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SPECIAL ISSUE ARTICLE

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Validating the rapid validity testing concept across regions

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Empirical studies in innovation management often draw on data collected in particular regions, mostly in Western economies, and imply universal applicability of the findings across regions. Given the relevance of innovation for economic progress and structural and cultural differences among regions, there is surprisingly little knowledge available on whether the knowledge developed from Western firms can be transferred to emerging economies. This dearth of knowledge is especially notable for the early phases of innovation processes. Rapid iterations between knowledge creation and learning are critical at the front end of innovation (FEI), a phase that, in turn, is crucial for innovation success. In a recently published article, Peña Häufler and co-authors developed the concept of rapid validity testing (RVT) and found support for its positive relation with innovation performance. Since the authors draw on a sample of Western firms, we explore whether the concept of RVT and its performance relevance remain valid across regional contexts. The data for this study stem from a sample of 1625 respondents from 232 firms in Europe and Latin America. Our findings advance our understanding of innovation management practices in different contexts, informing future research on the approach and relevance of assessing the effect of different contexts on central measures for improving innovative capabilities.

KEYWORDS

design thinking, fuzzy front-end, innovation performance, invariance test, Latin America, lean innovation, planned flexibility, pretotyping, rapid validity testing

1 | INTRODUCTION

As part of the relevant firm-level capabilities, managing the front end of innovation (FEI) has been identified as crucial for the success of innovation. However, this phase is also characterized by a heavy reliance on input from engaged individuals, unclear roles and responsibilities and strong uncertainties related to the innovative task. Consequently, innovation management literature has coined this phase the 'fuzzy front end of innovation'. Many practical approaches have emerged to assist organizations in managing this fuzziness. Prominent among these approaches are pretotyping (Savoia, 2019), prototyping (Bogers & Horst, 2014; Mascitelli, 2000), lean innovation (Blank, 2013; Ries, 2011) and design thinking (Brown, 2008; Roth, Globocnik, Rau, & Neyer, 2020). Research has traced the fuzziness at the FEI back mainly to insufficient knowledge of task performance—that is, task uncertainty (Mackenzie, 1984)—and conflicting and unclear knowledge on causal relationships—that is, equivocality (Daft & Lengel, 1986; Winkler, Kuklinski, & Moser, 2015). Following this rationale, Peña Häufler et al. (2021) structured and combined these approaches following Verganti's (1999) 'planned flexibility' paradigm to understand how these approaches contribute to the reduction of uncertainty and equivocality through knowledge generation at the FEI. Planned flexibility refers to the capability of organizations to combine and balance anticipation and reaction capabilities

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(Verganti, 1999) to cope with information-processing demands at the FEI (Peña Häufler et al., 2021). This paradigm guides the understanding of which capabilities are necessary to address uncertainty through anticipation by procuring and analysing relevant information early in the process. Rapidly modifying courses of action in the process in answer to new insights is enabled by reaction capabilities (Verganti, 1999). Thus, the activities described by the managerial approaches to the fuzzy FEI mentioned above are structured along the planned flexibility paradigm. Peña Häufler et al. (2021) identified, building on well-established principles of contingency theory, external factors (i.e., environmental turbulence and organizational culture) and argued for moderating relationships of these factors on the main relationship between these managerial approaches and innovation program performance. The analysis further provides empirical validation of the proposed relationships.

Stressing the notion of the relevance of firm-level innovation for economic development and prosperity seems unnecessary. However, there are regions of the world that struggle to catch up to the levels of development of advanced economies like some OECD member states and China (CEPAL, 2022). Although innovation research provides rich and deep insights into innovation activities, their relationship to organizational performance and the contingencies of these relationships, the study contexts have predominantly focused on advanced economies. Structural differences in environmental conditions across regions and their relevance for innovation processes in emerging economies have not been considered (CEPAL, 2022; Seclén-Luna & Morales, 2022). Thus, it remains unclear whether concepts like rapid validity testing (RVT) are uniformly understood across regions and if the performance relevance identified in companies located in advanced economies can be generalized to companies in other regions. As such, the applicability of this knowledge to the context of emerging economies remains inconclusive (Olavarrieta & Diaz, 2021).

In view of the findings of entrepreneurship literature considering differences between regions with different levels of economic development (Acs & Amorós, 2008; Gomes, Ferreira, & Lopes, 2023; Lopes, Antunes, & Rodrigues, 2018), we focus on the Latin America and the Caribbean (LAC) region as a good example of such emerging economies. Multiple reasons make the LAC region interesting for our analysis. Stemming from its colonial history, the region exhibits high levels of cultural homogeneity (Aguinis et al., 2020). Trade and industrial relationships with Europe and the United States also have a long tradition and are firmly consolidated. The EU is not only the leading investor in LAC, with a volume of investment of 794 billion Euros in 2019 but is also LAC's fifth biggest trading partner (EEAS, 2022). Notwithstanding, LAC still struggles to overcome a so-called middle-income technology trap, manifest in the structural barriers of the region to increase domestic value creation and 'sustained industrial and technological upgrading' (Andreoni & Tregenna, 2020, p. 326). Although several measures have been proposed at the institutional level to overcome this phenomenon, the relevance of focusing on the development of firm-level innovation capabilities is critical (Paus, Robinson, & Tregenna, 2022). Finally, cross-cultural research has also

identified significant differences in terms of management-related cultural differences (Friedrich, Mesquita, & Hatum, 2006; House, Hanges, Javidan, Dorfman, & Gupta, 2004). Together with the structural conditions of the economic development of the region described above, these findings on cultural differences inform our decision to investigate whether and how management approaches to the FEI can be applied in the LAC context.

Building on the empirical validity of the RVT concept in a European context established by Peña Häufler et al. (2021), this paper aims to test for invariance of the concept operationalization across the original European sample and a Latin American sample. As such, this study offers a quasi-replication approach using a data set from a different region and aims to assess the generalizability of the RVT concept to a new context (Bettis, Helfat, & Shaver, 2016) and region. Our motivation is twofold: First, we seek to assess construct measurement in order to investigate whether the concept of RVT is uniformly understood; second, we examine the relationship with performance and the role of 'boundary conditions based on different regional contexts' (Bettis et al., 2016, p. 2200) in order to see if RVT is a universal success factor across different regional contexts. The boundary conditions analysed in this paper are market and technology turbulence as well as cultural factors (i.e., risk aversion and long-term orientation). For this analysis, we use data from a cross-regional sample of 1625 respondents from 232 firms located in Europe and Latin America. We apply structural equation modelling (SEM) and confirmatory factor analysis (CFA), mirroring the procedure followed by Peña Häufler et al. (2021). We test the invariance of the RVT concept by assessing configural, metric, scalar and residual invariance. Our analysis supports measurement invariance. However, only partial metric invariance could be demonstrated, a finding that indicates differences in the understanding of business model experimentation across regions. We further assessed structural invariance of the model suggesting moderated performance effects of RVT as proposed by Peña Häufler and co-authors. Interestingly, we find indications of cross-regional differences, particularly concerning the environment. Our paper concludes with a discussion of possible explanations for the differences in variance as identified by our analysis. We thereby contribute to innovation literature by assessing the applicability of apparently wellestablished innovation management concepts across different regional settings.

