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Public sector innovation performance in Federation of Bosnia and Herzegovina: An exploratory factor analysis

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Abstract

Innovation has nowadays become the main force to cope with challenging times in the fast-changing world. The influence of public sector innovation (PSI) in resolving dynamic economical and societal challenges is undisputable. Regardless of the numerous advantages of innovation in the public sector (PS) which have been recognised worldwide, the concept of public sector innovation is still novel for the Federation of Bosnia and Herzegovina (FBiH). Moreover, there is limited empirical evidence which would facilitate the understanding of public sector innovation performance. The purpose of this paper is to identify main components of PSI performance. The primary research data was obtained through a survey with close-ended questions which was completed by the public sector institution employees in FBiH. The exploratory factor analysis (EFA) was used in order to determine the principal components of measuring public sector innovation performance. The EFA returned the factor-structures for all four suggested constructs, innovation capabilities, wider sector conditions for innovation, sources of information and the share of creative occupation, explaining between 65% and 78% of the variance of the innovation performance measurement construct. The results from the exploratory factor analysis provided a distinct estimation on the factor structure of measuring PSI. The paper has provided and analysed the first instrument in measuring public sector innovation performance in FBiH.

Keywords: exploratory factor analysis, government, innovation performance, public sector.

JEL classification: H11, O31, O32.
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Introduction

Innovation in the public sector, according to Tiganasu, Pascariu, Nijkamp (2019), consists of various processes or innovation environments. The innovation capability of an institution depends basically on the institutional quality. According to Head (2013), improvement of leadership should be an immediate objective for every institution. Even though innovation itself has many definitions, public sector innovation is certainly

connected to leadership and the application of a synergetic approach (Lewis, Ricard, Klijn, 2018). Innovation may not only be related to governmental effectiveness, but also to institutional and societal innovative behaviour, that in turn creates an innovation-oriented environment, or as Tiganasu, Pascariu, Nijkamp (2019) say, an innovation architecture.

Public sector institutions function in a bureaucracy framework which is limited by the budget constraints, and are, according to Bommert (2010) under constant pressure to resolve many challenges of the country. In this regard, public sector institutions have to be innovative and optimally use the resources in order to successfully fulfil the citizen's expectations. Furthermore, it is necessary to enhance the innovation capabilities of the public sector (PS), including its activities and performance. This is why it is crucial to embellish the understanding of public sector innovation (PSI) ecosystem.

There is currently a growing interest in measuring innovation performance of the public sector, which can mainly be associated with several initiatives within the European Union and Australia, as Audenaert et al. (2019) explain. When it comes to measuring innovation performance in the private sector, studies as Gittelman (2006), Kafouros et al. (2008), Lundvall, Nielsen (2007), Lin et al. (2011), have analysed and provided better understanding and knowledge in this regard. Nevertheless, as Bloch, Bugge (2013) underline, there is a lack of adequate and advanced studies in measuring PSI performance which additionally limits the knowledge on public sector innovation. Therefore, it is crucial to develop appropriate instruments for measuring PSI and to target the present knowledge gaps in this area.

The main contribution and aim of this paper is to develop a measuring instrument of PSI performance in the context of Federation of Bosnia and Herzegovina. According to Tiganasu, Pascariu, Nijkamp (2019) and Ramli, Abu-Hassan, Arifin (2017) the approach of evaluating public sector performance through perceptions is a broadly established approach, that is practiced by many international organisations and experts due to its high importance. Even though this approach exists in other countries, this is the first instrument of this kind developed in FBiH. In that regard, this primary research will provide an empirical support on the reliability and the identification of several factors of each construct and deepen the understanding on measuring public sector innovation performance in the current literature.

The main research method is exploratory factor analysis. The instrument will be based on four latent constructs, namely, innovation capabilities, wider sector conditions for innovation, sources of information and the share of creative occupation.

The first section of the paper outlines in detail the main characteristics of public sector innovation, the role which innovation has in enhancing public sector performance, and reviews several past studies which were analysing PSI performance. The following section describes the data and methods in the research. Finally, research results are presented and elaborated, with an emphasis on the main latent constructs of PSI performance. The paper ends with a summary of the main research findings and recommendations for further research.

