Original Article

Innovative Behavior Inventory and Innovation Support Inventory: Translation and Validation in Greek

Ioannis Moisoglou, RN, MSc, PhD
Faculty of Nursing, University of Thessaly, Larissa, Greece

Aglaia Katsiroumpa, RN, MSc, PhD (c)
Clinical Epidemiology Laboratory, Faculty of Nursing, National and Kapodistrian University of Athens, Athens, Greece

Maria Kalogeropoulou, RN, MSc, PhD
Clinical Epidemiology Laboratory, Faculty of Nursing, National and Kapodistrian University of Athens, Greece

Antigoni Kolisiati, MD, MSc
Department of Endocrinology and Diabetes Center, General Hospital "G. Gennimatas", Athens, Greece

Maria Tsiachri, MEd, PhD (c)
Kindergarten Teacher, 6th Kindergarten, Lamia, Greece

Anastasia Tsakalaki
Faculty of Primary Education, National and Kapodistrian University of Athens, Athens, Greece

Petros Galanis, MPH, PhD
Assistant Professor, Clinical Epidemiology Laboratory, Faculty of Nursing, National and Kapodistrian University of Athens, Athens, Greece

Correspondence: Petros Galanis, Assistant Professor, Clinical Epidemiology Laboratory, Faculty of Nursing, National and Kapodistrian University of Athens, 123 Papadiamantopoulou street, GR-11527, Athens, Greece, e-mail: pegalan@nurs.uoa.gr

Abstract

Background: Innovative behavior and innovation support should be measured with valid tools to better understand employees' attitudes.

Aim: To translate and validate the "Innovative Behavior Inventory" (IBI) and the "Innovation Support Inventory" (ISI) in Greek.

Methods: Our sample included 328 nurses in Greece. We performed our study during April 2024. We employed the forward-backward method to translate and adapt the IBI and the ISI in Greek language. We examined the construct validity of the scales by performing confirmatory factor analysis. We examined the concurrent validity of the scales using the "Quiet Quitting Scale" (QQS) and the single item burnout measure. We examined the reliability of the scales by calculating Cronbach's alpha.

Results: IBI and ISI showed very good psychometric properties. Our confirmatory factor analysis confirmed the six-factor structure of the IBI and the three-factor structure of the ISI. Concurrent validity

of the Greek versions of IBI and ISI was very good. We found statistically significant correlations between IBI and QQS (r = -0.540, p<0.001), and single item burnout measure (r = -0.198, p<0.001). We found statistically significant correlations between ISI and QQS (r = -0.313, p<0.001), and single item burnout measure (r = -0.242, p<0.001). Moreover, Cronbach's coefficient alpha for all factors of IBI and ISI was higher than the acceptable cut-off of 0.700.

Conclusions: The Greek versions of the "Innovative Behavior Inventory" and the "Innovation Support Inventory" are reliable and valid tools to measure innovative behavior, innovation support and innovation outputs among workers.

Keywords: Innovative Behavior Inventory; Innovation Support Inventory; innovation; nurses; Quiet Quitting Scale; burnout

Introduction

Organizations worldwide, regardless of their sector of activity, face significant challenges. These include ensuring the quality and safety of products and services, satisfying customer needs, changing consumer habits, the constant introduction of new technologies, high competition and the constant production of new knowledge. All of the above are part of a context of pressure to increase efficiency and at the same time save as many resources as possible.

Human resources play an important role in the growth of an organization, in particular through the innovative behavior that develops within it. A generally accepted definition of innovation is "…..*the intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, the organization or wider society*" (Anderson et al., 2004). As organizations have become more complex, there is huge scope for implementing innovative ideas and actions across the whole range of an organization's activities. When employees develop innovative behavior, then the performance of the organization and the employee's job performance within his/her role is enhanced, the quality of services provided is improved and the well-being of employees is achieved (Asurakkody & Shin, 2018; Mohamed El-Saidy et al., 2020; Shanker et al., 2017; Zhang et al., 2018).

