Spanish validation of the Benchmark Resilience Tool (Short-form version) to evaluate organisational resilience

Abstract

Organisational resilience (OR) is an organisation's ability to plan, respond to and recover from emergencies and crises. Evaluating resilience allows organisations to increase their level of awareness of the environment as well as their ability to react to threats. However, the research carried out in this field has been mainly theoretical, and there are few quantitative tools to measure it. The purpose of this study was to adapt and validate the short-form version of the Benchmark Resilience Tool into Spanish language and to explore its relationship with safety climate. A sample of 388 Spanish workers from two highly reliable sectors, healthcare and nuclear energy was used. Internal consistency analyses, test-retests, confirmatory factorial analysis (CFA), exploratory structural equation modelling (ESEM) and invariance analyses across organisation type and sex were performed. We concluded that the instrument fulfils the psychometric criteria to evaluate resilience in healthcare and nuclear organisations in Spain. We briefly discuss the practical implications as well as some of the limitations and recommendations for future research.

Keywords: Resilience, Benchmark Resilience Tool, validation, confirmatory factor analysis, high reliability organisations, safety climate.

Below we present the review of the relevant literature to define the objective of the study. Subsequently, the method was presented in section 2. Then, in section 3, the results obtained were presented, followed by their respective discussion in section 4. Finally, section 5 were highlighted the main conclusions of the investigation.

1. Introduction

Currently, organisations are dealing with climates of uncertainty which pose serious challenges to individuals, groups and organisations. Resilience is one way of responding to this inevitable adversity as a key behaviour that is strategically linked to the success, growth and survival of the organisation (King, Newman & Luthans, 2016).

Organisational resilience (OR) is an organisation's ability to survive and even strengthen in times of crisis (Seville et al., 2008). It is more visible after a natural disaster; however, in everyday life, organisations have to handle a variety of crises (financial difficulties, large-scale products, failures in the supply chain, industrial accidents, etc.), in which organisational resilience may be less visible but is nonetheless extremely important (Setphenson, Vargo & Seville, 2010).

One of the main benefits of evaluating resilience in organisations is that it increases the level of awareness of its climate (both internal and external) and allows the organisation to identify its main vulnerabilities as well as its action priorities in emergency situations (Seville, 2008; Villemain et al, 2016). Furthermore, levels of resilience are positively related to the organisation's safety (Bergström, Winsen & Henriqson, 2015; Pillay et al., 2015), reliability (Madni & Jackson, 2009; Weick & Sutcliffe, 2007) and competitiveness (Lee, Vargo & Seville, 2013).

Even though resilience has been thoroughly examined theoretically through the development of models and case studies in organisations (Annarelli & Nonino, 2016; Bhamra, Dani & Burnard, 2011; Madni & Jackson, 2009), the survey methodology has received little attention, and there are just a handful of studies that attempt to quantify it (Rigui, Saurin & Wachs, 2015; Tamvakis & Xenidis, 2013).

1.1. Instruments to measure organisational resilience

There are currently several questionnaires in the literature that measure organisational resilience with different empirical support. Some studies have attempted to evaluate the construct through different dimensions or indicators (Kantur & Iseri-Say, 2015). Below is a summary of different studies which have sought to measure organisational resilience.

Mallak (1998) designed a questionnaire based on Weick's model (1993) with a sample of 128 nursing managers and identified six indicators: the quest for goal-oriented solutions, avoidance or scepticism, critical understanding, a system of roles, sources of resilience and access to resources. Somers (2009) expanded upon this study with 142 workers in public organisations to develop the Potential Organisational Resilience scale. In addition to the six factors of the original questionnaire, the following were added: decision-making structure and centralisation, connectivity, planning and accreditation.