Literature review

When it comes to business performance, Armbruster et al. (2008) explain that institutional innovativeness is focal in terms of competitiveness. The institutional innovation facilitates and contributes to an efficient implementation of product and process innovation. Moreover, innovation directly impacts the competitive advantage of, especially in regards to productivity, quality, and flexibility which is

enhanced in an institution. Damanpour, Schneider (2006) claim that innovation is usually regarded as a prerequisite of efficiency of any institution, and sometimes even the only mean to survive. Especially nowadays, under the challenging circumstances of increasing international competition, new demands for quality, and the ever fast-developing technology, innovation is a crucial mean in achieving competitive advantage and economic growth. Also, Damanpour, Schneider (2008) emphasise that innovation is the origin of development and growth of an institution.

According to Tiganasu, Pascariu, Nijkamp (2019) it is challenging to assess the real meaning of innovation in the public sector, as it is still not clear what public sector innovation encompasses in comparison to the private sector. Innovation is depending on the context, related to institutional architecture, products or processes. Consequently, the factors which impact the innovation culture and the creation of an innovation-oriented environment in the public sector have to be determined (Tiganasu, Pascariu, Nijkamp, 2019).

Mulgan, Albury (2003) define innovation as an essential activity of any public sector, through which it is possible to satisfy all citizen expectations and needs. Innovation in the PS is described as the creation of novel ideas, implementation of new approaches which aim to enhance the quality of public services, or simply creating value and providing a better answer to societal needs. Furthermore, innovation enhances the performance and efficiency of public services and decreases the costs.

Bailey (2002) claims that the government institutions and its activities comprise the public sector. In most cases, the public sector is associated to bureaucratic silos, accompanied by delays and inertia. Due to these slow dynamics, there is a great pressure on the public sector to embrace innovation in all processes. Sørensen, Torfing (2011) explain that the PS requires innovation more than ever before as it is steadily shifting to the provision of intangible public services.

The public sector has always, as Vigoda-Gadot et al. (2008) notice, coped to accomplish its ideals. Albury (2005) emphasises the increasing pressure which the public sector is experiencing, in the form of demands for greater efficiency, better performance, or more personalised services. These new circumstances require that the public sector offers services which are more appropriated to the society in general, but also not generic and more tailored to the individual. Furthermore, Ricard et al. (2017) underline that the institutions are pressured to convey more value on one unit of public money and to explore some novel approach in coping with the financial crisis or demographic changes.

Governments have recently realised that with innovation they can respond better to the many environmental and social challenges. Schot, Steinmueller (2018) explain that the long-existing issues as poverty, climate change, or pollution, are nowadays challenges and opportunities for governmental innovation. According to Schot, Steinmueller (2018), innovation enables the institutions in public sector to enhance the quality of life of their citizens and contributes to stronger communities through. Keping (2018) also claims with certainty that the prospective of any efficient public sector will rely on innovation.

Bartlett, Dibben (2002) mention the increasing fiscal pressure as one additional factor which forces the public sector to innovate and maximise the efficiency of public service provision which would enable them to do less, but still achieve better results. According to Audenaert et al. (2019) the importance of innovation in the public sector is also seen in the performance effect. Through innovation, public sector institutions can improve the quality of life for their citizens and make the communities stronger.

Factors that can influence the innovation performance in the PS, as Taylor (2018) describes, encompass superior leadership and project management skills, networking and partnerships, and importantly the political and social engagement. Kurz, Hüsig, Dowling (2018) argue that innovation usually comes from higher-level employees in the public sector. According to Mongey (2013), the management is the one who supports innovation, improves people management, and the establishes a common entrepreneurial objective within the institution. The willingness and eagerness of the whole management is focal for the favourable implementation of innovation activities in the institution.

