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VALIDATION OF THE BIG FIVE PERSONALITY INVENTORY-15 (CBF-PI-15) SCALE FOR THE PORTUGUESE LANGUAGE AND EXAMPLE OF PRACTICAL APPLICATIONS IN PROJECT MANAGEMENT

VALIDAÇÃO DA ESCALA DE BIG FIVE PERSONALITY INVENTORY-15 (CBF-PI-15) PARA A LÍNGUA PORTUGUESA E EXEMPLO DE APLICAÇÕES PRÁTICAS EM GERENCIAMENTO DE PROJETOS

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Abstract
Although the Big Five personality model is recognized for its usefulness in personality assessment and research, its application in project management studies is limited due to proprietary research instruments. These instruments are either expensive or difficult to use due to their lengthy assessments. This article is divided into two parts. Firstly, we validated the 15-item short scale (CBF-PI-15) for Brazil, which was proposed by Zhang, Wang, He, Jie, and Deng (2019), and confirmed its effectiveness for project professionals. Secondly, we presented simple examples of practical applications for project management professionals. We argue that previous research on personality assessment provides opportunities for research with project professionals. We conducted Exploratory and Confirmatory Factor Analyses according to best practices, which resulted in appropriate levels of internal consistency and reliability. Our validation allows for scientific research on projects and is a parsimonious measure of the Big Five personality model, maintaining the five factors of the original proprietary scale. We also provided examples of practical use, which indicated changes in project professionals' behavior through growth and subsequent decrease in openness to experience with increased experience in project management.

Keywords: Big five personality model. Five Factor model. Project management. Scale validation. Success in projects. Behavior in projects. Project professional personality.

Resumo
Apesar de reconhecer o modelo de personalidade Big Five para avaliação de personalidade e sua aplicabilidade para pesquisa em geral, particularmente em estudos de gerenciamento de projetos, a relevância dos instrumentos de pesquisa é parcialmente devido aos instrumentos proprietários. Estes são caros ou difíceis de usar porque são instrumentos com muitas afirmações. Este artigo é dividido em duas partes. Primeiro, seguindo a proposta de Zhang, Wang, He, Jie e Deng (2019), neste estudo validamos a escala curta de 15 itens (CBF-PI-15) para o Brasil e confirmamos para profissionais de projetos. Então apresentamos exemplos simples de uso prático para profissionais de gerenciamento de projetos. Defendemos a pesquisa anterior em avaliação de personalidade e as possibilidades de pesquisa com profissionais de projetos. Seguindo as melhores práticas, Análise Fatorial Exploratória e Confirmatória foram conduzidas com níveis adequados de consistência interna e confiabilidade. Nossa validação permite pesquisa científica, considerada projetos, e é uma medida parcimoniosa do modelo Big Five de personalidade, mantendo os cinco fatores da escala proprietária original. Realizamos exemplos de uso que indicam uma mudança no comportamento dos profissionais de projetos através do crescimento e subsequente diminuição na abertura à experiência, aumentando a experiência em gerenciamento de projetos.

Palavras-chave: Modelo de personalidade Big Five. Modelo dos Cinco Grandes fatores. Gestão de projetos. Validação de escala. Sucesso em projetos. Comportamento em projetos. Personalidades profissionais de projetos.

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1 Introduction

There is a growing interest in comprehending behavior in projects, as highlighted in recent studies (Unterhitzenberger, 2021; Stingl & Geraldi, 2017; Millhollan & Kaarst-Brown, 2016). Many of these studies aim to investigate the influence of individuals and teams on projects (Unterhitzenberger, 2021), focusing on various aspects such as decision making (Stingl & Geraldi, 2017) or project success (Millhollan & Kaarst-Brown, 2016). However, further research is required to better comprehend the role of project professionals and their impact on both traditional project management methods and agile/hybrid projects (Lindskog & Netz, 2021).

The topic of individual performance at work is extensively studied in management (Van Iddekinge, Aguinis, Mackey, & DeOrtentiis, 2018) and is of significant interest in project management. Understanding the performance of professionals and project teams is critical, as it can impact project success and the strategic outcomes of the company (Millhollan & Kaarst-Brown, 2016; Meredith & Zwikael, 2020). Project Management Institute (PMI) defines a project as a temporary effort with a defined beginning and end to create a unique product, service, or result, which provides a favorable context to investigate middle managers' influence on the organization's performance (Wangrow, Schepker, & Barker, 2015).

While cognitive ability is recognized as an essential predictor of job performance, it interacts with personality traits, indicating that it is not the sole predictor of behavior (Ono, Sachau, Deal, Englert, & Taylor, 2011). Personality studies widely accept the Big Five framework (Zhang, Wang, He, Jiang, & Deng, 2019; Woods & Hampson, 2005; Funder, 2001), also known as the Big Five model (McCrae & Costa Jr., 1986; Nunes, Hutz, & Nunes, 2010). This framework consists of five personality factors: Openness to Experience, Conscientiousness, Agreeableness, Extroversion, and Neuroticism.