Shirali et al. (2013) based on the Resilience Engineering model of Hollnagel et al. (2006) developed a questionnaire with 61 items grouped into six dimensions resulting from a principal component analysis: commitment of management, fair culture, learning culture, awareness, preparation and flexibility. Azadeh et al. (2014) designed a questionnaire to measure Integrated Organisational Resilience, which in addition to the six previous factors includes the following dimensions: self-organisation, teamwork, redundancy and tolerance of error. They administered the instrument to 115 workers at a company in the petrochemical sector. They concluded that this instrument not only provides quantitative data on resilience but also enables the organisation's safety to be improved.

Stephenson (2010) developed a quantitative methodology to measure indicators of organisational resilience based on qualitative work via an extensive literature survey conducted by McManus et al. (2008). Based on both studies, Lee, Vargo and Seville (2013) developed the Benchmark Resilience Tool (BRT-53) a questionnaire tested on a random sample of 68 organisations in the Auckland region of New Zealand. Through an exploratory factor analysis, the 53 items representing 13 theoretical indicators were grouped into two factors: planning and adaptive capacity. Planning implied the use of predetermined planning capacities for the continuity of the business and risk management initiatives. Adaptive capacity was associated with the ability to deal with the organisation's needs before they become critical, and it emerges as a result of strong leadership and culture.

More recently, Brown, Seville and Vargo (2017) administered an improved version of the Benchmark Resilience Tool (BRT-53) to 18 critical-infrastructure organisations (electricity, telecommunications, gas and fuel, roads, rails, ports and water) with the purpose of evaluating their organisational resilience. Through principal component factor analysis with varimax rotation, they performed a previous validation of the questionnaire and found a single factor. According to these authors, this structure does not necessarily exclude the two-factor structure of the original scale, which has been proven in organisations from a wide variety of sectors. Indeed, the one-dimensional structure may be a characteristic of critical-infrastructure organisations and should be the focus of future studies.

The Benchmark Resilience Tool (BRT-53) provides organisations with relevant information on their resilience strengths and weaknesses. However, it has several limitations associated with its length, which motivated Whitman et al. (2013) to develop a short-form version through two validation procedures. The 13 items that best represented each of the 13 indicators measured on the original scale were chosen by a panel of seven experts (BRT-13A) and via statistical analyses (BRT-13B). Both questionnaires were tested in three samples in New Zealand. Correlations were calculated between the BRT-53 and the two shorter versions by evaluating the scores on Total Organisational Resilience and on each factor individually (adaptive capacity and planning). Even though the two short-form versions provided valid results similar to the original scale, the BRT-13B version is highly recommended.

Sharma & Sharma (2015) evaluated the psychometric properties of the short-form version of the Benchmark Resilience Tool (BRT-13B) in a sample of 160 employees of twelve Information Technology (IT) companies located in India. The results supported the original two-factor structure, reliability and validity of the BRT-13 B instrument for measuring the resilience of executives in this kind of company.

Specifically in Spain, no organisational resilience questionnaire has been identified. Therefore, it is necessary to have an instrument that allows Spanish organisations to evaluate their resilience indicators. For this reason, the BRT-13B questionnaire was selected considering its theoretical model, its validation methods (quantitative and qualitative) and the practical benefits associated with a reduced version, described above. The present study has been designed with the objective of validating the Spanish version of the BRT-13B and determining its relationship with the safety culture as a form of concurrent validity, based on the assumption that both constructs could be associated according to the literature, as below.

1.2 Safety Culture

The term “safety culture” was first introduced in 1991 by the International Atomic Energy Agency (IAEA) after their inquiry into the Chernobyl nuclear power plant disaster in 1986. “Safety culture denotes the assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance” (IAEA, 2002).

A large number of definitions of safety culture have been developed (Cox & Cox, 1991; Pidgeon, 1991; Geller; 1994; Lee, 1996). It relates to the core assumptions that organisational members hold concerning safety issues; it is expressed through the beliefs, values and behavioral norms and it is evident in company safety policy, rules and procedures (Mearn & Flin, 1999; Clarke, 2000). Although there is no universally accepted definition of positive safety culture, commonly it is regarding to a shared understanding that safety is a priority (Clarke, 2003).