It is also indicated that an innovative idea can occur at any institutional level and from any employee. Hence, PSI should intend offer new opportunities for their employees and encourage their innovative behaviour. Even though motivation is for the most part intrinsic, it may not be neglected that it is highly dependent on the overall working environment which has to be open to innovation (Organization for Economic Cooperation and Development, 2017).

Mongey (2013) proposes rewards as one of the ways to effectively stimulate innovation. Hence, the management has a duty to offer the employees motivational rewards. PS institutions should inspire, encourage and appreciate their employees in innovating. Inspiration is, in most cases, intrinsic, but it is also highly dependent on the working environment, whereas opportunity refers mostly on the provision of trust and independence, and resources. Rivera-León, Simmonds, Roman (2012) explain that it is probable that innovation will occur in institutional cultures, which stimulate and provide rewards based on competencies and personal endeavour. Unfortunately, there are still many public sector institutions in which deficient improvement attempts are punished, so that many new ideas are prevented in the beginning due to a fear of failure.

Daglio, Gerson, Kitchen (2014) underline that searching and sharing information is essential for the improvement of innovation. Furthermore, Abukhait, Bani-Melhem, Zeffane (2019) explain that knowledge sharing includes a mutual exchange of task information and working expertise in which it enhances innovative employee behaviour and fosters critical thinking.

Mongey (2013) claims that every successful institution requires an overall understanding of the internal conditions affecting innovation. Bland et al. (2010) also emphasise that resources, talent and quality skills are necessary in order to place innovative ideas into practice. The support of the whole institutional structure is a key for a successful implementation of the innovative institutional activities. Furthermore, Andersen, Jakobsen (2018) claim that in order to understand the public sector performance, it is also important to consider the external factors, as the political pressure, horizontal factors as compliance pressures, citizen needs and others.

Tiganasu, Pascariu, Nijkamp (2019) claim that the simplest way of assessing the public sector performance is through the governmental capabilities to accomplish its objectives in a timely and efficient manner. Nevertheless, assessing the governmental performance in terms of innovation is very difficult, as there is a lack of basic theory. Some researchers evaluate performance through the indicators of output and outcome in some general areas of public sector policy, as for example in health, education, security or social welfare. Still, there is an issue in regards to an accurate quantification, especially in countries which have a weak institutional setting, and also a systematic assessment on the performance cannot be performed, as for many areas there is no genuine comparative data on all countries. Other researchers use secondary data or the survey-based approach in order to assess the performance by

combining the results obtained through surveys of citizens or companies (Tiganasu, Pascariu, Nijkamp, 2019).

The lack of innovation was a focal issue of many management researches during the 1990's that focused on the implementation of New Public Management (NPM). According to Vigoda-Gadot at al. (2008), one of the main PS changes of the NPM comprised the inclusion of market-based mechanisms, as for example, performance measurement tools. From this period and on, the interest about PSI has increased gradually, but most researches were still using case studies. As Hollanders, Arundel, Buligescu (2013) claim, the survey-based approach in examining public sector innovation is a rather new undertaking.

As time went by, according to Hollanders, Arundel, Buligescu (2013), the attention has moved to the application of innovation surveys. Some of the recently most important surveys on public sector innovation are the National Public Sector Innovation Index (NESTA) and Measuring Public Innovation in the Nordic countries (MEPIN) project. Hughes, Moore, Kataria (2011) explain that the NESTA surveyed the local government institutions in England. The MEPIN was implemented in the Nordic countries as a survey involving over 2000 regional and local government institutions. The methodology on measuring PSI was equally tackled by both surveys. NESTA analysed the present practices in England and overseas in regards to measuring PSI. Moreover, the paper resulted in three possible paths in developing a PSI index, a government research and development scoreboard, an innovation scoreboard and a multi-factor productivity index.

Various notable initiatives have happened in Europe and outside with the aim to enhance the understanding of public sector innovation and to examine the data collection tools, whether that has been the MEPIN, or the NESTA project from 2010. Nevertheless, Hollanders, Arundel, Buligescu (2013) emphasise that Europe requires more and enhanced data on PSI.

