypothesis [17] shows that societal-level personality factors influence manifestations of culture, such as cultural practices and institutions. These cultural manifestations are social adaptations and reflections of the psychological environment which the aggregated distribution of personality factors represents [17].

These two core arguments - 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.

C. Culture and Innovation

Whereas nationally aggregated personality factors describe tendencies of dispositions in different countries, the GLOBE cultural practice dimensions describe norms of behavior [29] and the interaction between individuals in different nations. Cultural practices act as informal institutions [30], which regulate and often constrain human interactions [31, 32] and represent observable manifestations of the national cultural environment. Empirically, the GLOBE national cultural practice dimensions of future orientation (positive relationship), institutional collectivism (positive relationship), in-group collectivism (negative relationship), performance orientation (positive relationship), and uncertainty avoidance (positive relationship) are significantly related to innovation at the national level [33]. Essentially, 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 [34]. This is combined with achievement orientation, a positive disposition to challenges and improvements and a stable environment with cultural practices which make it possible to take risks and provides freedom to trial and error [34]. 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.

D. Mediation Effect of Culture

At the individual level, cultural practices moderate the relationship between individual personality factors and innovative behavior. This is because the individual can hardly influence national cultural practices. In contrast, cultural practices necessarily act as a mediator at the national level as they are influenced by national dispositions in personality [17]. Conceptually, this argument is statistically supported by

the fact that moderators should not be correlated with the independent variable, but mediators must [10]. The first is more likely the case when investigating the trait–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 [35–37]. We argue that the person–environment-fit theory also works at the societal level. In accordance with hypothesis one, at the aggregated level, environmental factors depend on the individuals: the people make the place [38].

Concretely, this means that if an innovation-friendly constellation of national personality factors (high openness to experience and agreeableness) and cultural practices (high future orientation, institutional collectivism, performance orientation, uncertainty avoidance and low in-group collectivism) exists in a country, good person–environment-fit is enabled [37], which in turn relates to national innovativeness. By contrast, if national cultural practices are opposite (low future orientation, institutional collectivism, performance orientation, uncertainty avoidance and high in-group collectivism) innovative national personality factors (high openness to experience and agreeableness) 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.

III. METHOD

We investigate the relationship between culture, personality, and innovation at the national level. To test our model, we triangulate three different and independent datasets. To be included into our sample, a country had to fulfill the following requirements: data from the Personality Profiles of Cultures project, from the GLOBE study as well as from two editions (2010 and 2011) of the Global Innovation Index had to be reported.

These sources were chosen on the grounds of the following considerations: all three datasets represent the output of state-of-the-art, major research projects in their respective fields. The criteria of selection result in a sample of $N = 33$ countries.

Table 1. Countries Analyzed

Argentina	Hong Kong	Morocco	Spain
Australia	India	New Zealand	Switzerland
Austria	Indonesia	Nigeria	Thailand
Brazil	Ireland	Philippines	Turkey
Canada	Italy	Poland	United Kingdom
China	Japan	Portugal	United States

Denmark	Kuwait	Russia
France	Malaysia	Slovenia
Germany	Mexico	South Korea

Additionally, we eliminate the danger of common method bias and common source bias by choosing three separate and disassociate data sources [39]. We test our hypotheses and our model by using Partial Least Square (PLS) equation modeling. We do so because the sample size of $N = 33$ countries is too small for the application of covariance-based structural equation modeling. Therefore, the application of variance-based structural equation modeling is required. We use the software SmartPLS [40] to test our model.

IV. RESULTS

A. Evaluation of the Measurement Model

The three latent variables have been operationalized as reflective constructs. All indicator loadings, except institutional collectivism, are above the recommended value of .70. All loadings were also significant at least to the 1% level running 1,000 bootstrap samples; therefore, indicator reliability can be assumed. The significant relationship of institutional collectivism was the reason to keep the dimension in the model despite the low factor-loading. Table 2 shows the correlations between the indicator and the latent variables.