On the other hand, the concept of safety climate refers to the beliefs, values, and perceptions about safety that are shared within a specific group (Zohar, 1980; Cooper and Philips, 2004). Weigman et al (2002) argue that safety climate is a psychological phenomenon, which is usually defined as the perceptions of the state of safety at a particular time, it is a temporal phenomenon, relatively unstable and subject to change.

In a systematic review of the literature, Guldenmund (2000) has found that some authors perceived safety climate and culture as the same phenomenon, while many perceive the two as separate constructs. It is concluded that safety climate might be considered an alternative safety performance indicator.

Safety climate has a narrower focus than safety culture and exists closer to operations, being characterized by dayto-day perceptions towards the working environment (Bhattacharya, 2015). Also Wiegmann et al., (2004) viewed the safety climate as a measure of the safety culture, which provides “quick snapshot” of the workers’ perceptions of safety (Yule et al., 2007; Shannon & Norman, 2009). Recently, Do Nascimento, Andrade, & de Mesquita, (2017) argue that a significant number of assessment the safety culture based on safety climate questionnaires, have been published in health and ‘safety at work’ areas.

Although an exhaustive review in this regard, is not the objective of this study, it is worth mentioning the following questionnaires: Pharmacy Safety Climate Questionnaire (PSCQ) by Ashcroft DM & Parker D. (2009), el Safety Attitudes Questionnaire (SAQ) by Sexton et al (2006), The Nordic Safety Climate Questionnaire (NOSACQ-50) by Kines et al 2011 and Organisational-Level Safety Climate scale by Zohar and Luria (2005)

In this study, we used the Spanish adaptation developed by Martínez-Córcoles et al. (2011) of the Zohar & Luria (2005) questionnaire. According to the previous literature, safety climate was considered a way to measure the safety culture, with the aim of providing an indicator of concurrent validity of the BRT-13B, based on the assumption that they are constructs could be related. In the next section we present the arguments of this possible relationship.

1.3 Organisational resilience and safety culture

The interest in the study of resilience and safety of organisations has increased considerably in recent years (Azadeh & Zarrin, 2015; Bergström et al 2015; Hosseini, Barker & Ramirez-Marquez, 2016; Righi, Saurin & Wachs, 2015). Resilience is considered a way to deal with the risk and managing uncertainty is essential for safety critical organisations (Grote, 2015).

Pillay (2015) exposed the evolution and development of safety culture and resilience as different eras and associated these as more advanced and sophisticated strategies for managing safety.

Some papers discussed that safety culture and resilience are linked. Han, Lee and Pena-Mora (2010) investigated how organisations perceived change in safety culture and restored it to an acceptable state using a resilience engineering perspective.

Macchi et al (2011) demonstrated how key principles of safety culture can be examined through resilience engineering in contexts such as nuclear and healthcare. According to Shirali, Shekari and Angali (2016) a strong safety culture and the proactive nature of the resilience engineering can help the organisation not only to prevent the occurrence of accidents but also to recover after an upset. Other studies posit that a culture of safety is necessary for developing resilience in organisations (Akselsson et al 2009; Jeffcott et al.2009; Pillay, 2010). Chen, McCabe and Hyatt (2017), in turn, found favourable results between the climate of safety and the individual resilience of workers.

However, according to Pillay (2017) many of the papers are conceptual and have not been empirically tested, and it could be therefore suggested that the link between safety culture and resilience is still an area of further attention, both in terms of research and practice. More empirical studies are necessary to develop, understand and/or validate any association between both constructs.

With the aim to provide an indicator of concurrent validity of BRT-13B, in the present research, we empirically exploring the relationship between organisational resilience and the safety climate, under the hypothesis that both constructs are positively correlated.