Two distinctive Innobarometer surveys were launched during the period of 2010 to 2012. Their main aim was to examine the influence of PS innovative activities on business performance. Even though the obtained information was useful, it offered only a snapshot view. Therefore, the latest European Public Sector Innovation Scoreboard (EPSIS) from 2013 is a rather exploratory analysis, established on definite available data and the information from previous Innobarometer studies. The overall results indicate that the PS in Europe is innovative but it still encounters a number of challenges and internal barriers which may impact the effectiveness of the government in general.

Beside the already mentioned studies, a very important questionnaire was distributed by the Australian Public Sector Innovation Indicators Project (APSII) which used the conceptual model in order to measure PSI in Australia. According to Australian Public Service Commission (APSC) (2012) the survey asked for five main types of innovation, the process innovations, investments in innovation, communication and policy innovations, product and service, and innovation strategies, and additionally asked for the examples of most and least successful innovation. Early results indicated that the respondents have difficulties in differentiating the five innovation types.

The contribution of this paper, with respect to other research, is the development of a measuring PSI performance instrument in FBiH which identifies several factors of each construct in accordance with prior reviewed research as of Andersen, Jakobsen (2018), Daglio, Gerson, Kitchen (2014), Kurz, Hüsig, Dowling (2018), Mongey (2013), Taylor (2018), and others. Finally, this research will deepen the understanding on measuring public sector innovation performance in the current literature.

Research methodology

Data

The instrument of measuring PSI performance was based on four latent constructs, namely, innovation capabilities, wider sector conditions for innovation, sources of information and the share of creative occupation. The first two constructs were adopted from Hughes, Moore, Kataria (2011) as part of an existing framework for measuring PSI in the United Kingdom. The innovation capability relates to the focal underpinning institutional capabilities which can sustainably impact innovation within an institution. Furthermore, wider sector conditions for innovation relate to factors which may either support or hinder innovation. The construct for sources of information was adopted from the APSC (2012), where this term refers to drawing on a wide range of information sources by which innovation can be successfully developed and implemented. Finally, the fourth construct was chosen following Hollanders, Arundel, Buligescu (2013). The share of creative occupation refers to an enabler from the point of human resources dimension and factors which contribute to their creativity that later impacts innovative behaviour. This "creative class" is said to foster an open, dynamic and professional environment.

The primary data was obtained through a survey with close-ended questions which was completed by the employees of the PS institutions in the Federation of Bosnia and Herzegovina (FBiH). The population for the analysis consisted of all PS institutions in FBiH, including 16 ministries, 2 agencies, and 11 institutes.

Fricker (2008) underlines that surveys which facilitate a mailing list-based sampling structure can be regarded in the same way as the traditional survey structures. Accordingly, random sampling is used in this research and solely the e-mail address from each unit in the sample is necessary. Furthermore, Fricker (2008) explains that such an approach is usually used for broad homogeneous groups which have publically available e-mail addresses, as the case of PS institutions. The focal criteria for the population in the paper is that the person is a PS employee in the FBiH. The minimal size of the sample was set at 200 participants, which is according to Hair et al. (2010) enough for a multivariate analysis.

In order to perform the research a five-level Likert scale was used in a range from 1 (absolutely do not agree) to 5 (absolutely agree), as well as in the range from 1 (absolutely hinder) to 5 (absolutely support). The survey questions were adopted from previously recognised articles (i.e. Fernandez, Moldogaziev, 2012, Lewis, Ricard, Klijn, 2018, Singh, Sarkar, 2019), and additionally, from existing measurement items found in the literature on measuring innovation (i.e. APSC, 2012, Hollanders, Arundel, Buligescu, 2013, Hughes, Moore, Kataria, 2011).

A sample survey was piloted on 30 e-mail addresses from the public sector in the FBiH five days before it was officially sent to all PS employees in FBiH. The validity and the comprehension of the questions was tested. The survey was sent in a form of a link over the email so that a direct feedback could be obtained. Based on the collected comments, a few corrections were made and some questions were accordingly rephrased.