2 | THEORETICAL BACKGROUND

The planned flexibility paradigm (Verganti, 1999) offers a conceptualization of the organizational capability to balance anticipation of and reaction to uncertainty and equivocality as a template to categorize management approaches to the fuzzy FEI. Building on this paradigm, Peña Häufler et al. (2021) structured popular management approaches to the FEI according to the mechanisms behind anticipation and reaction capabilities: (i) *early establishment of central assumptions*; (ii) *prototypes as an internal communication tool to visualize, assess and communicate the concept*; (iii) *user integration through prototype tests* and other assessment techniques; and (iv) early evaluation of market potential, implementation costs and pricing scope capture anticipationrelated capabilities. Reaction-related capabilities include (v) continuous and rapid experimentation to test assumptions, (vi) development of alternative and overlapping prototypes, and (vii) development of alternative and overlapping business models. This classification along the planned flexibility paradigm provides a twofold advancement of FEI literature: their empirical validation as a unified concept aids in clarifying which activities take place at the fuzzy FEI. Further, it provides a rationale for planning and formalizing these activities, coined as rapid validity testing (RVT). Second, and building on long-established knowledge of the relevance of the fuzzy FEI for innovation performance, the authors conceptually and empirically relate the application of RVT at the FEI to innovation program performance. In assessing the performance relevance of RVT, and building on the well-established body of knowledge of contingency theory (Scott, 1981; Van de Ven, Ganco, & Hinings, 2013), Peña Häufler et al. (2021) also considered internal and external contingencies. Significant moderating relationships are found for technology turbulence, risk aversion, and long-term orientation. Figure 1 summarizes the author's conceptual model.

2.1 | Contextual factors influencing RVT's crossregional validity

Gaining a better understanding of the applicability of the RVT concept across regions is enabled by the assessment of its relevance in non-European contexts. Investigating its applicability to a region such as LAC is relevant on multiple levels. First, LAC represents, in terms of culture, an interesting case for deeper analysis. The culture and religion of the 20 sovereign countries and seven territories show high levels of homogeneity stemming from their colonial history. This results in regional structures strongly influenced by Southern European culture (Aguinis et al., 2020). These cultural similarities allow to build a case for the assessment of the applicability of the RVT concept to the LAC region. Such research is further warranted as dramatic differences between Europe (and other, advanced Western regions) and LAC exist in terms of technological development, market infrastructures and income inequality (Aguinis et al., 2020; Salvia, 2021; Suarez & Yoguel, 2020). Although these issues have been analysed by researchers in entrepreneurship, economics and public policy, there is a marked need for gaining a better understanding of what Olavarrieta and Diaz (2021) call 'business reality' (p. 386). As an emerging economy, the LAC region represents an ideal ground for the validation and extension of knowledge created in Western, economically more advanced contexts (Aguinis et al., 2020). Insights generated through the study of this region can serve to direct research in other emerging economies (Aguinis et al., 2020). Some examples of research on the cross-regional applicability of management concepts, like team commitment, organizational support (De Beuckelaer, Lievens, & Swinnen, 2007) or job satisfaction (Liu, Borg, & Spector, 2004), focusing on the LAC region can be found in the literature. However, especially in the field of innovation, assessing applicability and universality focusing on the LAC region remains a largely unexplored territory (Aguinis et al., 2020; Kroh, Globocnik, Schultz, Holdhof, & Salomo, 2024; Olavarrieta & Diaz, 2021; Olavarrieta & Villena, 2014).

Our analysis of invariance of the RVT approach across different world regions is, thus, motivated by potential contextual differences between the European context, in which the concept was first validated by Peña Häufler and co-authors (2021), and the Latin American context. Such differences may stem from cultural variation as well as different levels of economic development, translating to market structure and technology orientation differences.

National culture, understood as the shared implicit assumptions held by members of a cultural group, guides their perception, processing of, and reaction to their environment (Schein, 1996). Although organizational culture depends largely on managerial action and is thus characterized by increased levels of plasticity (Schein, 2004), national culture has been conceptualized to have a deeper, more stable influence on organizational behavior (Hofstede, Neuijen, Ohayv, & Sanders, 1990; Valtakoski, Reynoso, Maranto, Edvardsson, & Cabrera, 2019). Findings of comparative entrepreneurship research confirm the relevance of cultural factors (i.e., entrepreneurship culture) for attitudes toward the development of innovative economic activities (Lopes et al., 2018; Valtakoski et al., 2019). This literature finds significant differences in cultural factors between high- and lowincome countries, with the latter showing lower levels of proentrepreneurial culture (Gomes et al., 2023). Thus, in regions with



FIGURE 1 Original conceptual RVT model. Note. From Peña Häufler, B., Globocnik, D., Landaeta Saldías, P., & Salomo, S. (2021).

lower levels of pro-entrepreneurial culture, the novel ways of structuring economic activities could receive less attention than in a context with high pro-entrepreneurial culture. In the innovation research literature, national culture has been found to moderate the relationship between the level of formalization and new service development (Valtakoski et al., 2019). Moreover, meta-analytical findings have indicated an impact of dimensions of national culture (i.e., individualism and risk aversion) on the relationship of cross-functional communication and competitive response intensity to NPD success (Evanschitzky, Eisend, Calantone, & Jiang, 2012). With these findings in mind, we expect to find some degrees of variation in the perception and understanding of the RVT concept between the two regions from which our data originates.

Furthermore, we also expect differences regarding external contingencies given the differences in the European and Latin American market structure and technological orientation. Most notably, a historical overreliance on public sector support in Latin America has limited the development of private sector demand (Paus, 2020), subsequently limiting market and technology dynamism. Acs and Amorós (2008) note, in their analysis of entrepreneurship in Latin America, a tendency of policy in the LAC region to focus on production efficiency rather than on furthering innovation. Building on well-established models of economic development and competitiveness (e.g., Porter, Sachs, & McArthur, 2001), the authors identify the LAC region as being for the most part, in an efficiency-driven stage of development, in which industry focuses mainly on manufacturing or providing basic services (Acs & Amorós, 2008, p. 18). These authors note that, although the region has seen significant improvements in terms of the development of 'institutions (and) infrastructure' (p. 5), deficits in, for example, economic reform, markets in LAC show low levels of dynamism (Lopes et al., 2018). Lower levels of market dynamics might decrease the relevance of approaches like RVT, which rely on addressing rapid changes in competitive structures and customer needs (Peña Häufler et al., 2021). By prioritizing production efficiency, consideration of alternative approaches to value creation, delivery, and capture (i.e., business model innovation) can often be outside of the scope of organizations (Acs & Amorós, 2008). Similarly, lower technological dynamism decreases the likelihood of concept obsolescence and diminishes the imperative of constant renewal of technology-related knowledge structures. In line with these arguments, meta-analytical findings report stronger effects on product innovation of RVT-related factors like task proficiency, cross-functional integration, and organizational design in high-tech markets compared with low-tech markets (Evanschitzky et al., 2012). A lack of focus on innovation promotion, through which new markets and new technologies drive the creation of new knowledge (Acs & Amorós, 2008, Lezana, Guede, & Cancino, 2022), can explain a lower awareness of the potential of managerial approaches focusing on generating knowledge to react to dynamic markets and technological developments in regions such as LAC.