The Big Five personality model has also been utilized in project management studies. Rashid and Boussabiane (2021) investigated the risk-taking behavior of project teams. Strang (2011) analyzed the impact on results by considering the iron triangle in product development projects. Hassan, Bashir, and Abbas (2017) assessed the effect of project managers on the success of non-governmental organization projects. However, despite recognizing that specific personality traits of project managers can be advantageous in more challenging situations (Millhollan & Kaarst-Brown, 2016), few studies have explored the personality traits of project professionals (Hassan, Bashir, & Abbas, 2017).

One of the issues in researching the Big Five personality traits in project management is the use of appropriate scales. Two of the most commonly used scales are the proprietary 240-item NEO personality inventory revised (NEO-PI-R) scale and its 60-item reduced scale, which inhibits their use for academic research (McCrae & Costa Jr., 1986; Zhang et al., 2019). Other scales have been developed over time to address this limitation, such as the 44-item Big Five Inventory (BFI-44) (John, Donahue, & Kentle, 1991). However, there has been continued efforts to develop even shorter scales, such as the 10-item Big Five Inventory (BFI-10) (Rammstedt, 2007) and the 20-item Mini International Personality Item Pool (Mini-IPIP) (Donnellan, Oswald, Baird, & Lucas, 2006). Many other reduced scales have also been developed and validated for use in other countries, which are quite robust for Western cultures (Thalmayer, Saucier, & Eigenhuis, 2011). Zhang et al. (2019) developed and validated a 15-item short version of the Big Five scale (Chinese Big Five Personality Inventory - CBF-PI-15) specifically for use in China.

In this article, we aimed to find a short scale suitable for project professionals in the Portuguese language and validated the CBF-PI-15 scale. We chose this scale as it encompasses the original five factors of the Big Five framework. Moreover, each factor has three statements, which alleviate issues related to dropping an item in some collection, factor relevance, and sample problems (Morgado, Meireles, Neves, Amaral, & Ferreira, 2018). The validation of the scale by project professionals is not a limitation but rather enhances the confidence in using the instrument for project management, as exemplified in this article.

To validate the scale, we conducted an exploratory factor analysis (EFA) with participants aged 18 years and above. Subsequently, we performed a confirmatory factor analysis (CFA) with design professionals. In both analyses, we utilized polychoric correlation, which allows for the study of ordinal data (Lorenzo-Seva & Ferrando, 2019). For the examples presented, we employed t-tests and ANOVA to demonstrate the difference in personality traits between general professionals and project management (PM) professionals and the impact of aging on the personality of PM professionals.

The findings of the exploratory and confirmatory factor analyses confirmed the validity of the CBF-PI-15 scale, which consists of 15 items and measures the five personality traits proposed by the Big Five model, each with three assertions. The scale was deemed parsimonious and robust, and its internal consistency, as assessed by Cronbach's α, was

satisfactory, with values exceeding 0.7. The CBF-PI-15 is a reliable tool for evaluating the personality traits of project professionals in Brazil.

In addition to validating the scale, we explored two applications of the CBF-PI-15 in project management. Firstly, we examined the influence of project professionals' age, which is commonly used as a proxy for experience (e.g., Serra, Três & Ferreira, 2016), on the Big Five personality traits. The results showed that as experience increased, professionals' openness also increased to a certain point and then decreased. This finding suggests that the context of a project may impact its performance. Secondly, we identified some distinct predominant personality traits among project management professionals.

We structured the article into five sections. After the introduction, we provided a literature review that discusses the significance of behavioral skills for project success, as well as the role of the Big Five model in project management. We then presented the scale validation method and an additional example involving design professionals. Finally, we discussed the results and offered concluding remarks.

2 Litterature Review

2.1 The importance of behavioral skills for project success

We define managerial discretion as the latitude that executives can exercise in the decision-making process (Sierra, Serra, Guerrazzi, & Teixeira, 2019), which refers to the extent of the manager's freedom to act (Takeuchi, Shay, & Li, 2008). Although this concept was initially developed for the upper echelon (Hambrick & Finkelstein, 1987), there is a gap in understanding the impact of middle managers on organizational performance (Wangrow, Schepker, & Barker, 2015).

Semi-autonomous organizations are characterized by relatively decentralized decision-making from a certain level of autonomy of the parent organization (Meyer & Zhou, 2017). These types of organizations typically arise in the context of projects, particularly strategic ones, as temporary organizations that can have an impact on companies even after their completion (Eskerod, Huemann, & Savage, 2015). The intention behind these provisional organizations is to have a strategic impact through their projects and the influence of their project managers, which is why they are considered semi-autonomous (Sierra et al., 2019; Wangrow, Schepker, & Barker, 2015).