Consequently, the final questionnaire was developed. It comprised of 25 items for measuring innovation capabilities, 12 items for wider public sector conditions for innovation, 10 items for measuring information sources, and 19 items for the share of creative occupation. The survey was sent on the 17th of July 2019, through the Lime Survey Software and it was open until the 3rd August 2019. During that period, 291 PS employees completed and submitted the questionnaire.

Methods

The exploratory factor analysis (EFA) was used in order to determine the principal components of measuring public sector innovation performance. Prior to that, some data from this research was missing as several employees have not submitted a response to certain questions, and this is not negligible. In that regard, a missing value analysis (MVA) was performed. There were in total 291 survey responses, and following Hair et al. (2010), all observations from the sample with more than 15% of missing data were excluded. After this step, 214 responses remained for the analysis, which represented an adequate sample size. When it comes to the analysis of data randomness, a Little MCAR test was used, in order to show if there is a significant difference between the observed sample of missing data and the sample of randomness. The test results (Chi-Square = 7118.787, df = 7082, Sig. = .377) showed a significant difference between the missing data, the sample, and the randomness sample. According to Hair et al. (2010), the missing data in the research is missing entirely at random which means that the variables are unrelated to other measured variables. Moreover, as the data was missing entirely at random, the missing values were inserted through regression imputation. Furthermore, in analysing the collected data, Hair et al. (2010) mention that extremely high or extremely low values in the sample, or the outliers, have to be identified. With the aim to identify any multivariate outliers, the Mahalanobis (D^2) method was used. Mahalanobis D^2 measures the distance of each observation of a multidimensional space relative to the centre of the mean values of all observations by calculating the value of each observation regardless of the number of variables. Thus, the measure D^2 is divided by the number of variables included - D^2/df, in order to identify outliers in the observed significance level of 0.005 or 0.001. The result of 0.0000056 – 1.0000000 was obtained, whereas the threshold, according to Hair et al. (2010), is 3.5. Therefore, it was concluded that there are no outliers and that also all observations can be used in the further analysis.

As already mentioned, the measurement scale validity was evaluated by using the exploratory factor analysis. Through this approach it was possible to condense a larger number of items into a smaller set, as suggested by Hair et al. (2010). The EFA was used to determine the appropriate number of latent factor structures and to analyse the number of fundamental factors in the set of items in each construct (Ramli, Abu-Hassan, Arifin, 2017). Furthermore, the purpose of EFA was to examine and identify the underlying factor structure for the observed variables, but without setting a preconceived structure on the outcome. Moreover, the results offered a clear estimation of the factor structure of variables.

According to Kline (2013), the exploratory factor analysis is effective in less mature areas of research, in which the underlying measurement questions are still not resolved. By using the SPSS 22, EFA was conducted in the way that initial extraction was performed, the number of factors to retain was determined, the rotation or transformation was done and finally the solution was interpreted and the factor scores were calculated. The EFA employed the principal component analysis (PCA) as the extraction method, and the Varimax rotation as a factor rotation method.

Results and Discussion

According to Lattin, Carroll, Green (2003), the two main assumptions of a factor analysis, the multivariate normality and sampling adequacy, should be satisfied prior to extracting the factors in order to confirm the data suitability for the EFA. The Bartlett's test of sphericity determines the variables multivariate normality and is used to validate the hypothesis that a correlation matrix is an identity matrix. George,

Mallery (2016) emphasise that the aim of the KMO test is to assess the sampling adequacy or whether the values distribution is appropriate for the factor analysis.

Following Hair et al. (2010), the criteria in determining the number of factors and items was based on the three main principles. Firstly, the value of the Kaiser-Meyer-Olkin (KMO) test had to be above 0.60. Secondly, in order to verify whether the correlation between the variables is large enough for the factor analysis, the factor significant value of the Bartlett's test had to be below 0.001.

When it comes to the data analysis, firstly the adequacy of the data was tested by using the mentioned KMO and Bartlett's Test. The results in Table 1 show that the KMO measure of sampling adequacy for all four constructs is in the range between 0.840 and 0.918, meaning that the values are near 1.0 and significantly above the recommended threshold value. Moreover, the Bartlett's Test, with value of p equal to 0.000, is significant for all four constructs. Both results indicate that the data is adequate for conducting the factor analysis.