In sum, we expect contextual factors related to regional cultures as well as different market and technology structures determining the perception of external environment dynamism across different regions, to affect the relationship between RVT and firm innovation performance. As both the conceptual basis and existing empirical evidence are rather underdeveloped, we abstain from suggesting specific hypotheses on the assumed moderation effects. We suggest an exploratory approach, which may help shed light on the more universal validity of central innovation management concepts with proven validity based on a sample of firms in Western countries.

3 | METHOD AND RESULTS

3.1 | Data collection and sample

The original sample of firm-level data used by Peña Häufler and coauthors (2021) stems from Western Europe, in particular, Austria and Germany (Sample WE), and included responses from 1022 informants in 129 organizations (an average of 7.92 informants per organization). Data collection in LAC (Bolivia, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru and Uruguay) took place in 2020 and 2021 over a 12-month period and followed the same approach, using the same electronic survey tool for data collection as in the original research (Peña Häufler et al., 2021). The measurement instrument, for which English and German versions were already validated, was translated into Spanish and translated back to German by a bilingual researcher, familiar both with the Latin American context and the research domain. The translations were subsequently discussed with two of the developers of the instrument, following established guidelines (Van de Vijver & Hambleton, 1996). The sample from LAC (Sample LAC) included 594 informants from 97 organizations (an average of 6.12 informants per organization). The characteristics of both samples are summarized in Table 1.

4 | MEASURES AND SCALE PROPERTIES

The initial set of multi-item measures used are listed in Table A1. Peña Häufler et al. (2021) reported the scale properties of the initial study. The same procedure was applied using data from Sample LAC. To assess the validity and reliability of the measures, Cronbach's alpha scores were calculated and ranged between .68 and .96, showing acceptable levels (Hair, Black, Babin, & Anderson, 2019). Further, we performed a set of principal component analyses (varimax rotation) for the items of each construct separately. Each analysis extracted only one factor with an eigenvalue greater than one, loadings above .7, and explained variance greater than 50%, supporting unidimensionality (Ahire & Devaraj, 2001).

Next, we applied CFA and specified a model including all constructs correlating with each other to assess convergent validity. All factor loadings were significant (p < .001) and greater than .4, with an average loading of .83. Average variance extracted was above .5 for all but two constructs: long-term orientation and market turbulence, which were .43 and .38. However, sufficient discriminant validity could be demonstrated also for those constructs because, as for all

TABLE 1 Sample characteristics.

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Total number of informants	Sample WE 1022		Sample LAC 594	
Job areas	No.	Percentage	No.	Percentage
R&D/Innovation management	219	21.4%	70	11.8%
Marketing/Sales	158	15.5%	124	20.9%
Leadership/strategy	146	14.3%	133	22.4%
Production	86	8.4%	50	8.4%
Product management	79	7.7%	33	5.6%
Project management	44	4.3%	18	3.0%
Quality management	20	2.0%	3	0.5%
Purchasing	20	2.0%	14	2.4%
IT	17	1.7%	9	1.5%
Controlling/accounting	16	1.6%	47	7.9%
Human resources	11	1.1%	12	2.0%
Others	101	9.9%	72	12.1%
n.a.	105	10.3%	9	1.5%
Hierarchical position	No.	Percentage	No.	Percentage
Upper management	162	15.9%	166	27.9%
Middle management	220	21.5%	222	37.4%
Lower management/eam leader	340	33.3%	80	13.5%
Employee	256	25.0%	126	21.2%
n.a.	44	4.3%	0	0.0%
Total number of firms	129		97	
Industry	No.	Percentage	No.	Percentage
Manufacturing goods (e.g., chemicals, food, plastics and glass)	52	40.3%	14	14.4%
Industrial engineering (e.g., machine construction and plant engineering)	18	14.0%	15	15.5%
Utilities (e.g., energy, water and recycling)	42	32.6%	4	4.1%
Others (e.g., information technology and industrial research)	17	13.2%	64	66.0%
Firm size (revenue; Mio. EUR)	No.	Percentage	No.	Percentage
Less than 50 Mio.	35	27.1%	70	72.2%
51-250	38	29.5%	4	4.1%
251-500	13	10.1%	1	1.0%
More than 500 Mio.	26	20.2%	0	0.0%
n.a.	17	13.2%	22	22.7%
Firm size (FTE)	No.	Percentage	No.	Percentage
Less than 100 FTE	31	24.0%	72	74.2%
101-250	35	27.1%	9	9.3%
251-500	21	16.3%	5	5.2%
More than 500 FTE	42	32.6%	11	11.3%
n.a.	0	0.0%	0	0.0%
No. informants	No.	Percentage	No.	Percentage
2-3 informants	21	16.3%	7	7.2%
4-5	18	14.0%	25	25.8%
6-7	37	28.7%	37	38.1%
8-9	22	17.1%	12	12.4%

TABLE 1 (Continued)

Total number of informants	Sample WE 1022		Sample LAC 594	
More than 10 informants	31	24.0%	16	16.5%
Average no. informants by firm		7.92		6.12

TABLE 2 Mean, standard deviations and correlation matrix.

	Sample W	/E									
	Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.	AVE
1. Market turbulence	3.01	.49	(.79)								.54
2. Technology turbulence	2.72	.57	.45	(.88)							.65
3. Risk aversion	3.14	.66	.11	19	(.91)						.77
4. Long-term orientation	3.60	.46	.14	07	14	(.77)					.56
5. Innovation process formality	2.64	1.27	43	11	.00	13	(.98)				.94
6. Project management control	2.66	.75	40	14	08	01	.76	(.94)			.87
7. Rapid validity testing	2.88	.72	32	.20	31	16	.64	.62	(.93)		.70
8. Innovation program performance	3.12	.56	12	15	20	.14	.04	.22	.18	(.81)	.87
	Sample L	AC									
	Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.	AVE
1. Market turbulence	3.35	.47	(.69)								.38
2. Technology turbulence	3.51	.71	.48	(.94)							.81
3. Risk aversion	2.91	.60	05	17	(.85)						.66
4. Long-term orientation	3.37	.47	03	.19	.05	(.68)					.43
5. Innovation process formality	2.13	.88	.24	.23	.11	.33	(.97)				.89
6. Project management control	2.34	.72	.27	.28	03	.33	.78	(.96)			.78
7. Rapid validity testing	2.62	.79	.14	.34	21	.49	.58	.64	(.96)		.78
8. Innovation program performance	2.95	.79	.09	.36	08	.50	.32	.45	.49	(.94)	.83

Note: Sample WE: n = 129. Sample LAC: n = 97. Cronbach's alpha is reported along the diagonal. All correlations > |.18| significant at *p < .05 (two-tailed).