Considering the generic influence of project managers on the dimensions of project success (Shenhar & Dvir, 2007) is crucial. The impact of project managers on project success can vary due to their managerial discretion and the context in which they operate (Meredith & Zwikael, 2020). While some studies seek to understand the relationship between project professionals' roles and project success (Ekrot, Kock, & Gemünden, 2016; Tabassi, Roufechaei, Ramli, Bakar, Ismail, & Pakir, 2016; Sharma & Kumar, 2018), they typically do not focus on behavior. However, behavioral skills are necessary for project success (Chipulu, Neoh, Ojiako, & Williams, 2012), and they can be influenced by professionals' personality traits (Cohen, Ornoy, & Keren, 2013).

2.2 The Big Five personality model in project management

The Big Five Personality Model is the most widely recognized taxonomy for assessing personality traits (Zhang, Wang, He, Jiang, & Deng, 2019; Woods & Hampson, 2005; Funder, 2001). McCrae and Costa Jr. (1986) developed the model from a broad set of personality traits. The Big Five Model of Personality consists of five factors: Extroversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to experience.

The definitions for each of the five factors of the Big Five Model of Personality follow the original definition by McCrae and Costa Jr. (1986). Extroversion is the personality factor in which individuals are enthusiastic, assertive, and energetic. Agreeableness is the personality factor in which individuals tend to value cooperation and prefer to have positive interpersonal relationships. Conscientiousness is the personality factor in which individuals are motivated to set and achieve their goals. Neuroticism is related to emotional stability, with less emotionally stable individuals tending to experience more negative emotions. Openness to experience is the personality factor linked to individuals who are curious and seek out new experiences and ideas.

An important aspect of previous research has been an interest in understanding how specific groups of professionals and professional roles differ. Previous studies have examined professionals such as police officers, managers, and semi-skilled versus skilled professionals (Barrick & Mount, 1991). When validating personality assessment tools for use with project professionals, it is important to consider that they may have certain personality traits that differ from those of the general population, as suggested by previous research using different conceptual approaches. These traits may be beneficial for behavior in ambiguous design environments with limited information and data (Cohen, Ornoy, & Keren, 2013).

Rashid and Boussabiane (2021) proposed a link between project manager risk-taking behaviors and the Big Five model. They argue that project managers with high levels of extroversion and openness to experience are more likely to make risky decisions. Conversely, those with high agreeableness, conscientiousness, and neuroticism tend to make less risky decisions. Strang (2011) investigated the effects of personality on the quality and time performance of new product development projects. Their results indicate that neuroticism, agreeableness, and high extroversion can improve quality, while neuroticism can worsen time performance. Openness to experience impairs quality, leading to rework, but improves team performance. The results suggest that trade-off choices in quality and time are dependent on the project team. Hassan, Bashir, and Abbas (2017) examined the impact of leadership on project managers in various situations. They argue that openness to experience indicates the possibility of managers acting creatively to solve problems that lead to project success, while pleasantness influences team relationships for high performance.

Previous research has investigated the possibility of evaluating personality traits in traditional and agile/hybrid project environments. While previous work has focused heavily on job performance (Oh, Wang, & Mount, 2011; Hurtz & Donovan, 2000; Barrick & Mount, 1991), studies have consistently shown that conscientiousness is a significant predictor across all occupational groups (Oh, Wang, & Mount, 2011; Hurtz & Donovan, 2000; Barrick & Mount, 1991). Professionals with high levels of conscientiousness exhibit personality traits that suggest a sense of purpose, obligation, and persistence, which seems to be necessary for overall job performance (McCrae & Costa Jr., 1986). It is important to note that conscientiousness also has a significant relationship with cognitive ability (Oh, Wang, & Mount, 2011). While it can influence several dimensions of project success evaluation, it appears to be especially crucial in project efficiency, which is linked to the iron triangle. Even agile/hybrid project management methods tend to follow defined rituals (Hobbs & Petit, 2017; Stettina & Hörz, 2015), which can be influenced by this personality trait.

Previous research also suggests that extroversion is associated with management and sales functions (Hurtz & Donovan, 2000; Barrick & Mount, 1991), where sociability, gregarious behavior, assertiveness, and high activity levels are crucial (McCrae & Costa Jr., 1986). Although the indicators are weak (Oh, Wang, & Mount, 2011), extroversion is essential in reinforcing the project manager's role in the traditional approach and aspects shared in the

hybrid and agile methods, considering the impact on the team, customers, and stakeholders (Gemino, Reich, & Sawyer, 2021).

Openness to experience, while not showing a significant impact on work performance, is considered essential for learning and adapting to new situations (Hurtz & Donovan, 2000; Barrick & Mount, 1991). With the rise of agile projects, a willingness to learn and adapt to new ways of working is essential, making this personality trait particularly relevant (Lindskog & Netz, 2021).