The overall results of the factor analysis for all four constructs are also presented in Table 1. The PCA for innovation capabilities extracted four component dimensions with eigenvalues more than 1.0, and these four components are able to explain 66.43% of the construct. In terms of the second construct, the PCA extracted two components with eigenvalues above 1.0, and stated that the cumulative capability of these components is able to explain 55.52% of the wider public sector conditions for innovation construct. The PCA of analysing the sources of information construct extracted two components with eigenvalues more than 1.0, explaining 65.88% of the construct. In terms of the share of creative occupation construct, the analysis extracted five component dimensions with initial eigenvalues exceeding 1.0 which are able to explain 77.53% of the construct.

Table 1 Data Adequacy and Factor Analysis results

Construct	KMO Test Result	Bartlett's Test Significant Value Result	Number of Components with Initial Eigenvalues more than 1.00	Cumulative Rotation Sums of Squared Loading
Innovation Capabilities	0.918	0.000	4	66.43%
Wider Public Sector Conditions for Innovation	0.879	0.000	2	55.52%
Sources of Information	0.840	0.000	2	65.88%
Share of Creative Occupation	0.888	0.000	5	77.53%

Source: Author's work.

With the EFA, two key steps were conducted, the factor extraction and the factor rotation which enhances the explanation of a factor solution as Pallant (2013) underlines. Principal component analysis was used as extraction method of the data as its main aim is to reduce and summarise the data, and define the factors, as recommended by Hair et al. (2010). The Varimax rotation was conducted in order to maximise the factor loadings variance and reduce the number of variables with high loadings over each other, following Pallant (2013). Finally, in order for an item to be included in every construct, the factor loading for each item had to be larger than 0.60.

The innovation capabilities construct was measured by using a five-level Likert scale which ranged from 1 (absolutely do not agree) to 5 (absolutely agree). The rotation

converged in six iterations and the results of the reliability analysis for this construct are outlined in Table 2.

Table 2 Rotated Component Matrix for Innovation Capabilities

No.	Rotted Component Matrix				
		Component			
		1	2	3	4
1	I have enough resources (equipment and supplies) to do my job				
2	I have the freedom to look for new technologies, processes, techniques and / or ideas in the workplace		0.592		
3	The expectations of the employees in the institution are well-communicated (we know what is expected of us in the workplace)		0.603		
4	The current state of the institution is well communicated by the manager				
5	Employees at my institution are encouraged to develop new ideas		0.772		
6	Employees receive fair and constructive feedback on their new ideas		0.793		
7	My manager shows confidence in my work	0.747			
8	My manager sets goals appropriately	0.808			
9	My manager encourages me to take risks, and it is perfectly fine to go wrong in trying	0.741			
10	My manager encourages subordinates to do their best	0.844			
11	My manager talks optimistically about the future	0.742			
12	My manager cites others to look at problems from many different angles	0.817			
13	My manager values employee contributions	0.741			
14	My supervisor encourages subordinates to rethink their ideas	0.827			
15	Promotions in my work unit are based on merit		0.821		
16	Employees are rewarded for providing high quality services		0.854		
17	At my institution, people are rewarded for new ideas that work well		0.830		
18	My efforts have been rewarded the way it should be		0.729		
19	In the workplace, I am constantly looking for new processes, techniques and / or new ideas for doing work activities			0.751	
20	In the workplace, I promote and spread ideas to other colleagues			0.757	
21	I share the information I gained with my colleagues.			0.720	
22	I find it important that my colleagues know what I'm working on.			0.747	
23	I often communicate with a representative of a business association				0.865
24	I often communicate with a leader of a medium or large private company				0.832
25	I often communicate with an officer at another federal institution				0.618

Source: Author's work.