Abbreviations: AVE, average variance extracted; SD, standard deviation.

other variables, their square root of the average variance extracted was larger than their correlations with all other constructs (Fornell & Larcker, 1981). Considering the limited sample size of 97 cases (recommended are 200 cases for CFA; Boomsma & Hoogland, 2001), global fit indices were also acceptable with a χ^2/df ratio of 2.011 (p < .001), the comparative fit index (CFI) of .86 and a root mean square error of approximation (RMSEA) of .10 (Hair et al., 2019). Correlations, means, standard deviations, Cronbach's alpha and average variance extracted are reported for the original (Sample WE) and the new sample (Sample LAC) in Table 2. Table A1 includes details at the item level including item loadings and a comparison with the results of the original study.

4.1 | Measurement invariance test

We followed prior research to assess measurement invariance (Putnick & Bornstein, 2016; Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000). The literature recommends the total sample size to exceed 200 cases (here n = 226) and each subgroup to include about 100 cases (here: n = 129 and n = 97) for multi-group modelling (Kline, 2005). We performed a series of multi-group CFAs to assess sequentially configural, metric, scalar and residual invariance across the two samples. The approach requests the assessments of differences in the model fit of two nested models, which differ only regarding imposed constraints. If significant differences are detected, they can be attributed to the constraints. To detect significant differences, typically the significance of the change in χ^2 is used. However, this approach has recently been challenged due to the high sensitivity of χ^2 to even small deviations and its dependency on sample size. Therefore, scholars recommend assessing changes in alternative fit indices. Chen (2007) and Putnick and Bornstein (2016) define changes of -.01 in CFI, paired with .015 in RMSEA as thresholds to support measurement invariance. In case invariance cannot be supported, the literature suggests that constraints can be stepwise relaxed and that in case most indicators are still invariant, tests for dependencies,

relationships and mean differences are still valid (Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000).

We followed a stepwise approach to assess measurement invariance proposed in the literature (Putnick & Bornstein, 2016; Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000). To assess configural invariance, which tests if the pattern of salient and non-salient loadings is different across the groups, the model includes no constraints. Metric invariance investigation informs if the loadings of items on their corresponding factor are equal across groups. Therefore, the imposed constraints specify equal loadings across groups. This model is then compared with the one assessing configural invariance. Testing for scalar invariance assesses potential mean differences by adding the constraint of intercepts being equal across groups and then comparing this model with the one assessing metric invariance. Residual invariance assessment informs if the measurement errors are equal across groups. It is tested by imposing the constraints that residuals are equal across groups and then comparing this model with the model assessing scalar invariance.

4.1.1 | RVT scale measurement invariance assessment

Our first assessment of measurement invariance focussed on the scale capturing RVT. Therefore, a CFA model was specified that only included the latent construct and its corresponding items. The two groups were Sample WE with Sample LAC. The results are

summarized in Table 3. Although the χ^2 differences were all significant, the changes in CFI and RMSEA indicated full configural, metric and residual invariance. Only with respect to metric invariance, changes in CFI were above the recommended threshold, whereas changes in RMSEA did not indicate worse model fit. Although not all fit indices indicated violations of the metric invariance hypothesis, we did not attest scale metric invariance. However, by relaxing one constraint with respect to the item referring to the degree of experimentation with business models, which had significantly different loadings across the two regions, partial metric invariance could be demonstrated. With only one relaxed constraint, most indicators being invariant, the RVT scale can be used cross-regionally. However, researchers should be aware of potential different interpretations of the concept of business models as experimentation tools in the LAC context and therefore should be cautious with respect to this item.

4.1.2 | Contextual factor measurement invariance assessment

In the next step, all remaining constructs were added to the model to assess measurement invariance in a greater model context. The analysis followed the same stepwise approach as before. The results are summarized in Table 4. Whereas configural, metric and residual invariance could be supported based on the evaluation criteria established before, the change in CFI for Model 3 was above the threshold although the change in RMSEA was not. Thus, we cannot attest the

TABLE 3 Results of measurement invariance test–construct rapid validity testing.

	Model fit									
Model	χ ²	df	χ²/df	CFI	RMSEA	Model comp	$\Delta \chi^2$	Δdf	ΔCFI	ΔRMSEA
M1: Configural invariance	112.17	28	4.006	.95	.116					
M2: Metric invariance	154.12	34	4.533	.93	.126	M1	41.95***	6	02	.010
M2a: Partial metric invariance	148.86	33	4.511	.93	.125	M1	36.68***	5	01	.009
M3: Scalar invariance	173.12	40	4.328	.92	.122	M2a	24.26**	7	02	003
M4: Residual invariance	193.70	47	4.121	.91	.118	M3	20.58**	7	01	004

Note: Sample WE: n = 129. Sample LAC: n = 97.

*p < .05.**p < .01.***p < .001 (two-tailed).

TABLE 4	Results of	measurement	invariance	test-ful	I model.
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	Model fit									
Model	χ ²	df	χ²/df	CFI	RMSEA	Model comp	$\Delta \chi^2$	Δdf	ΔCFI	ΔRMSEA
M1: Configural invariance	1940.38	988	1.964	.88	.066					
M2: Metric invariance	2027.19	1014	1.999	.87	.067	M1	86.81***	26	01	.001
M3: Scalar invariance	2346.77	1048	2.239	.83	.074	M2	319.58***	34	04	.007
M3a: Partial scalar invariance	2150.57	1040	2.068	.86	.069	M2	123.38***	26	01	.002
M4: Residual invariance	2265.69	1074	2.110	.85	.070	M3a	115.12***	34	01	.001

Note: Sample WE: n = 129. Sample LAC: n = 97.

*p < .05.**p < .01.***p < .001 (two-tailed).

model full scalar invariance and relaxed imposed constraints to determine the degree of measurement variance. To search for the source of scalar invariance (Putnick & Bornstein, 2016), we stepwise relaxed constraints and could achieve partial scalar invariance of the entire model after relaxing eight. Most of the relaxed constraints belonged to a single scale, that is, all items of the construct technology turbulence, which could thereby be identified as the source of the detected scalar variance. Consequently, there are systematic mean differences for this contextual factor across regions that caused variance across regions.