Neuroticism has demonstrated relatively low indicators of work performance in previous personality research (Oh, Wang & Mount, 2011; Hurtz & Donovan, 2000; Barrick & Mount, 1991). However, it may be of interest in the field of project management, as it has been found to impact decision-making (Rashid and Boussabiane, 2019; Strang, 2011). This personality trait may be particularly relevant in the context of implementing agile projects, which can create challenging situations for project professionals, including cultural resistance to the adoption of agile methodologies (Stettina & Hörz, 2015).

While previous personality studies have not found significant results for work performance related to agreeableness (Hurtz & Donovan, 2000; Barrick & Mount, 1991), the work environment and context of project management have undergone significant changes in recent years. This may suggest the need for a better understanding of this personality trait in the context of implementing the agile method (Hobbs & Petit, 2017; Stettina & Hörz, 2015).

Precautions are crucial when using the Big Five personality scales in project management, as suggested by previous research (Oh, Wang & Mount, 2011). These precautions should be taken, especially in evaluating the different dimensions of project success, as the scales rely on self-perception and the respondent's perspective (Barker, Pistrang, & Elliott, 2015). However, the use of self-perception scales can lead to biases caused by Common Method Variance (CMV) (Podsakoff & Organ, 1986). Therefore, to overcome CMV, researchers should follow the recommendations of Podsakoff, MacKenzie, Lee, and Podsakoff (2003) that include the use of different sources of information, careful questionnaire design and administration, appropriate statistical techniques, and Harman's post hoc one-factor analysis test. Nevertheless, assessing aspects related to neuroticism and openness to experience may be difficult, and direct observation assessments may be more suitable in certain situations (Oh, Wang & Mount, 2011).

Although few studies have used the Big Five method in project research, the results suggest several possibilities, especially in implementing agile practices and increasing virtual

and international projects. The availability of a reliable and suitable instrument to assess the personality of project professionals, including those in Brazil, seems relevant to encourage research that considers behavioral aspects in project management (Unterhitzenberger, 2021; Stingl & Geraldi, 2017).

3 Materials and methods

The methods followed appropriate practices for the use of attitude measurement scales (Hair, Gabriel, Silva, & Braga Junior, 2019).

3.1 Participants

We conducted two data collections, one for exploratory factor analysis (EFA) and another for confirmatory factor analysis (CFA). The EFA data collection was carried out on a generic population of working Brazilian adults. The questionnaires, consisting of a reduced scale of 15 items from the Big Five personality model (CBF-PI-15) proposed by Zhang, Wang, He, Jie, and Deng (2019), were prepared using Google Forms® and were translated and back-translated into Portuguese. We collected 160 responses, which exceeded the minimum requirement of 10 responses per assertion recommended by best practices (Morgado et al., 2018). The EFA participant demographics are presented in Table 1.

The collection for the CFA was from a specific population of professionals dedicated to project management. Although the choice of a homogeneous sample brings limitations for generalization (Morgado *et al.*, 2018), it brings the possibility of evaluating specific professionals, in this case, project professionals. The assessment of professionals and roles has been a feature of personality research (Barrick & Mount, 1991).

The questionnaires were also prepared in Google Forms®, with a reduced scale and translated into Portuguese, of 15 items of the Big Five personality model (CBF-PI-15), proposed by Zhang *et al*. (2019). We collected 163 responses. Again, as recommended, more than 10 responses per assertion (Morgado *et al.*, 2018). We presented the data about the participants in Table 1 of the CFA part.

3.2 Instrument

The Big Five personality scale CBF-PI-15 proposed by Zhang, Wang, He, Jie, and Deng (2019) was chosen for several reasons (Appendix 1), particularly because it is a free instrument

that replaces the proprietary 240-item NEO-PI-R scales and its reduced 60-item scale (McCrae & Costa Jr., 1986). A second reason it is a short scale is that it is parsimonious but continues to represent the five factors of the original scale (Boateng, Torsten, Frongillo, Melgar-Quiñonez, & Young, 2018). Being a short scale, it will take less time for the response if the instrument's reliability is adequate.

Following the back-translation procedure, two different bilingual professionals in Portuguese and English translated and back-translated the scale. We tested it and converted assertion E3 to negative. We follow the recommendation that reverse items, especially on the same factor, can be confusing (Morgado *et al*., 2018).

Data collection took place in March and April 2022, online and with the questionnaire prepared in Google Forms®. The collection of the first sample for the EFA, was done by snowball, contacts who passed on to other contacts of working adults. The second sample, for the CFA, was collected from project professionals nominated by other project professionals.