For employees to develop innovative behavior, factors in their work environment have been identified that help to support and promote it. Organizational culture influences the development of innovative behavior, with relationship-oriented and task-oriented organizational cultures being the types of organizational culture most conducive to innovation (Yeong & Young, 2016). Also, workplace happiness, organizational justice, work engagement, supervisor and organizational support are the most significant determinants of employees' innovative behavior (Akram et al., 2020; Bani-Melhem et al., 2018; Kwon & Kim, 2020; Qi et al., 2019). Regarding the leadership style of the employee's immediate supervisor, transformational leadership has been found to have a high influence on the manifestation of innovative behavior, as it motivates employees, creates opportunities for growth and development and provides them with opportunities to express new ideas

and take initiatives (Afsar & Umrani, 2020; Li et al., 2019). The organizational learning can strengthen the work engagement of employees, thereby affecting employee's innovation behavior (Lin & Lee, 2017).

As innovative behavior is related to individual and organizational well-being, and organizational support for this behavior is crucial for its development, it is important for the management of the organizations to be aware of the degree of innovative behavior developed by employees and the support provided to them. The use of valid research tools to measure innovative behavior and support will facilitate the above efforts of administrations. In this context, we examined the psychometric properties of the "Innovative Behavior Inventory" (IBI) and the "Innovation Support Inventory" (ISI) (Lukes & Stephan, 2017) and the "Innovation Outputs" (IO) scale in Greek language.

Methods

Study design: We performed our cross-sectional study during April 2024. We employed a sample of nurses in Greece. We employed the forward-backward method to translate and adapt IBI and ISI in Greek language (Galanis, 2019). We examined the reliability of IBI and ISI by calculating Cronbach's alpha. We examined the construct validity of IBI and ISI by performing confirmatory factor analysis (Galanis, 2013). We examined the concurrent validity of IBI and ISI using the "Quiet Quitting Scale" (QQS) and the single item burnout measure (Hansen & Pit, 2016). In particular, we used the Greek version of QQS (Galanis et al., 2023; Galanis, Katsiroumpa, Vraka, Siskou, Konstantakopoulou, Katsoulas, Moisoglou, et al., 2024) and single item burnout measure (Galanis, Katsiroumpa, Vraka, Siskou, Konstantakopoulou, Katsoulas, Gallos, et al., 2024).

Ethical considerations: We applied the guidelines of the Declaration of Helsinki to perform this study (Association, 2013). Additionally, the study protocol was approved by the Ethics Committee of Faculty of Nursing, National and Kapodistrian University of Athens (reference number; 498, April 01 2024).

Statistical analysis: We performed confirmatory factor analysis (CFA) to examine the construct validity of IBI and ISI. In particular, we calculated chi-square/degree of freedom (x^2/df); root mean square error of approximation (RMSEA); goodness of fit index (GFI); adjusted goodness of fit index (AGFI); Tucker–Lewis index (TLI); incremental fit index (IFI); normed fit index (NFI); comparative fit index (CFI) (Baumgartner & Homburg, 1996; Hu & Bentler, 1998). Acceptable value for x^2/df is <5, for RMSEA is <0.10, and for all other measures in the CFA >0.90. We used the AMOS version 21 (Amos Development Corporation, 2018) to conduct the CFA. We calculated Pearson's correlation coefficient between IBI, ISI, QQS, and the single item burnout measure to examine the concurrent validity of IBI and ISI. P-values less than 0.05 were considered as statistically significant. We used the IBM SPSS 21.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) for the analysis.

Results

Our sample included 328 nurses. In our sample, percentage of females was 89.9% and percentage of males was 10.1%. Mean age of participants was 42.3 years with a standard deviation of 9.7 years.

Cronbach's coefficient alpha for IBI and ISI are shown in Table 1. Cronbach's coefficient alpha for all scales was higher than the acceptable cut-off of 0.700. Thus, our scales had acceptable internal reliability.

We performed confirmatory factor analysis to examine the structure of the IBI and we found that the Greek version of the IBI had a six-factor structure as the original version (Figure 1). Table 2 presents model fit indices for the confirmatory factor analysis of the IBI. All indices indicated an acceptable three-factor model. In particular, x^2/df was 234.130, RMSEA was 0.045, GFI was 0.932, AGFI was 0.978, TLI was 0.901, IFI was 0.946, NFI was 0.999, and CFI was 0.978. Correlation between the six factors ranged from 0.38 to 0.90 (Figure 1). Moreover, standardized regression weights for the 20 items ranged from 0.56 to 0.90.