4.2 | Cross-regional model assessment

Finally, we assessed the role of regions in explaining the performance relevance of RVT and its external and internal contingency factors. Therefore, we added a dummy variable (0: Sample WE; 1: Sample LAC) representing the country origin to the original regression model to determine systematic differences in explaining the dependent variable 'innovation program performance'. We then estimated the OLS regression model using the joint data set including the data from Sample WE and Sample LAC. The results are summarized in Table 5 (Model 1). The region does not have a direct effect on the dependent variable ($\beta = -.04$, p = .63), and the original main effect pattern,

including a significant relationship of RVT with innovation program performance, remains unchanged from the original study. Furthermore, we investigated the conditional effect, that is, the performance relevance of RVT conditional on the region, in Model 1a. Therefore, we created an interaction term by multiplying RVT with the region dummy variable. Sample WE is the reference group (coded with zero) and the interaction term represents the difference between the simple slope of the RVT effect for Sample LAC and the simple slope for Sample WE. The interaction term was not significant (B = .17, p = .15), and model fit did not improve significantly, which supports the notion that the performance relevance of RVT is not contingent upon regional origin.

Following the same approach, we also assessed the moderation effects identified in the original study. We re-estimated the original model including the region dummy variable using the combined data set to validate the moderation effects. Then, we assessed the conditional effects, that is, the moderation effects conditional on the regions. Therefore, we calculated another dummy variable multiplying the moderator term with the region dummy variable. Formally, we specify a three-way interaction. The results are summarized in Table 6, and the significant interaction effects are plotted in Figure 2.

Regarding the moderation of the RVT-performance relationship by market turbulence (Model 2), the lack of such an effect identified in the original study could also be identified using the joint data set

TABLE 5Results of main effect model.

Dependent variable: Innovation program performance	Model 1				Model 1a			
Variables	β	В	s.e.	p	β	В	s.e.	р
Intercept	(_)*	1.13	.52	.030	(_)**	1.59	.61	.009
Region (Latin America)	04	06	.12	.633	07	09	.12	.457
Industry dummy (utility)	.09	.15	.15	.319	.07	.12	.16	.450
Industry dummy (manufacturing)	07	10	.13	.436	06	10	.13	.447
Industry dummy (engineering)	.02	.05	.13	.722	.02	.04	.13	.769
Firm size (FTE)	07	03	.03	.330	07	03	.03	.362
Market turbulence	08	10	.11	.342	09	12	.11	.266
Technology turbulence	.08	.07	.08	.358	.08	.07	.08	.345
Risk aversion	03	03	.07	.685	04	04	.07	.595
Long-term orientation	.22***	.31	.09	.001	.20**	.28	.10	.004
Innovation process formality	19	11	.07	.098	17	10	.07	.129
Project management control	.34***	.30	.09	.001	.34***	.30	.09	.001
Rapid validity testing	.25**	.22	.08	.006	.15	.13	.10	.220
Rapid validity testing \times region					.13	.17	.12	.148
R ²	.27				.28			
Adj. R ²	.23				.23			
ΔR^2	.27				.01			
F	6.54***				6.23***			
ΔF	6.54***				2.11			

Note: n = 226 (β , standardized beta coefficient; *B*, unstandardized beta coefficient; s.e., standard error; *p*, level of significance; (Adj.) R^2 , (adjusted) explained variance).

 $p < .05.^{**}p < .01.^{***}p < .001$ (two-tailed).

Dependent variable: Innovation program performance	Model 2				Model 2a				Model 3				Model 3a			
Variables	β	B	s.e.	d	β	B	s.e.	d	β	B	s.e.	d	β	В	s.e.	d
Intercept	*(-)	1.09	0.52	0.037	**(-)	1.91	0.69	0.006	*(-)	1.09	0.52	0.036	***()	2.1	0.61	0.001
Region (Latin America)	04	05	0.12	0.681	03	04	0.13	0.774	05	07	0.12	0.583	0.1	0.14	0.13	0.29
Industry dummy (utility)	0.08	0.13	0.16	0.409	0.09	0.15	0.17	0.374	0.1	0.16	0.15	0.289	0.07	0.12	0.15	0.449
Industry dummy (manufacturing)	07	10	0.13	0.432	08	12	0.13	0.358	06	10	0.13	0.449	12	18	0.12	0.154
Industry dummy (engineering)	0.02	0.04	0.13	0.745	0.01	0.03	0.13	0.845	0.02	0.05	0.13	0.722	01	02	0.13	0.847
Firm size (FTE)	07	03	0.03	0.345	06	03	0.03	0.417	07	03	0.03	0.318	05	02	0.03	0.446
Market turbulence	07	09	0.11	0.408	15	20	0.15	0.189	08	11	0.11	0.295	11	15	0.11	0.168
Technology turbulence	0.07	0.07	0.08	0.398	0.06	0.05	0.08	0.49	0.1	0.09	0.08	0.285	15	14	0.11	0.213
Risk aversion	03	03	0.07	0.657	05	05	0.07	0.458	01	02	0.07	0.832	03	03	0.07	0.71
Long-term orientation	0.23***	0.32	0.09	0.001	0.21**	0.29	0.1	0.003	0.22***	0.31	0.09	0.001	0.19**	0.27	0.09	0.004
Innovation process formality	19	11	0.07	0.1	18	10	0.07	0.118	18	11	0.07	0.113	16	09	0.06	0.144
Project management control	0.33***	0.3	0.09	0.001	0.33***	0.29	0.09	0.001	0.34***	0.3	0.09	0.001	0.27**	0.24	0.09	0.005
Rapid validity testing (RVT)	0.26**	0.23	0.08	0.005	0.15	0.13	0.1	0.21	0.25**	0.22	0.08	0.007	0.26*	0.23	0.1	0.03
Market turbulence $ imes$ RVT	04	08	0.11	0.497	0.03	0.05	0.14	0.711								
Market turbulence $ imes$ region					0.05	0.12	0.2	0.557								
RVT imes region					0.15	0.19	0.12	0.106								
Market turbulence $ imes$ RVT $ imes$ region					11	34	0.25	0.17								
Technology turbulence $ imes$ RVT									0.05	0.06	0.09	0.479	0.22**	0.3	0.11	0.008
Technology turbulence $ imes$ region													0.24*	0.35	0.14	0.012
RVT imes region													0.07	0.09	0.12	0.46
Technology turbulence $ imes$ RVT $ imes$ region													25**	47	0.16	0.004
Risk aversion $ imes$ RVT																
Risk aversion $ imes$ region																
RVT imes region																
Risk aversion $ imes$ RVT $ imes$ region																
Long-term orientation $ imes$ RVT																
Long-term orientation $ imes$ region																
RVT imes region																
Long-term orientation $ imes$ RVT $ imes$ region																

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TABLE 6 Results of moderation effect models.