3.3 Data analysis

We performed the data analysis using Factor software Version 12.01.02. We completed the EFA initially and then a CFA (Nunnaly & Bernstein, 1994). We used polychoric correlation for both factor analyses since this correlation allows the analysis of ordinal data, such as the Likert scale with Robust Promim oblique rotation (Lorenzo-Seva, & Ferrando, 2019)

Table 1

Participants of EFA and CFA

First Sampe - EFA								Second Sample - CFA							
Gender		Age		Schooling		Profession		Gender		Age		Schooling		Profession	
60	Female	2	18 - 20	18	High school	17	Business administration	31	Female	0	18 - 20	2	High School	44	Project coordinator / Project analyst
100	Male	6	21 - 30	59	Undergraduate	6	Lawyer	132	Male	8	21 - 30	36	Undergraduate	56	Project Manager
		34	31 - 40	67	MBA	9	Area Coordinator			78	31 - 40	99	MBA	14	Portfolio Manager
		87	41 - 50	16	Graduate	7	Managing Director			50	41 - 50	26	Graduate	49	Product Owner/Scrum Master
						37	Entrepreneur			22	51 - 60				
						14	Engineer			4	61 - 70				
						27	Manager			1	71 - 80				
						15	Physician / Dentist / Pharmaceutical / Psychologist/ Nurse			0	81 - 90				
						28	Military / Blue-collar/ Teacher / Public Servant / Stutdent								
163		160		160	**Total**	160		163		163		163	**Total**	163	

Source: The authors.

4 Results

The results will be presented in two parts as proposed. The first part will cover the validation of the scale, while the second part will showcase two examples of practical application.

4.1 Big Five personality scale CBF-PI-15 validation

Table 2 presents the results of the factor analysis. The Kaiser-Meyer-Olkin (KMO) test was performed, and a value greater than 0.6 indicated that the sample size was appropriate for EFA calculations. The Bartlett's sphericity test values were significant, with a p-value of less than 0.05, indicating that the correlation matrix was suitable for factor analysis (Moretti, Anholon, Rampasso, Silva, Santa-Eulalia, & Ignácio, 2019). All the communality values were appropriate (Holm, Alvariza, Fürst, Öhlen, & Årestedt, 2019). The total explained variance was greater than 60%, which was considered adequate (Moretti et al., 2019).

We calculated the overall reliability by ORION (Overall Reliability of fully-Informative prior Oblique N-EAP), or marginal reliabilities, which assesses the reliability of factor score estimates. The ORION value must be greater than 0.80, indicating internal reliability consistency in factor score estimates (Lorenzo-Seva & Ferrando, 2019).

The factor analyses demonstrated good reliability values, as indicated by the ORION, with all values above 0.8. In terms of the validation process, the KMO coefficient showed fair values in both factor analyses. The values of Bartlett's coefficient, in both cases, were significant. Moreover, the total explained variance, in both cases, was entirely satisfactory, ranging from 76% to 77%. It is worth noting that the scale was successfully validated, preserving the constructs of the original scale, when applied to project professionals in the CFA

.

Table 2

Factor Analysis Results - EFA And CFA

CBF-PI-15		Extroversion	Neuroticism	Conscienciousness	Agreability	Openness to experience	
EFA	Factor loads	0.810	0.678	0.699	0.787	0.748	**KMO**
		0.953	0.903	0.644	0.692	0.846	0.681
		0.568	0.657	0.792	0.767	0.889	**Bartlett**
	Communali-ties	0.707	0.541	0.508	0.629	0.547	χ2 1160.0***
		0.918	0.806	0.480	0.937	0.796	**Toal Variance**
		0.338	0.494	0.679	0.683	0.778	
	Variance	13.92%	17.10%	11.99%	9.35%	23.84%	76.84%
	ORION	0.930	0.829	0.868	0.963	0.864	
CFA	Factor loads	0.900	0.758	0.811	0.692	0.589	**KMO**
		0.962	0.830	0.715	1.040	0.848	0.625
		0.534	0.674	0.835	0.809	0.860	**Bartlett**
	Communali-ties	0.851	0.538	0.715	0.570	0.395	χ2 1308.3***
		0.869	0.687	0.518	0.953	0.717	**Total Variance**
		0.429	0.491	0.754	0.773	0.722	
	Variance	24.30%	19.80%	13.90%	10.32%	8.52%	76.22%
	ORION	0.930	0.829	0.868	0.963	0.864	

Source: The authors.

4.2 Big Five personality scale CBF-PI-15 practical application examples

There are several possibilities for using the validated scale for professionals in the project area. Below, we present the results of two simple analyses by way of illustration. The first considers the comparison between groups of professionals in general and project professionals, and the second the relationship between the age of project professionals and the personality traits of the Big Five model in a group of project professionals from a project-based company.

4.2.1 First example

As mentioned in the literature review, previous research indicated that project professionals possess personality traits that can facilitate their behavior in ambiguous environments with limited information and data. However, this research used a personality typology - MBTI (Cohen, Ornoy, & Keren, 2013).

The following application example compares project professionals to professionals in general from the collected sample. We conducted a t-test to compare the groups of professionals in general and project professionals. The t-test enables the comparison of the means of one or two samples, verifying whether there are significant differences between the means of the groups (Vieira, 1980).