Concurrent validity of the Greek version of the IBI was very good since we found statistically significant correlations between IBI and QQS ($r = -0.540$, $p<0.001$), and single item burnout measure ($r = -0.198$, $p<0.001$).

We performed confirmatory factor analysis to examine the structure of ISI and we found that the Greek version of the ISI had a three-factor structure as the original version (Figure 2). Table 3 presents model fit indices for the confirmatory factor analysis of the ISI. All indices indicated an acceptable three-factor model. In particular, x^2/df was 1.695, RMSEA was 0.046, GFI was 0.976, AGFI was 0.934, TLI was 0.966, IFI was 0.976, NFI was 0.944, and CFI was 0.976. Correlation between the three factors ranged from 0.16 to 0.50 (Figure 2). Moreover, standardized regression weights for the 12 items ranged from 0.22 to 0.88.

Concurrent validity of the Greek version of the ISI was very good since we found statistically significant correlations between ISI and QQS ($r = -0.313$, $p<0.001$), and single item burnout measure ($r = -0.242$, $p<0.001$).

Discussion

This is the first study that translates and validates the IBI and ISI in a sample of Greek nurses. Our findings revealed that IBI and ISI are reliable and valid tools to measure employee innovative behavior and support. Moreover, since we examined several types of reliability (test-retest reliability, internal reliability), and validity (face validity, construct validity, and concurrent validity) our results seem to be robust. In particular, the results of the confirmatory factor analysis for both IBI and ISI showed that the Greek version shows excellent fit, as all indices have acceptable values. Also, confirmatory factor analysis confirmed the six-factor structure of the IBI and the three-factor structure of the ISI. Concurrent validity of the Greek version of the IBI and the ISI was very good since we found statistically significant correlations between IBI and ISI and the other tools.

Additionally, all Cronbach's coefficients alpha for all scales were higher than the acceptable cut-off of 0.700 (range from 0.701 to 0.885). Several studies, which have validated these inventories or used their validated versions, including the initial study of those who developed the inventories, support this finding by confirming the strong internal consistency of the IBI and ISI (Emiralioglu & Sonmez, 2021; Kuril et al., 2023; Lukes & Stephan, 2017; Sonmez et al., 2019). The use of reliable and valid tools will assist the management of organizations to assess the degree of innovative behavior of employees and the support provided to them,

to improve the working environment and to create favorable conditions for the development and strengthening of such behaviors.

Limitations: Our study had several limitations. We used a convenience sample of nurses to validate IBI and ISI in Greek. Therefore, we cannot generalize our results. There is a need to validate the tools among other workers in Greece. Moreover, we employed self-reported questionnaires, such as the QQS and the single item burnout measure to investigate the concurrent validity of IBI and ISI. Also, scholars can investigate several other types of validity of IBI and ISI.

Conclusion: In conclusion, the Greek versions of the "Innovative Behavior Inventory" and the "Innovation Support Inventory" are reliable and valid tools to measure innovative behavior and innovation support among workers.

Table 1. Cronbach's coefficient alphas for the "Innovative Behavior Inventory" and the "Innovation Support Inventory".

Scale	Cronbach's coefficient alpha
Innovation Support Inventory	
Managerial support	0.825
Organizational support	0.701
Cultural support	0.727
Innovative Behavior Inventory	
Idea generation	0.723
Idea search	0.860
Idea communication	0.873
Implementation starting activities	0.818
Involving others	0.790
Overcoming obstacles	0.885

Table 2. Confirmatory factor analysis for the Greek version of the "Innovative Behavior Inventory".