Table 2. Correlations - Indicator and Latent Variables

Indicator variables	1	2	3	4	5	6	7	8	9	10	11
1. Agreeableness	--										
2. Open to experience	.31	--									
3. Future orientation	.33	.49**	--								
4. In-group coll.	.41*	-.58***	-.56**	--							
5. Institutional coll.	.11	.16	.31	-.25***	--						
6. Perf. orientation	.23	.34	-.65***	-.59***	.47**	--					
7. Uncertain. avoidance	-.40*	.56**	.70***	-.71***	.19	.68***	--				
8. Scientific outputs	.42*	.51**	.51**	-.70***	.54***	.71***	.58***	--			
9. Creative outputs	.28*	.34	-.46**	-.60***	.13	.61***	.62***	.70***	--		
Latent variables											
10. Innovation-related nat. personality profiles	.74***	-.87***	.52**	-.62***	.17	.36*	.61***	.58***	.39*	--	
11. Innovation-related nat. cultural practices	.40*	-.57**	.83***	-.83***	.46*	.86***	.88***	.77***	.64***	.61***	--
12. Nat. innovativeness	.38*	-.47**	.52**	-.71***	.38**	.72***	.65***	.94***	.91***	.53***	.77***

Notes. Pearson correlations. Two-tailed significance. Sample Size is $N = 33$ countries. Correlations between latent variables are based on PLS latent variable scores
* $p < .05$. ** $p < .01$. *** $p < .001$.

Construct reliability was tested by using composite reliability. For all constructs, the composite reliability is between .72 and .92, that is, above the recommended threshold of .70; therefore, construct reliability can be assumed.

Discriminant validity is measured with the Average Variance Extracted (AVE) parameter. The AVE values of the model are between .62 and .85, that is, well above the recommended threshold of .50. To ensure discriminant validity, the square roots of the AVE values must be greater than the values in the corresponding rows and columns of the correlation matrix of the latent constructs [41]. The model also fulfills these criteria; therefore, discriminant validity can be assumed. Moreover, cross-loadings show that all indicators load highest on their corresponding construct, and every construct loads highest on its own items. Overall,

discriminant validity is given. Table 3 depicts the correlation matrix of the latent variables and the root of AVE in the diagonal.

Table 3. Correlation Matrix and Root of Average Variance Extracted

Composite	(1)	(2)	(3)
1. Innovation-related national personality profiles	.81		
2. Innovation-related national cultural practices	.61	.79	
3. National innovativeness	.53	.77	.92

B. Evaluation of the Structural Model

The R^2 measure of the endogenous construct on national innovativeness is .60, which is considered good to substantial [42, 43]. Predictive relevance was tested by cross-validation employing the blind folding procedure. The measures for Stone-Geisser’s Q^2 , measured by cross-validated redundancy (cv red), are positive for innovation-related national personality profiles (cv red = .07), innovation-related national cultural practices (cv red = .20) and national innovativeness (cv red = .43). Figure 1 shows the results of the structural model equation.

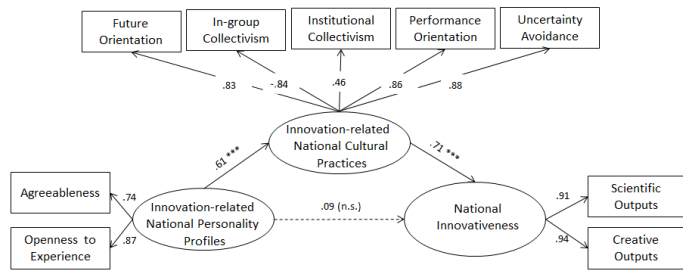


Figure 1. Structural Model

Significance of the path models has been tested by running 1,000 bootstrap samples. The path coefficient between innovation-related national personality profiles and innovation-related national culture is significant ($\beta = .61$; $p < .001$). The path coefficient between innovation-related national culture and national innovativeness is also significant ($\beta = .71$; $p < .001$). However, the path between the innovation-related national personality profiles and national innovativeness did not reach the level of significance ($\beta = .09$; n.s.). These findings support three of the four hypotheses.

The mediation effect of national culture has been tested by combining the bootstrapping method with the Sobel test [44], as is recommended particularly for small sample sizes [45]. The Sobel test determines whether the influence of the proposed mediator national culture influences the relationship between personality factors and national innovativeness based on the regression coefficient between the independent variable and the mediator and between the mediator and the dependent variable, and the standard errors of these two relationships.

The Sobel test value of 3.54 ($p < .01$) supported the conceptualization of natural cultural practices as a mediator of the relationship between the national personality profile and national innovation. Additionally, the finding that the direct path between national personality profiles and national innovativeness loses significance (which leads to rejection of Hypothesis 1) when including national culture in the model supports the conceptualization of national culture as a mediator [10]. Table 4 summarizes the results of our study.