We used IBM® SPSS® Statistics 27.0 software to perform data analysis by comparing the Big Five personality scores of general professionals (160 respondents) and project professionals (163 respondents) through a t-test of independent groups. Both AFS and CFA samples were used in this analysis. The t-test enabled us to determine whether there were significant differences between the means of the two groups (Vieira, 1980). The results showed a statistically significant difference ($T(321)=-2.555$; $p<0.05$) in the personality trait "Openness to Experience" between general professionals and project management professionals. Project professionals had higher scores for openness to experience ($M=3.81$; $SD=1.35$) than professionals in general ($M=3.49$; $SD=1.48$), as shown in Table 3. This finding supports previous research suggesting that project professionals possess personality traits that are beneficial in ambiguous and complex environments (Cohen, Ornoy, & Keren, 2013).

Table 3

Comparisons Considering Age Quartiles

Professionals	N	Mean	Std Deviation	t	df	p
1. Extroversion						
General professionals	160	2.71	1.46	-1.24	321	0.21
Project professionals	163	2.95	1.45			
2. Neuroticism						
General professionals	160	2.83	1.44	-1.02	321	0.31
Project professionals	163	2.82	1.39			
3. Conscienciousness						
General professionals	160	5.62	1.24	-0.43	321	0.66
Project professionals	163	5.73	1.15			
4. Agreability						
General professionals	160	4.65	1.36	-1.20	321	0.23
Project professionals	163	4.84	1.30			
5. Openness to experience						
General professionals	160	3.49	1.48	-2.55	321	**0.01**
Project professionals	163	3.81	1.35			

Source: The authors.

The personality trait of Openness to Experience has been found to be linked to greater creativity and adaptability in dynamic and uncertain project environments (Hassan, Bashir & Abbas, 2017). The study's results suggest that project managers face more uncertainties, conflicts, and complex situations, which require them to make decisions, manage conflicts, and relationships. These findings suggest that, regardless of the impact of the project management environment on project professionals' personality traits, those who remain in the profession possess certain distinguishing characteristics. The use of the Big Five scale can aid in both selection and interventions to support project professionals' adaptability.

4.2.2 Second example

The company's data presents important situations that require analysis, in line with the evidence-based management perspective proposed by Pfeffer and Sutton (2006). According to the authors, evidence-based management should not only rely on professional expertise, but also on scientific research and internal data to inform decision-making (Reay, Berta & Kohn,

2009). We contend that this is equally applicable to evidence-based project management. In this regard, we present an example using company-specific data.

The company in question is an American-based international manufacturer of components and solutions for motion and motion control, with five factories in Brazil. It has been operating in the mechanical engineering field since the beginning of the 20th century, producing motion and control systems, among other products. Its solutions apply to a wide range of industries, including manufacturing and processing of raw materials, durable goods, infrastructure development, and transportation. The company's shares are listed and traded on the New York Stock Exchange. It has project-oriented and project-based divisions, with the latter consisting of the systems and solutions divisions dedicated to meeting the needs of customers from diverse market segments. We collected data from project professionals in this company dedicated to projects installed in other companies, which included components and motion and control systems, using a specific solution. Table 4 provides an overview of the characteristics of the company's project professionals.

Table 4

Project Professionals Sample Description

Gender		Age		Schooling		PM role	
77.45%	Female	7.84%	21 - 30	22.55%	Undergraduate	18,62%	Project coordinator / Project analyst
22.55%	Male	47,07%	31 - 40	65.69%	MBA	43.14%	Project Manager / Portfolio Manager
		34.31%	41 - 50	11.76%	Graduate	38,24%	Product Owner/Scrum Master
		10.78%	51-60				

Source: The authors.

We applied Fisher's DMS (Minimum Significant Difference) method in the second example using ANOVA to generate confidence intervals that consider differences between pairs of factor level means while controlling for the individual error rate at the specified significance level. In this example, we examined the impact of project professionals' age on openness to experience.

Although the first example suggested that project professionals tend to be more open to experiences, studies in other fields suggest that this effect may be reversed for older professionals, who tend to be more conservative (Musteen, Barker & Baeten, 2006). Our results, presented in Table 4 and graphically depicted in Figure 1, also indicate this trend.