Model	x^2	df	x^2/df	RMSEA	GFI	AGFI	TLI	IFI	NFI	CFI
20 items	234.130	140	1.672	0.045	0.932	0.978	0.901	0.978	0.946	0.978

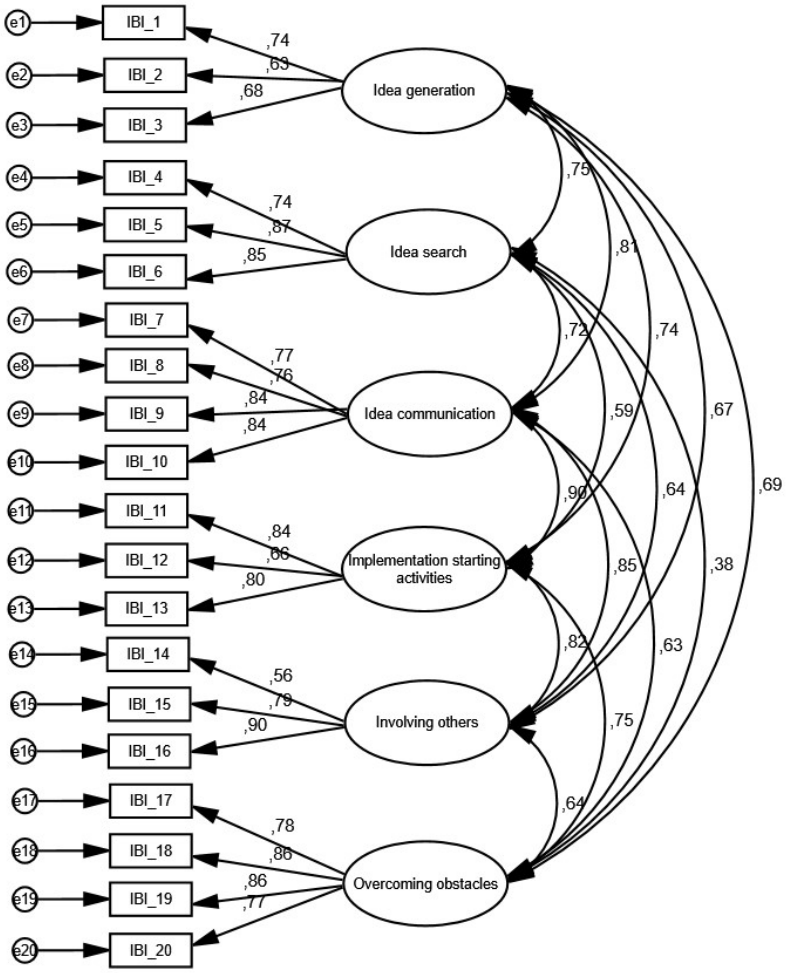

Figure 1. Confirmatory factor analysis for the Greek version of the "Innovative Behavior Inventory".

Table 3. Confirmatory factor analysis for the Greek version of the "Innovation Support Inventory".

Model	x^2	df	x^2/df	RMSEA	GFI	AGFI	TLI	IFI	NFI	CFI
12 items	79.649	47	1.695	0.046	0.976	0.934	0.966	0.976	0.944	0.976