1.3. Organisational resilience in High Reliability Organizations

The 'high reliability organisation' (HRO) paradigm identified commonalities of operations among aircraft carriers, air traffic control and nuclear power. Although they may seem diverse, these organisations have a number of similarities. First, they operate in unforgiving social and political environments. Second, their technologies are risky and present potential for error. Third, the scale of possible consequences from errors or mistakes precludes learning through experimentation. Finally, to avoid failures, these organisations use complex processes to manage complex technologies (Roberts KH & Bea, 2001).

According to some studies, the HRO paradigm can be extrapolated to the field of health (Chassin y Loeb, 2013; Roberts y cols, 2005; van Stralen, D., 2008). Amalberti, (2013) argues that health organisations are also characterized by their high uncertainty, diversity and interactive complexity. From a theoretical standpoint, Sutcliffe (2011) analized anesthesia as an environment in which there is a great interdependence of various aspects of the organisational system and in which the organisational environment changes continuously, which causes unforeseen disturbances of great variety. In anesthesia, a highly reliable performance is necessary, the work is not routine and there is a high level of interactive complexity.

The High Reliability Organisations cultivate resilience by anticipating possible dangers before damage is done (Sutcliffe, 2011). In this regard, different studies have been conducted to cover the importance of resilience in nuclear power plants (Weick and Sutcliffe, 2007) and healthcare (Hollnagel et al., 2013), as mentioned below.

In the nuclear sector, Carvalho et al., (2008) analyzed micro incidents during nuclear power plant operation. Gómes et al., (2014) found sources of resilience related to team coordination in the nuclear emergency. Savioja et al., (2014) contributed in the construction of resilient emergency operating activity in nuclear plant.

Regarding to the healthcare organisations, resilience makes a large contribution to patient safety and medical practice (Fairbanks, 2014), using adaptive and flexible work processes to deliver safe and reliable services, to increase their capacity to handle unexpected events (Macrae & Draycott, 2016) less centralized processes to learn from everyday clinical work (Sujan, Huang & Braithwaite (2016) and designing a work environment that supports people and positively influences the acquisition and use of resilience skills (Wachs et al, 2016).

Based on the previous review, both nuclear energy and the healthcare sector could be considered as HROs, to study resilience. The purpose of this study was to validate the short-form version of the Benchmark Resilience Tool (BRT-13B) into Spanish language in healthcare and nuclear organisations to create an instrument that allows for an overall evaluation of resilience in the field of HROs. With this aim, it was proposed to contribute to organisational resilience literature by enabling development of quantitative methods focusing on evaluation of resilience in Spanish organisations.

2. Method

2.1. Participants

In this study participated different Spanish organisations representative of the fields of healthcare (7 organisations) and nuclear energy (9 organisations). The total sample was made up of 388 workers, 174 in healthcare and 212 in nuclear energy.

A 49.2% of the respondents were men. 64% fell within an age range of 36 to 57 (M=46.42; SD=10.16); 61.6% of the participants had less than 20 years of seniority in the organisation (M=16.78; SD=10.35). We found significant differences between the healthcare and nuclear energy sectors in terms of the gender of the participants: while the nuclear energy sample was primarily comprised of men (73.4%), the sample from the healthcare sector was formed mainly by women (80.5%). The details on each sub-sample are shown in Table 1.

2.2. Instruments

Organisational resilience was measured using the adaptation of the short-form version of the Benchmark Resilience Tool (BRT-53) developed by Lee, Vargo & Seville (2013). The short-form version (BRT-13B) validated by Whitman et al. (2013) consists in 13 items on a Likert response scale with 8 options from 1 (strongly disagree) to 8 (strongly agree). This shorter questionnaire reproduces the two factors found on the original scale: planning and adaptive capacity. The items on the questionnaire are shown in Appendix A.

As the purpose of proving the concurrent validity, it was evaluated the safety climate. We used the Spanish adaptation developed by Martínez-Córcoles et al. (2011) of the Organisational-Level Safety Climate scale by Zohar and Luria (2005). The questionnaire contains 16 items with a 5-point Likert response scale from 1 “strongly disagree” to 5 “strongly agree”. Martínez-Córcoles et al. (2011) found that the best structure of the scale is the one-dimensional structure.