Dependent variable: Innovation program performance	Model 2				Model 2	е			Model 3				Model 3a			
Variables	β	В	s.e.	d	β	B	s.e.	d	β	В	s.e.	d	β	B	s.e.	d
R ²	0.27				0.29				0.27				0.34			
Adj. R ²	0.23				0.23				0.23				0.29			
ΔR^2	0				0.02				0				0.07			
F	6.06***				5.24***				6.06***				6.62***			
ΔF	0.46				1.48				0.5				6.85***			
Note: $n = 226$ (β , standardized beta coefficient; B, unstant * $p < .05$. ** $p < .01$. *** $p < .001$ (two-tailed).	idardized bet	a coeffi	cient; s.e	., standar	d error; <i>p</i> , le	vel of sign	lificance	; (Adj.) R ² ,	(adjusted)	explained	variance	÷				
TABLE 6 (Continued)																
Dependent variable: Innovation program	Model 4				Model 4	n			Model 5				Model 5a			
Variables	β	в	s.e.	d	β	8	s.e.	٩	β	В	s.e.	٩	β	В	s.e.	a
Intercept	*()	1.06	0.5	0.036	*()	1.48	0.67	0.028	(-)	0.93	0.51	0.07	**()	1.99	0.66	0.003
Region (Latin America)	04	05	0.12	0.649	06	08	0.12	0.497	0.01	0.01	0.12	0.94	05	06	0.12	0.617
Industry dummy (utility)	0.15	0.25	0.15	0.101	0.13	0.22	0.16	0.169	0.08	0.14	0.15	0.354	0.09	0.15	0.15	0.337
Industry dummy (manufacturing)	05	07	0.12	0.572	05	07	0.12	0.586	04	06	0.12	0.61	02	03	0.12	0.819
Industry dummy (engineering)	0.03	0.06	0.13	0.669	0.02	0.05	0.13	0.717	0.01	0.02	0.13	0.864	0.03	0.05	0.13	0.708
Firm size (FTE)	07	03	0.03	0.346	06	03	0.03	0.375	08	03	0.03	0.286	07	03	0.03	0.311
Market turbulence	08	11	0.1	0.295	09	12	0.1	0.239	06	08	0.1	0.473	05	07	0.11	0.497
Technology turbulence	0.11	0.1	0.08	0.202	0.11	0.1	0.08	0.199	0.08	0.08	0.08	0.326	0.07	0.06	0.08	0.424
Risk aversion	03	03	0.07	0.617	04	04	0.09	0.648	03	03	0.07	0.703	06	07	0.07	0.351
Long-term orientation	0.21**	0.29	0.09	0.002	0.19**	0.26	0.1	0.007	0.25***	0.35	0.09	0	0.12	0.17	0.12	0.169
Innovation process formality	22*	13	0.06	0.048	20	12	0.07	0.072	13	08	0.07	0.258	09	05	0.07	0.419
Project management control	0.3**	0.27	0.09	0.002	0.3**	0.26	0.09	0.003	0.28**	0.25	0.09	0.005	0.27**	0.25	0.09	0.007
Rapid validity testing (RVT)	0.35***	0.31	0.08	0	0.25*	0.22	0.11	0.043	0.26**	0.23	0.08	0.004	0.13	0.12	0.1	0.256
Market turbulence $ imes$ RVT																
Market turbulence $ imes$ region																
$RVT \times region$																

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TABLE 6 (Continued)

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Dependent variable: Innovation program	Model 4			-	Model 4a			Model 5				Model 5a			[
Variables	β	B	s.e. p		3 B	s.e.	d	β	B	s.e.	d	β	B	s.e.	d
Market turbulence $ imes$ RVT $ imes$ region															
Technology turbulence $ imes$ RVT															
Technology turbulence $ imes$ region															
$RVT \times region$															
Technology turbulence \times RVT \times region															
Risk aversion $ imes$ RVT	0.21***	0.23	0.07	0.001	0.2** 0.2	2 0.09	0.014								
Risk aversion $ imes$ region					010	1 0.14	0.95								
$RVT \times region$					0.12 0.1	5 0.12	0.205								
Risk aversion $ imes$ RVT $ imes$ region					0.01 0.0	2 0.14	0.879								
Long-term orientation $ imes$ RVT								18**	28	0.1	0.006	25**	40	0.14	0.004
Long-term orientation $ imes$ region												0.18*	0.41	0.19	0.035
$RVT \times region$												0.08	0.1	0.12	0.412
Long-term orientation $ imes$ RVT $ imes$ region												0.12	0.29	0.2	0.153
R ²	0.31				0.31			0.29				0.33			
Adj. R ²	0.26				0.26			0.25				0.27			
ΔR^2	0.04				0.01			0.03				0.03			
ц	7.2***				5.93***			6.82***				6.31***			
ΔF	11.28***				0.6			7.7**				3.18*			

Note: n = 226 (β , standardized beta coefficient; B, unstandardized beta coefficient; s.e., standard error; p, level of significance; (Adj.) R^2 , (adjusted) explained variance). *p < .05.**p < .001 (two-tailed).

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TABLE 6 (Continued)





($\beta = -.04$, p = .50). The assessment of the conditional effect (Model 2a) also supported that the moderation effect is not dependent upon regions (B = -.34, p = .17).

When investigating the moderating effect of technological turbulence in the combined sample (Model 3), the results deviate from the findings of the original study: instead of a significant positive moderation, the results indicate no moderating effect ($\beta = .05$, p = .48). When investigating whether the effect is contingent upon regions in Model 4a, the added interaction term is significant (B = -.47, p = .004). This indicates that the moderation effect is less positive for Sample LAC as opposed to the reference group Sample WE. In other words, in the reference group, that is, the sample from Germany and Austria, the positive relationship between RVT and innovation program performance is strengthened in a context of higher technological turbulence. However, the slope of the moderation effect is .47 lower for Sample LAC, that is, the moderation effect for firms in LAC is -.17.

Regarding the moderating role of risk aversion (Model 4), the significant positive effect was replicated in the joint data set (β = .21, p < .001) and the results of the conditional effect model (Model 4a) support that the moderation effect is similar across regions (B = .01, p = .88).

The assessment of the moderator long-term orientation (Model 5) also replicated the original study's findings by revealing a significant

negative effect ($\beta = -.18$, p = .006), and the moderating effect is not conditional upon regions (Model 4a), indicated by a non-significant (B = .29, p = .15) interaction term.

Overall, the results of the main and moderation model assessments lend strong support to the cross-regional validity of the original study results. Only one factor of the external environment, technological turbulence, seems to cause relevant invariances in both the measurement and the structural model. Since all items of this scale, and thereby the construct, have significantly higher values in Sample LAC, the reason for these invariances is likely a higher and thereby more critically perceived exposure of firms in LAC to technological change rather than a matter of different understanding and interpretation of this established scale, which has been used in research for many years.