Table 5

Multiple Comparisons Considering Age Quartiles

Age quartiles			Mean difference (I-J)	Standard error	Sig.	95% confidence internaval	
						Lower limit	Upper limit
DMS	0.00	1,00	-0.38095	0,32452	0.243	-1.0250	0.2631
		2,00	-0.24675	0,34594	0.477	-0.9333	0.4398
		3,00	0.54365	0,33777	0.111	-0.1267	1.2140
	1.00	0,00	0.38095	0,32452	0.243	-0.2631	1.0250
		2,00	0.13420	0,34594	0.699	-0.5523	0.8207
		3,00	0.92460**	0,33777	0.007	0.2543	1.5949
	2.00	0,00	0.24675	0,34594	0.477	-0.4398	0.9333
		1,00	-0.13420	0,34594	0.699	-0.8207	0.5523
		3,00	0.79040**	0,35840	0.030	0.0792	1.5016
	3.00	0,00	-0.54365	0,33777	0.111	-1.2140	0,1267
		1,00	-0.92460**	0,33777	0.007	-1.5949	-0.2543
		2,00	-0.79040**	0,35840	0.030	-1.5016	-0.0792

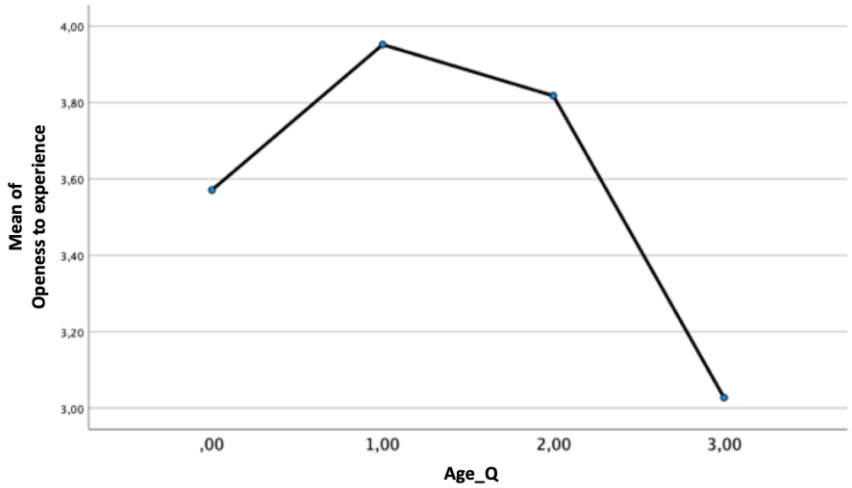
Mean is significant at 0.05.

Source: The authors.

The results presented in Table 5 indicate the possibility that with age, as a proxy for the project manager's experience, openness to experience increases and then decreases. Although we have not done inverted U relationship tests, for example, with a regression, it illustrates that openness to experience increases up to a certain age (or experience) and then drops (Figure 1).

Figure 1

Graphic Representation Of Evolution With Age



Source: The authors.

In practice, this can confirm that project professionals tend to become more rigid and less open to creative solutions or taking risks as their experience increases. This can have strategic implications, such as resistance to cultural change for implementing agile projects or leadership challenges in complex situations with stakeholders. These factors can significantly impact project performance and success.

5 Discussion

The main objective of this study was to validate the 15-item short scale for evaluating the Big Five personality traits (CBF-PI-15). As previously mentioned, one of the significant reasons for validating this scale in Brazil is its public use and its potential for scientific research. This motivation is similar to that of the authors who developed the scale for China (Zhang et al., 2019).

A particular motivation for validating the scale was to assess project professionals' personality traits. Previous studies on personality assessment have shown interest in exploring the relationship between professionals' behavior and their roles in different contexts (Barrick & Mount, 1991). The scale validated in this study through CFA offers a tool for evaluating project professionals in different contexts and assessing the impact of their behavior on project success (Oh, Wang & Mount, 2011). Additionally, the scale is a parsimonious measure of the Big Five

personality model, consisting of the five factors of the original scale (McCrae & Costa Jr., 1986) and three assertions for each factor (Boateng et al., 2018).

The validation of the CBF-PI-15 short scale for the Portuguese language provides an efficient and reliable assessment of personality traits for project professionals, confirming the original scale's validity (Zhang et al., 2019). As project professionals have increasing demands for agility, they have less time for responses, making the use of short scales like CBF-PI-15 a practical solution. Its use reduces the possibility of wrong answers that could affect the results. Moreover, the CBF-PI-15's parsimony reduces the chance of incomplete answers or refusal to participate in surveys due to time constraints (Credé, Harms, Niehorster & Gaye-Valentine, 2012). This is particularly relevant as researchers use multiple scales in project management studies, and using reduced scales like CBF-PI-15 can minimize these problems (Zhang et al., 2019).

To validate the CBF-PI-15 scale in Portuguese, we utilized polychoric correlation, which is suitable for analyzing ordinal data, as presented by Lorenzo-Seva and Ferrando (2019). The results of EFA and CFA exhibited an ORION greater than 0.8, indicating internal consistency of the data and satisfactory test results.

In the theoretical framework, we discussed the potential of using this validated scale to better comprehend the influence of project professionals' personalities on project performance and success. As agile and hybrid methods continue to grow, there is a change of context that brings significant behavioral challenges requiring further investigation at individual and team levels (Lindskog & Netz, 2021; Hobbs & Petit, 2017; Stettina & Hörz, 2015). Research in project management should provide contributions to practice by using validated tools to analyze specific company data and contexts. We advocate for evidence-based project management, which entails using science and data, incorporating appropriate analysis techniques, such as the simplified CBF-PI-15 scale we used, to support decision making (Reay, Berta & Kohn, 2009).