2.3. Procedure

We requested the authorisation of the authors of the BRT-13, belonging to the Resilient Organisations research group in New Zealand, to adapt and validate the short-form version of the Organisational Resilience scale into Spanish. In line with the recommendations by Muñiz, Elosua and Hambleton (2013), three researchers made independent translations from English to Spanish, which were then integrated into a joint version which was given to two bilingual experts who carried out a back-translation of the items to English. Both back-translations from bilingual experts were integrated into a single version which was sent to the authors of the questionnaire, so they could verify the correspondence between the back-translated items and the original ones. The comments received from the authors were incorporated and gave rise to the final version of the questionnaire in Spanish.

The questionnaire was administered in its online version. The anonymity and confidentiality of the data were guaranteed, as was strict compliance with ethical research guidelines.

In order to evaluate temporal stability, the questionnaire was re-administered to a voluntary sub-sample of participants (N=73) approximately five weeks after the first administration.

2.4. Data analysis

The data were analysed using SPSS 24 and STATA 14. Comparison of percentages between the two sub-samples was done using chi-squared tests and the means were compared via Student's t-test, previous verification of the normality of the measures.

To confirm structural validity of the BRT-13, a two-factor confirmatory factor analysis (CFA) and a 1-to-3-factor exploratory structural equation modelling (ESEM) with oblique rotation were estimated. ESEM is sometimes described as an exploratory CFA because allows to have factorial loads different of zero in the items not assigned to a factor. Because of the absence of multivariate normality, but with approximately normal univariate distributions, the robust maximum likelihood method was applied (Muthén & Muthén, 1998-2012). To evaluate the fit of the models the parameters recommended in the literature were used (Hair et al., 2007; Klyne, 2005). Specifically, we examined the chi-squared statistics, the Root Mean Square Error Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR), the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI). These indexes were interpreted following the usual proposals, which revealed goodness of fit of the model when: RMSEA $\leq$ .06, SRMR $<$ .08, CFI $>$ .95 and TLI $>$ .95.

Invariance across organisation type (healthcare and nuclear energy) and across sex was measured for the previously selected model. Invariance analysis determines if the factorial structure is shared between organisation type and between sexes. Table 4 shows the models in each step of the invariance analysis (Byrne, 2012), which consisted in comparing progressively more constrained nested models (from least to most restrictive) using Satorra's (2000) adjusted test statistic. The alpha value for testing nested models through the likelihood ratio test was set at .01 for Type I error control (Green & Babyak, 1997; Gomez, 2013).

To evaluate the internal consistency of the total and the two organisational resilience scales, Cronbach's alpha coefficients were calculated. The test-retest reliability was studied with the intra-class correlation coefficients (ICC). To interpret the results, we considered the criteria suggested by Fleiss (1986), which states that values above .70 are indicators of good concordance between the measures.

To study the concurrent validity between organisational resilience and safety climate, we calculated Pearson correlations between both constructs. Although this procedure was not carried out in the original validation of the questionnaire, it was considered this type of analysis as an additional contribution of this study.

3. Results

3.1. Descriptive Analysis

The descriptive statistics for each of the organisational resilience and safety climate factors are shown in Table 1. The Planning factor earned higher scores (M = 5.64; SD = 1.30) than the Adaptive Capacity factor (M = 4.72; SD = 1.54). The nuclear sector obtained significantly higher scores than the healthcare sector on the measurements of resilience and safety climate.