The Table 2 showed the factor loadings of the innovation capabilities construct consisting of 25 items over four components, from number 1 to 4. In Table 3, on the next page, the final results of the construct can be seen, where items 7-14 belong to component 1, items 2, 3, 5, 6, 15-18 belong to component 2, items 19-22 belong to component 3, and items 23, 24 and 25 belong to component 4. Because of low factor loadings, two items were removed from the original 25 items.

According to Awang et al. (2015) a component with Cronbach's alpha of 0.6 or higher, indicates that the items of a particular component present a reliable internal consistency measure. The values of the Cronbach alpha for the sub-constructs 1 to 4 are 0.930, 0.947, 0.756 and 0.694, respectively, and the value for the consolidated four components is 0.925. It can be seen that the focal underpinning institutional capabilities which can sustainably impact innovation within an institution are in accordance with prior research made by Head (2013), Taylor (2018), Kurz, Hüsig, Dowling (2018), and Mongey (2013). In the case of FBiH these components are leadership, people management, proactiveness and networking.

Table 3 Final Items of Innovation Capabilities

Items	Cronbach Alpha for the Sub-Construct
Component 1: Leadership	0.930
My manager shows confidence in my work	
My manager sets goals appropriately	
My manager encourages me to take risks, and it is perfectly fine to go wrong in trying	
My manager encourages subordinates to do their best	
My manager talks optimistically about the future	
My manager cites others to look at problems from many different angles	
My manager values employee contributions	
My supervisor encourages subordinates to rethink their ideas	
Component 2: People Management	0.947
I have the freedom to look for new technologies, processes, techniques and/ or ideas in the workplace	
The expectations of the employees in the institution are well-communicated (we know what is expected of us in the workplace)	
Employees at my institution are encouraged to develop new ideas	
Employees receive fair and constructive feedback on their new ideas	
Promotions in my work unit are based on merit	
Employees are rewarded for providing high quality services	
At my institution, people are rewarded for new ideas that work well	
My efforts have been rewarded the way it should be	
Component 3: Proactiveness	0.756
In the workplace, I am constantly looking for new processes, techniques and / or new ideas for doing work activities	
In the workplace, I promote and spread ideas to other colleagues	
I share the information I gained with my colleagues.	
I find it important that my colleagues know what I'm working on.	
Component 4: Networking	0.694
I often communicate with a representative of a business association	
I often communicate with a leader of a medium or large private company	
I often communicate with an officer at another federal institution	
Cronbach Alpha for the Construct	0.925

Source: Author's work.

The descriptive statistics for the Innovation Capabilities construct are presented in Table 4. The variables were computed as means so that they have the same scale (from 1 to 5) as the input variables. Accordingly, it may be concluded that "Proactiveness" is rated the best, while "People Management" is rated worst.

Table 4 Descriptive statistics for Innovation Capabilities

	N	Min	Max	Mean	Std. deviation
Component 1: Leadership	214	1	5	3.78	1.03
Component 2: People Management	214	1	5	2.73	1.10
Component 3: Proactiveness	214	1.75	5	3.91	0.67
Component 4: Networking	214	1	5	2.81	1.21

Source: Author's work.

The wider public sector conditions for innovation construct was measured by using a five-level Likert scale which ranged from 1 (absolutely hinder) to 5 (absolutely support). The rotation converged in three iterations and the results of the reliability analysis for this construct are outlined in Table 5.

Table 5 Rotated Component Matrix for Wider Sector Conditions

No.	Rotated Component Matrix		
		Component	
		1	2
1	Annual budget		
2	Salary and promotion system	0.766	
3	Values and culture of the executive management	0.729	
4	Institutional structure	0.759	
5	Quality of ideas coming from the employees		
6	Values and culture of the politicians	0.778	
7	Quality of the policy proposals	0.761	
8	National government pressure on the FBiH	0.666	
9	EU directives		0.666
10	Economic crisis	0.654	
11	Media attention		0.703
12	Citizen involvement		0.771

Source: Author's work.