5 | DISCUSSION

This study assesses the cross-regional applicability of a recently developed concept—RVT—for understanding activities at the fuzzy FEI with data from 1625 informants in 232 organizations across Western Europe and LAC. We thereby contribute to the empirical innovation research, which with few exceptions (e.g., Kroh et al., 2024) has broadly neglected potential differences in how measurement ⁶³² ₩ILEY-

instruments are understood by respondents from different regions and how the investigated concepts are related. Regional differences are also rarely mentioned as potential limitations in past studies. Thereby, most empirical innovation studies imply measurement and structural invariance across regions and take the position that the scales and identified relations are universally applicable across regions. With this study, we demonstrate how to approach and what to learn for future research from applying globally diverse data to empirically assess if findings based on data collected from firms in one region can also be applied to firms located in another region, that is, the findings' cross-regional validity.

Our analysis shows measurement invariance in general, pointing to an overall shared understanding of the RVT concept. As such, we provide support for the notion of RVT validity across regions. Further, we replicated the positive relationship between the application of RVT at the fuzzy FEI and innovation management performance and validated most of the contingency factors investigated in the original research model. There are, however, discrepancies worth discussing. First, the item of the RVT scale concerning the development of alternative and overlapping business models showed differences between the two regions. This element of RVT, identified by Peña Häufler and co-authors (2021) as a mechanism related to reaction capabilities. describes an integrated consideration of product/service features and commercial considerations related to them. As such, it is seen as an approach enabling testing different configurations of mechanisms for the creation, capture, and delivery of value. One explanation of the differences between the countries could be explained in terms of differences in pro-entrepreneurial culture between the two regions, specifically, concerning performance orientation. The Western countries included in the original study by Peña Häufler and co-authors (2021) belong to the so-called Germanic Europe cluster and manifest higher levels of performance orientation than the Latin American group (Globe, 2020). Higher levels of performance orientation entail an increased focus on competitiveness and a higher concern with financial returns, which incentivize the search for opportunities to maximize financial returns (Bockstedt, Druehl, & Mishra, 2015). Thus, the Germanic Europe cluster might focus on developing alternative business models as a strategy to augment learning opportunities and increase the likelihood of maximizing profit margins. Lower performance orientation levels in LAC may cause different perceptions of business models in organizations located in this region. Thus, a potential explanation can be related to differences in the perception of business models as tools for knowledge generation through experimentation and profit maximization, between organizations in Germanic European countries and those in LAC. A further potential explanation for these differences in the perception of the relevance of business model experimentation can be found in the different levels of entrepreneurship education. Comparative research on entrepreneurship factors suggests a lower focus on 'the creation and management of new businesses and growth' (Lopes et al., 2018, p. 7) in Latin America compared with Europe. This diminished focus could lead to lower awareness of business models as a knowledge-generation tool (Lecuna, Cohen, & Chavez, 2017). This could lead to a diminished

relevance of business model experimentation as a tool to structure activities along value proposition, creation, delivery, and capture in comparison with other regions (Johnson, Christensen, & Kagermann, 2008; Osterwalder & Pigneur, 2010).

Furthermore, the impact of uncertainty avoidance or the level to which members of society tolerate uncertainty and ambiguity may also aid in interpreting these differences in the perception of the effectiveness of business model experimentation. This dimension has been found to show the strongest associations with innovation indicators (Calantone, Garcia, & Droge, 2003; Shane, 1993). As Germanic European countries manifest higher levels of uncertainty avoidance than Latin American countries (GLOBE 2022), developing alternative and overlapping business models can be understood as a strategy for risk reduction in these countries. Moreover, countries with higher toleration of risks might not perceive this kind of approach as valuable.

Second, considering the perception of contextual factors, only the dimension of technological turbulence showed scalar variance and consequently also resulted in a moderation effect of the RVTperformance relationship different from the original model. This can be interpreted in terms of higher and thereby more critically perceived exposure of firms in LAC to technological change. These perceptions may be rooted back to the historically determined. low-tech orientation of LAC industries (Bianchi, Mingo, & Fernandez, 2019), which hinders not only the production but also the adoption of new technologies (Suarez & Yoguel, 2020). These challenges may lead to managerial perceptions of increased uncertainty regarding the application of new technologies to development projects, or even the anticipation of technological changes (Song & Montova-Weiss, 2001). Organizations in the LAC region may be aware of global technological developments. When juxtaposing these developments with technological capabilities, the perceptions of technological turbulence may become more salient (Bao, Su, & Noble, 2021). This finding can be interpreted to suggest that, although firms in the LAC region do indeed apply the management practices encompassed in the RVT concept, they do so with an incomplete understanding of their underlying concepts, as evidenced in our finding of the differences concerning the development of alternative business models. Disruption and dynamism brought on by technological turbulence can produce knowledge gaps in the firm, which impedes the development and integration of new knowledge (Bao et al., 2021). These interdependencies contribute to our understanding of the relevance of contextual factors, highlighting the imperative to develop a clear understanding of the factors external to the organizations that may play a role when planning for applying managerial practices, especially in regions structurally different from Western societies.

From a managerial perspective, these findings offer insights on issues organizations aiming to employ approaches like RVT in LAC or structurally similar countries should be aware of. On a general level, our findings suggest the RVT approach to be a valuable tool for knowledge creation, particularly at the FEI. As such, this approach seems to address the uncertainty-related issues in the LAC region as conceptualized in the original publication of Peña Häufler and coauthors (2021). However, specific knowledge-related issues might appear, of which managers should be aware. In the LAC case, a lower awareness of the concepts underlying the management approaches comprised in the RVT concept may be mitigated by in-house training on their basic mechanics and overarching goals. For instance, training could aid in building an understanding of business models as the structure through which a firm ensures value creation, delivers it to its customers and captures the returns of such activities. A joint understanding of this concept could contribute to increasing the firm's awareness of the value of formulating and experimenting with alternative business model configurations as a strategy to respond, for example, to rapid changes in the environment. In-house training dealing with the elements of the business model of the firm could also help consolidate knowledge of the firm's capabilities. This could facilitate the development of appropriate responses to, for example, turbulent technological environments.

6 | LIMITATIONS AND FUTURE RESEARCH

Overall, our exploration of the equivalence of both the concept of RVT and its contingencies across regions indicates the suitability for its application in the LAC region. Our study focused on LAC as a region that, although geographically and developmentally distant, is inextricably linked, both culturally and economically, to Europe and other Western regions. Future research could investigate the applicability of RVT in further, culturally even more distant regions like South-East Asia, or Africa. Although the identified minor differences in perceptions between LAC and Germanic Europe are not surprising, they serve as a reminder for caution when applying concepts validated in Western regions to other regional contexts.