Table 1. Description of the two sub-samples

Sociodemographic variables	Complete sample (N=388)	Healthcare sector (N=174)	Nuclear sector (N=214)	*p*
Sex – N (%)				
Males	191 (49.2)	34 (19.5)	157 (73.4)	<.001
Females	197 (50.8)	140 (80.5)	57 (26.6)	
Age - M (SD)	46.42 (10.16)	43.90 (9.67)	48.44 (10.10)	<.001
Seniority – M (SD)	16.80 (10.35)	14.22 (9.23)	18.89 (10.75)	<.001
Job Title - Healthcare N (%)				
Physician		24 (14.1)		
Nurse		47 (27.6)		
Assistant		24 (14.1)		
Other professionals		23 (13.5)		
Technicians		52 (30.7)		
Job Title – Nuclear N (%)				
Senior management			18 (8.5)	
Middle management			100 (46.9)	
Supervisors – Bosses			38 (17.8)	
Workers			57 (26.8)	
Organisational resilience (1-8)				
Planning – M (SD)	5.64 (1.30)	5.37 (1.16)	5.86 (1.37)	<.001
Adaptive capacity – M (SD)	4.72 (1.54)	4.48 (1.43)	4.92 (1.59)	.004
Overall score – M (SD)	5.08 (1.36)	4.82 (1.22)	5.28 (1.43)	.001
Climate of Safety – M (SD)	55.94 (13.70)	50.92 (12.81)	59.60 (13.19)	<.001

3.2. Confirmatory Factorial Analysis (CFA) and Exploratory Structural Equation Modelling (ESEM)

Table 2 presents results of the CFA and ESEM models. The two-factor CFA model obtained a significant goodness of fit as assessed with Pearson χ^2 ($p < .001$), along with acceptable CFI and TLI values and good SRMR, although the RMSEA was above .06. The correlation between factors was .875. Table 3 shows the loading factors for the 13 items in the 2 factors. Values were between .637 and .843, except for item 2 (.415), although this lower load was above the criteria (.40) stated in Hair et al. (2007). The univariate ESEM model showed the worst goodness of fit values, with only the SRMR meeting the minimum recommendations. As expected, the 13 items had significant and high factor loadings. The ESEM 2-factor model showed good indices, but those for the ESEM-3 factor were even better. Table 3 shows the loading factors for the 2- and 3-factor models. In the 2-factor model, the loads for items 1 to 9 were higher for factor 1, while the loads for items 10 to 13 were higher for factor 2. Although the loads for items 6 to 9 in factor 2 were statistically significant, they did not reach the value .40. In the 3-factor model, items 5, 8 and 11 had significant loads in factor 3, and only item 8 was above .40.

Table 2. Goodness-of-fit indices of CFA and ESEM models

MODEL	χ2 (df)	CFI	TLI	SRMR	RMSEA (90% CI)
CFA 2-factor	234.46 (64)	.926	.910	.044	.083 (.072 ; .094)
ESEM 1-factor	297.78 (65)	.899	.879	.051	.096 (.085 ; .107)
ESEM 2-factor	108.78 (53)	.976	.964	.024	.052 (.038 ; .066)
ESEM 3-factor	59.12 (42)	.993	.986	.017	.032 (.007 ; .050)

CFI: Comparative fit index; TLI: Tucker-Lewis Index; SRMR: standardized root mean square residual; RMSEA: Root Mean Square Error of Approximation; CI: Confidence interval

Table 3. Loadings for CFA and ESEM two-factor solutions models

	CFA 2-factor		ESEM 2-factor		ESEM 3-factor		
Item	Planning	Adaption	Factor 1	Factor 2	Factor 1	Factor 2	Factor 3
1	.637*		.623*	.015	.626*	.006	.095
2	.415*		.429*	-.012	.467*	-.066	-.034
3	.715*		.835*	-.130	.858*	-.174*	.038
4	.740*		.738*	-.025	.740*	-.011	.243
5	.843*		.648*	.214*	.653*	.220*	.179*
6		.724*	.482*	.299*	.566*	.187	-.153
7		.801*	.589*	.280*	.628*	.228*	.004
8		.776*	.552*	.280*	.782*	.001	-.464*
9		.826*	.604*	.291*	.666*	.204*	-.078
10		.819*	.005	.905*	.054	.865*	.000
11		.704*	.048	.718*	.031	.762*	.142*
12		.790*	.383*	.470*	.426*	.414*	-.046
13		.752*	-.025	.854*	-.027	.884*	.107