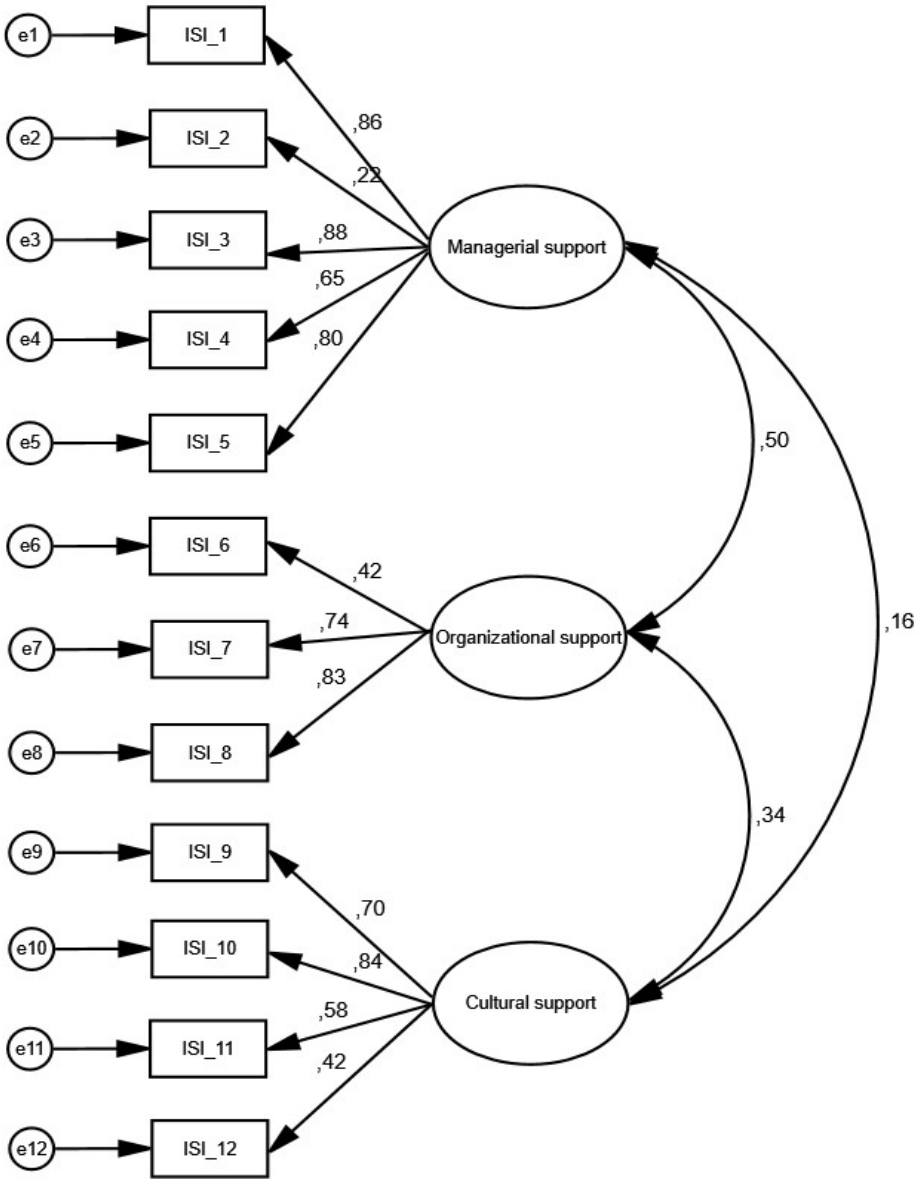

Figure 2. Confirmatory factor analysis for the Greek version of the "Innovation Support Inventory".

References

Afsar, B., & Umrani, W. A. (2020). Transformational leadership and innovative work behavior: The role of motivation to learn, task complexity and innovation climate. *European Journal of Innovation Management*, *23*(3), 402–428.

Akram, T., Lei, S., Haider, M. J., & Hussain, S. T. (2020). The impact of organizational justice on employee innovative work behavior: Mediating role of knowledge sharing. *Journal of Innovation & Knowledge*, *5*(2), 117–129.

Anderson, N., De Dreu, C. K. W., & Nijstad, B. A. (2004). The routinization of innovation research: a constructively critical review of the state-of-the-science. *Journal of Organizational Behavior*, *25*(2), 147–173.

Association, W. M. (2013). World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. *JAMA*, *310*(20), 2191–2194.

Asurakkody, T. A., & Shin, S. Y. (2018). Innovative Behavior in Nursing Context: A Concept Analysis. *Asian Nursing Research*, *12*(4), 237–244.

Bani-Melhem, S., Zeffane, R., & Albaity, M. (2018). Determinants of employees' innovative behavior. *International Journal of Contemporary Hospitality Management*, *30*(3), 1601–1620.

Baumgartner, H., & Homburg, C. (1996). Applications of structural equation modeling in marketing and consumer research: A review. *International Journal of Research in Marketing*, *13*(2), 139–161.

Emiralioglu, R., & Sonmez, B. (2021). The relationship of nursing work environment and innovation support with nurses' innovative behaviours and outputs. *Journal of Nursing Management*, *29*(7), 2132–2141.

Galanis, P. (2013). Validity and reliability of questionnaires in epidemiological studies. *Archives of Hellenic Medicine*, *30*(1), 97–110.

Galanis, P. (2019). Translation and cross-cultural adaptation methodology for questionnaires in languages other than Greek. *Archives of Hellenic Medicine*, *36*(1), 124–135.

Galanis, P., Katsiroumpa, A., Vraka, I., Siskou, O., Konstantakopoulou, O., Katsoulas, T., Gallos, P., & Kaitelidou, D. (2024). The single item burnout measure is a reliable and valid tool to measure occupational burnout. *Archives of Hellenic Medicine*, *41*(2), 245–250.