We also present two small exercises. In the first exercise, we performed a t-test comparing two independent samples: professionals in general and project professionals from a relevant, project-based company. The t-test results indicate that project professionals are more open to experience, making them more adept at dealing with the dynamism and complexity of projects. The practical use of the CBF-PI-15 scale suggests its potential for evaluating and selecting project professionals, especially for agile projects (Lindskog & Netz, 2021).

As contexts vary, environmental factors may influence professionals in different situations (Van Iddekinge, Aguinis, Mackey & DeOrtentiis, 2018; Oh, Wang & Mount, 2011). The second exercise, using ANOVA with DMS, illustrates the influence of project professionals' experience on "openness to experiences" in a specific context of an international company operating in Brazil. The results suggest that project professionals change their behavior over time, increasing and then decreasing their openness to experiences depending on their experience in their professional practice. These findings have practical implications, such as in the implementation of agile methods, due to the challenges of change and cultural resistance (Lindskog & Netz, 2021; Hobbs & Petit, 2017; Stettina & Hörz, 2015).

The study has some limitations that should be acknowledged. For instance, the CBF-PI-15 scale was validated only for use in Brazil. Although the scale could potentially be used in other Portuguese-speaking countries with a semantic validation, caution is advised. It is important to note that the practical application of scales should not be viewed as a substitute for academic research, but rather as a supplementary tool for decision making. Furthermore, the proper use and application of statistical methods are crucial. Therefore, we encourage practitioners to seek specific training or even consider hiring research professors as consultants to ensure the appropriate use of the scale.

6 Final considerations

This study aimed to validate the CBF-PI-15 short scale for the Portuguese language, assessing its factorial structure, internal consistency, and validity reliability. The results confirmed that the scale is suitable for use in Brazil and other Portuguese-speaking countries, indicating its potential universal application. Moreover, as a non-proprietary short scale that follows the original Big Five personality traits proposal, it is a useful tool for practitioners and researchers to assess personality traits without requiring a large sample size.

The validation of the scale offers numerous opportunities to investigate the impact of project professionals' personality traits in different project management contexts, contributing to the advancement of the field (Unterhitzenberger, 2021; Stingl & Geraldi, 2017).

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Appendix 1

BIG FIVE	Original	Português	Inglês
21 N1	I often worry about trifles.	Frequentemente, eu me preocupo com ninharias.	I often worry about trifles.
26 N2	I often feel disturbed.	Frequentemente, eu me sinto perturbado.	I often feel troubles.
31 N3	I always worry that something bad is going to happen.	Eu sempre me preocupo que algo ruim pode acontecer.	I always worry that something bad will happen.
17 C1	I like to plan things from the beginning.	Eu gosto de planejar as coisas desde o início.	I like to plan things right from the start.
22 C2	I am diligent in my work or study.	Eu sou diligente em meu trabalho ou estudo.	I am very thorough when I work or study.
37 C3	One of my characteristics is doing things logically and orderly.	Uma das minhas características é fazer as coisas de maneira lógica e ordenada.	One of my characteristics is to do things logically and in an orderly manner.
3 A1	I think most people are well-intentioned.	Eu penso que a maioria das pessoas é bem-intencionadas.	I think that most people mean well.
23 A2	Although there are some frauds in the society, I think most people can be trusted.	Embora existam algumas fraudes na sociedade, eu acho que a maioria das pessoas é confiável.	Although there are frauds in society, I think that most people are trustworthy.
33 A3	Although there are some bad things in human society (such as war, evil, and fraud), I still believe that human nature is generally good.	Embora existam algumas coisas ruins na sociedade humana (como guerra, maldades e fraude), eu ainda acredito que a natureza humana, no geral, é boa.	Despite the bad things in human society (such as war, evil and fraud) I still believe that human nature is ultimately good.
9 O1	I'm a person who loves to take risks and break the rules.	Eu sou uma pessoa que adora correr riscos e quebrar as regras.	I am a person who loves to take risks and break the rules.
14 O2	I like adventure.	Eu gosto de aventura.	I like adventure.
24 O3	I have a spirit of adventure that no one else has.	Eu tenho um espírito de aventura que ninguém mais tem.	I have an adventurous spirit that no one else has.
5 E1	I'm bored by parties with lots of people. (R).	Eu fico entediado em festas com muita gente. (R).	I get bored at parties with lots of people. (R)
15 E2	I try to avoid parties with lots of people and noisy environments. (R)	Eu procuro evitar festas com muitas pessoas e ambientes barulhentos. (R)	I try to avoid parties with many people and noisy environments. (R).
35 E3	I like to go to social and recreational parties.	Eu gosto de ir a festas sociais e recreativas.	I like to go to social and recreational parties.

Source: The author.