* Statistically significant

3.3. Invariance measurement across organisation type and sex

Given the results on goodness of fit and loading factors comparing the CFA and ESEM models, taking also into account the original structure of the questionnaire and the parsimonious principle, the 2-factor CFA was selected to measure invariance. Table 4 (top) shows invariance across organisation type (healthcare and nuclear energy), with M0 showing CFA models estimated separately for each organisation, and M1 to M5 showing models with progressively more restrictions. The baseline models were better supported for nuclear energy than for healthcare organisations since model fit was clearly better. Metric invariance was found, which allows OR factors to be related with other constructs.

Table 4 (bottom) shows invariance measurement across sexes. Better goodness-of-fit indices were found in males than in females. Just as in the previous measurement analysis, metric invariance was found with acceptable fit indices for the corresponding model (M2).

Table 4. Invariance measurement for CFA across organisation type and sex

ORGANISATION	Goodness of fit indices				Comparison of nested models		
Model	$\chi 2$(df)	CFI	SRMR	RMSEA	Models	$\Delta\chi 2$ (Δdf)	p
M0: CFA healthcare	195.35(64)	.882	.067	.109			
M0: CFA nuclear	192.10(64)	.936	.047	.097			
M1: same configuration	387.45(128)	.917	.058	.102			
M2: metric invariance	404.35(139)	.915	.072	.099	M2 vs M1	16.9(11)	.111
M3: strong invariance	448.32(150)	.904	.073	.101	M3 vs M2	43.97(11)	<.001
M4: strict invariance	522.46(163)	.885	.078	.107			
M5: M4 plus equal factor means	541.18(165)	.879	.081	.108			
M6: M5 plus equal factor variances	546.79(168)	.879	.116	.108			

SEX	Goodness of fit índices				Comparison of nested models		
Model	$\chi 2$(df)	CFI	SRMR	RMSEA	Models	$\Delta\chi 2$ (Δdf)	p
M0: CFA male	186.13(64)	.929	.049	.101			
M0: CFA female	209.98(64)	.894	.062	.108			
M1: same configuration	396.12(128)	.913	.056	.104			
M2: metric invariance	401.27(139)	.915	.060	.099	M2 vs M1	5.15(11)	.924
M3: strong invariance	428.82(150)	.910	.060	.098	M3 vs M2	27.55(11)	.004
M4: strict invariance	451.38(163)	.907	.062	.096			
M5: M4 plus equal factor means	453.19(165)	.907	.062	.095			
M6: M5 plus equal factor variances	457.10(168)	.907	.099	.095			

M2: loadings are invariant; M3: loadings and intercepts are invariant; M4: loadings, intercepts

3.4. Internal consistency, test-retest and concurrent validity

Table 5 shows the reliability results of the organisational resilience questionnaire obtained with Cronbach's alpha. A result of .81 was obtained in the Planning factor, .92 in the Adaptive Capacity factor, and .93 in the overall organisational resilience scale. All the scores were above .70, value established as acceptable by Nunnally (1978), and in accordance with the criteria of Li (2007), results between .80 and .90 are indicators of good internal consistency among the items. The elimination of any of the items did not lead to significant improvements in any of the reliability results reported, so all items were retained for the analysis. Likewise, optimal results were obtained in the test-retest reliability evaluation based on ICC values above .70 (Fleiss, 1986).

Regarding concurrent validity, safety climate was positively and significantly correlated with organisational resilience (.691) and its respective factors: Planning (.553) and Adaptive Capacity (.701).

Table 5. Internal consistency and test-retest reliability

Scales	**Internal consistency (Cronbach's alpha)**	**Test-retest reliability (ICC)**
1. Planning	.81 (.79-.84)	.81 (.71-.88)
2. Adaptive capacity	.92 (.91-.93)	.87 (.80-.92)
3. Total organisational resilience	.93 (.92-.94)	.89 (.82-.93)

ICC: Intraclass correlation coefficient

4. Discussion and recommendations

The purpose of this study was to validate to Spanish language the short-form version of the Benchmark Resilience Tool following a protocol-based process of translation and adaptation, and to evaluate its psychometric properties in a Spanish sample of healthcare and nuclear energy organisations.