Regarding the identified differences, our lines of argument are rooted in the literature relating cultural facets to innovation management approaches, but our empirical research approach is only fit for uncovering such differences. A deeper assessment of the underlying mechanisms causing the observed differences appears to be a promising task for future research.

Our results suggest an overall shared understanding of the activities at the fuzzy FEI as well as its relationship to innovation program performance. A promising avenue for further research could be the investigation of the applicability of other central concepts of innovation management research like process formalization, champions or user integration. This avenue could follow an empirically led, datadriven investigation into potential cultural differences, which may bring on differences in the interpretation of these concepts, central to innovation management. Further research could focus on the developing hypothesis on the relationships between cultural dimensions like performance orientation and uncertainty avoidance, the application of RVT approaches and performance. A closer examination of the impact of factors identified in the entrepreneurship literature like the length of (entrepreneurship) education (Lecuna et al., 2017; Lopes et al., 2018) on the perception of business models as a tool for knowledge generation could also enhance our understanding of the differences found by our study.

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		Sample 1			Sample 2			
Construct/source	Items	Factor loading	AVE	Cronbach's alpha	Factor loading	AVE	Cronbach's alpha	
Innovation program performance	$(1= ext{strongly disagree. } 5= ext{strongly agree})$.87	.81		.83	.94	
Source: Gemünden, Salomo, & Hölzle, 2007	Regarding all innovation projects over the last three business years							
	The quality of results met our expectations.	.61***			.89***			
	The planned development times were achieved.	.83***			.91***			
	The planned development budgets were kept.	.80***			.93***			
Rapid validity testing	(1 = strongly disagree. 5 = strongly agree)		.70	.93		.78	.96	
Pena Häufler et al., 2021	When carrying out innovation activities we form central assumptions at an early stage which we then test and refine.	.82***			***06.			
	We continuously experiment during the product/ service development phase in order to test our assumptions thoroughly.	.88°.			.91***			
	We already begun to develop prototypes during an early development phase in order to visualize, communicate and assess our concepts.	.92***			.96			
	We carry out systematic prototype tests, e.g., systematic customer survey and customer observation.	.86***			.92***			
	Over the course of developing the product/service, we produce several prototypes, from mock-ups through to functional models.	.92***			.86***			
	Using prototypes we already attempt to estimate market potential as well as the production costs and pricing scope of our new products/services.	.92***			***			
	We experiment with different business models, e.g., developing alternative business cases.	.41***			.75***			
Market turbulence	(1 = strongly disagree. 5 = strongly agree)		.54	.79		.38	.69	
Adapted from: Calantone et al., 2003; Venkatraman, 1989	The competitive conditions in the market are unpredictable.	.68***						
	Customers' needs in our industry are changing rapidly.	***09.			.57***			
	Many new value chain partners (suppliers, service nartners) are artive in the market	.78***			.67***			

 TABLE A1
 Measures and scale properties.

APPENDIX A

		Samula 1			C alume 2		
Construct/source	Items	Factor loading	AVE	Cronbach's alpha	Eactor loading AVE		ronbach's alpha
	Business models often change in the market.	.86***			.41***	1	
Technology turbulence	(1 = strongly disagree. 5 = strongly agree)	·	65	88	.81	03	4
Adapted from: Calantone et al., 2003; Venkatraman, 1989	Our industry often experiences technological breakthroughs.	.86***			.78***		
	The technologies applied in our industry are constantly changing.	.92***			.92***		
	Technologies from different technological fields are often combined in our industry.	.79***			.96		
	New technologies in our industry often trigger business model changes.	.63***			.93***		
Risk aversion	(1 = strongly disagree. 5 = strongly agree)		77	91	99.	ų	5
Adapted from: Jaworski and Kohli, 1993	Our company is characterized by an 'always play it safe' mentality.	.84***			.85***		
	With respect to innovation, we have a wait-and-see posture.	.88			.84***		
	We have a strong proclivity for low-risk innovation activity.	.92***			.74***		
Long-term orientation	(1 = strongly disagree. 5 = strongly agree)		56	77	.43	Ņ	Q
Adapted from: Ruvio, Shoham, Vigoda-Gadot, & Schwabsky., 2014	Our innovation decisions explicitly take long-term and future developments into consideration.	.67***			.62***		
	When taking decisions, we also always consider the future consequences for our company.	.80***			.59***		
	We value long-term success over short-term profits.	.77***			.74***		
Innovation process formality	(1 = strongly disagree. 5 = strongly agree)		94	98	.89	0;	7
Source: Schultz, Globocnik, Kock, & Salomo, 2019	Our company uses a formal innovation process, e.g., a standardized set of stages and go/no-go decisions that guide all innovation activities from the idea through to market launch.	.95***			.94***		
	Our standardized innovation process lists and defines specific activities for each phase of the process (e.g., the validation stage contains activities such as prototype tests and customer tests).	***96.			.94***		
	Our standardized innovation process includes clearly defined go/no-go decision points for each stage of the process.	***66'			.98***		
	Our standardized innovation process defines 'gate keepers', whose task it is, e.g., to review the	.96***			.93***		
							(Continues)

TABLE A1 (Continued)

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TABLE A1 (Continued)							
		Sample 1			Sample 2		
Construct/source	Items	Factor loading	AVE	Cronbach's alpha	Factor loading	AVE	Cronbach's alpha
	activities at each stage of the process as well as decide on whether to continue or abort the project.						
Project management control	(1 = strongly disagree. 5 = strongly agree)		.87	.94		.78	.96
Source: Schultz, Salomo, de Brentani, & Kleinschmidt, 2013	Our company has clear, written and measurable goals for its innovation projects.	.87***			.89***		
	Specific financial goals are defined for our innovation projects.	.80***			.85***		
	The progress of our innovation projects and the achievement of innovation goals are regularly evaluated.	***06.			.91***		
	We have defined procedures for evaluating our innovation projects.	.96***			.93***		
	All innovation projects, even unsuccessful projects, are regularly evaluated in order to learn from experience.	.77***					
	We monitor the performance of our innovation projects at a defined time after market introduction.	.69***			.84***		
Note: Samula 1: $n = 1.29$ Global fit indices: $v^2/df = 1.91$	6: n < 001: CEI - 89: PMSEA - 085 Samula 2: n - 97 G	Inhal fit indices: v ² ,	df - 20	11. n < 001. CEI - 1	86: PMSEA - 103	~	

.86; KMSEA = .103. Note: Sample 1: n = 129. Global fit indices: $\chi^2/df = 1.916$; p < .001; CFI = .89; RMSEA = .085. Sample 2: n = 97. Global fit indices: $\chi^2/df = 2.011$; p < .001; CFI = . Abbreviation: AVE, average variance extracted.

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