Galanis, P., Katsiroumpa, A., Vraka, I., Siskou, O., Konstantakopoulou, O., Katsoulas, T., Moisoglou, I., Gallos, P., & Kaitelidou, D. (2024). Nurses quietly quit their job more often than other healthcare workers: An alarming issue for healthcare services. *International Nursing Review*, 1–10. https://doi.org/10.1111/INR.12931

Galanis, P., Katsiroumpa, A., Vraka, I., Siskou, O., Konstantakopoulou, O., Moisoglou, I., Gallos, P., & Kaitelidou, D. (2023). The quiet quitting scale: Development and initial validation. *AIMS Public Health*, *10*(4), 828–848.

Hansen, V., & Pit, S. (2016). The Single Item Burnout Measure is a Psychometrically Sound Screening Tool for Occupational Burnout. *Health Scope (Zahedan)*, *5*(2), 32164. https://doi.org/10.17795/JHEALTHSCOPE-32164

Hu, L. T., & Bentler, P. M. (1998). Fit Indices in Covariance Structure Modeling: Sensitivity to Underparameterized Model Misspecification. *Psychological Methods*, *3*(4), 424–453.

Kuril, S., Maun, D., & Chand, V. S. (2023). Measuring teacher innovative behavior: a validated multidimensional inventory for use with public school teachers. International Journal of Educational, 37(2), 393-416 *International Journal of Educational Management*, *37*(2), 393–416.

Kwon, K., & Kim, T. (2020). An integrative literature review of employee engagement and innovative behavior: Revisiting the JD-R model. *Human Resource Management Review*, *30*(2), 100704. https://doi.org/10.1016/J.HRMR.2019.100704

Li, H., Sajjad, N., Wang, Q., Ali, A. M., Khaqan, Z., & Amina, S. (2019). Influence of Transformational Leadership on Employees' Innovative Work Behavior in Sustainable Organizations: Test of Mediation and Moderation Processes. *Sustainability 2019, Vol. 11, Page 1594*, *11*(6), 1594.

Lin, H. C., & Lee, Y. D. (2017). A Study of The Influence of Organizational Learning on Employees' Innovative Behavior and Work Engagement by A Cross-Level Examination. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(7), 3463–3478.

Lukes, M., & Stephan, U. (2017). Measuring employee innovation: A review of existing scales and the development of the innovative behavior and innovation support inventories across cultures. *International Journal of Entrepreneurial Behaviour and Research*, *23*(1), 136–158.

Mohamed El-Saidy, T., Mohamed Baker, M., & Mohamed Khalefa El-saidy, T. (2020). Development of Nurse Manager Innovative Behavior and Its Effect on the Quality of Care for Elderly Patients. *International Journal of Novel Research in Healthcare and Nursing*, *7*(3), 277–288.

Qi, L., Liu, B., Wei, X., & Hu, Y. (2019). Impact of inclusive leadership on employee innovative behavior: Perceived organizational support as a mediator. *PLOS ONE*, *14*(2), e0212091. https://doi.org/10.1371/JOURNAL.PONE.0212091

Shanker, R., Bhanugopan, R., van der Heijden, B. I. J. M., & Farrell, M. (2017). Organizational climate for innovation and organizational performance: The mediating effect of innovative work behavior. *Journal of Vocational Behavior*, *100*, 67–77.

Sonmez, B., Ispir, O., Onal, M., & Emiralioglu, R. (2019). Turkish psychometric properties of the Innovative Behavior Inventory and Innovation Support Inventory: A model analysis on nurses. *Nursing Forum*, *54*(2), 254–262.

Yeong, M., & Young, S. (2016). Impact of Nursing Organizational Culture Types on Innovative Behavior and Job Embeddedness Perceived by Nurses. *Journal of Korean Academy of Nursing Administration*, *22*(4), 313–322.

Zhang, Y., Zhang, J., Forest, J., & Chen, C. (2018). The negative and positive aspects of employees' innovative behavior: Role of goals of employees and supervisors. *Frontiers in Psychology*, *9*(OCT), 406701. https://doi.org/10.3389/FPSYG.2018.01871/BIBTEX