In terms of reliability, optimal results were obtained for both the complete organisational resilience scale and its respective subscales: Planning and Adaptive Capacity. The test-retest reliability analyses also revealed favourable values indicating the stability of the responses over time. Likewise, the correlation between organisational resilience and safety climate was an important empirical contribution in favour of the concurrent validity of the questionnaire.

Regarding the factor structure, two-factor models showed the best fit indices, which confirmed the findings of other previous studies both for the short-form version of the questionnaire (Whitman et al., 2013) and for the original complete scale (Lee, et al. 2013). The results of this study also confirmed the factorial structure found in a preliminary validation of the instrument performed by Sharma & Sharma (2015) in the IT sector. In this sense, this study is a contribution to the validation of the questionnaire to measure OR in two high-risk sectors in Spain, namely healthcare and nuclear energy.

Metric invariance was found both across organisation type and sex. This means that the two OR factors had the same meaning in the two organisations and in both sexes; that is, the strength of the relationships between each item and its OR dimension was the same for both organisations and sexes. This allows for a relational analysis of the factors with other constructs for different groups and cross-sectional data, and the analysis of patterns of relations among variables in the same group over time with longitudinal data (Marsh, Nagengast, & Morin, 2013). When metric invariance is satisfied, the scores obtained can be compared across groups, and empirical item differences indicate group differences in the latent construct.

This study was the first adaptation and validation of the BRT-13B to Spanish language. However, it had some limitations as these analyses were solely performed on the individual level and not at the organisational level using multilevel models.

Future studies could undertake a validation of the questionnaire both nationally and internationally in these same sectors (healthcare and nuclear energy) with greater sample representativeness to yield greater scientific consensus on the validity of the instrument in the field of HROs. Likewise, they could consider other high-risk sectors like aviation, transport or petrochemical industry.

We would also recommend incorporating other analyses for assessing validity not encompassed within the scope of this study, such as divergent validity and predictive validity of organisational resilience and relevant variables in the study of safety. It would also be interesting to conduct studies to evaluate resilience with the BRT-13B, incorporating the three levels of analysis recommended by Jeffcott, Ibrahim and Cameron (2009): individual, micro-organisational (groups) and macro-organisational (organisations).

The findings of this study enable us to conclude that the BRT-13B is a practical instrument that offers a “quick snapshot” of organisational resilience and shows sufficient reliability and validity criteria in Spanish high-risk organisations.

5. Conclusion

Based on a gap in the knowledge of organisational resilience questionnaires in Spain, and the benefits associated with their evaluation for the safety of organisations, this article proposes the validation of a questionnaire to assess the resilience in the organisations of the nuclear and healthcare sectors. The findings obtained from different methods indicate that the BRT-13B provides optimal results of reliability and validity.

The application of the short-form version of Benchmark Resilience Tool would allow to identify the characteristics of the organisation that are related to resilience and would provide a starting point to increase resilience.

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Appendix A

1. We are mindful of how a crisis could affect us
2. We believe emergency plans must be practiced and tested to be effective
3. We are able to shift rapidly from business-as-usual to respond to crises
4. We build relationships with organisations we might have to work with in a crisis
5. Our priorities for recovery would provide direction for staff in a crisis
6. There is a sense of teamwork and camaraderie in our organisation
7. Our organisation maintains sufficient resources to absorb some unexpected change
8. People in our organisation ‘‘own’’ a problem until it is resolved
9. Staff have the information and knowledge they need to respond to unexpected problems
10. Managers in our organisation lead by example
11. Staff are rewarded for ‘‘thinking outside the box’’
12. Our organisation can make tough decisions quickly
13. Managers actively listen for problems

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