Table 5. Hypotheses and Results

Hypotheses	Result
H1. The nationally aggregated personality factors of openness to experience and agreeableness are positively linked to national innovativeness.	Rejected
H2. Innovation-related national personality profiles are linked to innovation-related national cultural practices.	Accepted
H3. Innovation-related GLOBE cultural practice dimensions are linked to national innovativeness.	Accepted
H4. Innovation-related national cultural practices mediate the relationship between national personality profiles and national innovativeness.	Accepted

V. CONTRIBUTION

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 been considered in one model as antecedents of innovation yet. We showed that the direct relationship between national personality profiles and national innovativeness vanishes when national cultural practices are integrated into the model. Methodically speaking, this is analogous to controlling the direct relationship for the effect of a third variable, namely national cultural practices.

Our model also has important practical implications. This is demonstrated with regard to personnel selection and leadership. Regarding personnel selection, the results provide suggestions for selection methods and job requirements that should be considered if innovation is the organizational goal. That means it is of higher importance in countries with a tendency towards innovation-adverse national personality profiles to set special focus on personnel selection if employees with innovation-relevant characteristics are needed. At the organizational level, such an innovation-related focus on personnel selection would not only impact the subset of dispositions, which enters the organization, but also regulate the entrance of national cultural factors into the organization. According to the ASA (attraction-selection-attrition) theory [38], hiring individuals with innovation-critical characteristics should lead to positive secondary effects in the long run: individuals with innovation-related skills, abilities, and characteristics are attracted by organizations that focus on these characteristics, they will be positively selected, and they will stabilize human capital needed for innovation. This results in a sustainable competitive advantage for organizations, especially for those operating in countries with low levels of innovation.

Leadership is another possibility of intervention at the organizational level. Leadership behavior cannot influence personality factors but their manifestation in observable behavior. Increasing degrees of freedom and autonomy (delegative-participative leadership) and of tolerance and openness in decision-making processes [46] as aspects of leadership behavior are likely to increase the chance that even lower levels of openness to experience may come to fruition in terms of innovation. Participative leadership behavior raises consensus and involvement of employees [44, 45] and, therefore, may have positive effects on the manifestation of agreeableness. This is of special importance if the level of agreeableness in society is low. These behaviors also positively impact the national cultural practices mediator: autonomy and degrees of freedom (tending to decrease effects of in-group collectivism), error tolerance (decreasing negative effects of uncertainty avoidance), and participation and openness in decision-making processes (increasing effects of performance and future orientation).

As every research project, our study also has some limitations. One limitation is the sample size of $N = 33$. However, this number of cases is relatively high considering the national level of analysis. Literature suggests that cross-cultural comparison of countries should include more than ten countries [47]. However, most studies compare only two or three countries [48]. Therefore, $N = 33$ is a respectable number of cases. Additionally, highly aggregated data, such as the data used, cannot be compared to individual level data, as much of the variance is already averaged out, which decreases the number of cases necessary to obtain statistically meaningful results [49]. Nevertheless, the number of cases prohibits the use of several statistical methods, such as covariance-based structural equation modeling. The number of cases made it necessary to employ variance-based equation modeling, which does not allow for bi-directional paths between the constructs. Another point of criticism could be the high level of aggregation. However, as the core units of analysis of this study are differences between countries regarding innovation, this level of aggregation is necessary and appropriate [50].

Another possible limitation are the data sources used. For example, the GLOBE study and data have been criticized for over-distinguishing cultural dimensions, being U.S.-centric, and for following an approach that is too psychological [51, 52]. However, the GLOBE study is the largest, most recent, most elaborate, and most substantial project in this field. It was thus employed since it is the most adequate data source available. Similar criticisms could be lodged against the Global Innovation Index and the Personality Profiles of Countries project. Criticism for the Global Innovation Index have been related to methodological and over-aggregation issues [53, 54]. Again, this index is the most recent, largest, most elaborate, and the only statistically approved [13] measure of national innovation that exists. Thus it is the most adequate source available. The Personality Profiles of Cultures Project has been criticized mainly for the aggregation issues, too. The aggregation of the Big Five personality

factors to the national level and the investigation of the linkage of these factors with society-level outcomes such as innovation is an issue that may appear exotic to personnel psychologists [14]. However, it should not be forgotten that the acceptance of "personality traits at the individual level has had a very stormy history" [14]. For example, most industrial and organizational psychologists have derided trait measures as useless in their area until Barrick and Mount's meta-analysis [55] was published. Therefore, in line with McCrae [56], it is argued that aggregated personality factors are a reasonable criterion to indicate a profile of disposition at the national level.

VI. REFERENCES

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