The factor loadings of 12 items of this construct fall under two main components. In Table 6 it can be seen that items 2-4, 6-8 and 10 belong to component 1, and items 9, 11 and 12 belong to component 2. Due to low factor loadings, items 1 and 5 were dropped. The Cronbach alpha value for component 1 is 0.891 and 0.608 for component 2, while the consolidated value also exceeds the minimum and equals 0.878. Furthermore, in Table 6, it can be noticed that the factors which may either support or hinder innovation can be internal and external which was also supported by Mongey (2013), Bland et al. (2010), and Andersen, Jakobsen (2018).

The descriptive statistics for the Wider Sector Conditions construct are presented in Table 7. Accordingly, it may be concluded that "External" is rated the best, while "Internal" is rated worst.

The construct for sources of information was measured by using a five-level Likert scale which ranged from 1 (absolutely do not agree) to 5 (absolutely agree). The rotation converged in three iterations and the results of the reliability analysis for this construct are outlined in Table 8.

Table 6 Final Items for Wider Sector Conditions

Items	Cronbach Alpha for the Sub-Construct
Component 1: Internal	0.891
Salary and promotion system	
Values and culture of the executive management	
Institutional structure	
Values and culture of the politicians	
Quality of the policy proposals	
National government pressure on the FBiH	
Economic crisis	
Component 2: External	0.608
EU directives	
Media attention	
Citizen involvement	
Cronbach Alpha for the Construct	0.878

Source: Author's work.

Table 7 Descriptive statistics for Wider Sector Conditions

	N	Min	Max	Mean	Std. deviation
Component 1: Internal	214	1	5	2.81	1.09
Component 2: External	214	1	5	3.29	0.83

Source: Author's work.

Table 8 Rotated Component Matrix for Sources of Information

No.	Rotated Component Matrix		
		Component	
		1	2
1	I have enough information about my institution's current activities		0.741
2	In due time, I receive relevant work information from my supervisor		0.902
3	I get complete and accurate information all the time		0.872
4	The frequency of communication between the supervisor and myself is excellent, i.e. I get regular job instructions		0.849
5	I like to be fully informed of what my colleagues know	0.642	
6	When I need some knowledge, I ask my colleagues about it	0.801	
7	I regularly inform my colleagues about what I am working on	0.771	
8	When I have learned something new, I have made sure my colleagues learned about it	0.811	
9	I ask my colleagues about their skills when I want to learn something	0.811	
10	When a colleague is good at something, I ask him to teach me	0.803	

Source: Author's work.

The factor loadings of ten items of this construct fall under two main components. In Table 9 it can be seen that items 1-4 belong to component 1, and items 5-10 belong to component 2. No items were dropped for sources of information. The Cronbach alpha value for component 1 is 0.869 and 0.866 for component 2, while the consolidated value equals 0.832. Moreover, it can be noticed that the two components of sources of information, following Daglio, Gerson, Kitchen (2014), Abukhait, Bani-Melhem, Zeffane (2019), may be named as receiving information and searching for it.

The descriptive statistics for the Sources of Information construct are presented in Table 10. Accordingly, it may be concluded that "Searching Information" is rated the best, while "Receiving Information" is rated worst.

Table 9 Final Items for Sources of Information

Items	Cronbach Alpha for the Sub-Construct
Component 1: Receiving Information	0.869
I have enough information about my institution's current activities	
In due time, I receive relevant work information from my supervisor	
I get complete and accurate information all the time	
The frequency of communication between the supervisor and myself is excellent, i.e. I get regular job instructions	
Component 2: Searching Information	0.866
I like to be fully informed of what my colleagues know	
When I need some knowledge, I ask my colleagues about it	
I regularly inform my colleagues about what I am working on	
When I have learned something new, I have made sure my colleagues learned about it	
I ask my colleagues about their skills when I want to learn something	
When a colleague is good at something, I ask him to teach me	
Cronbach Alpha for the Construct	0.832

Source: Author's work.

Table 10 Descriptive statistics for Sources of Information

	N	Min	Max	Mean	Std. deviation
Component 1: Receiving Information	214	1	5	3.37	0.74
Component 2: Searching Information	214	1	5	4.02	0.72

Source: Author's work.

The construct for the share of creative occupation was measured by using a five-level Likert scale which ranged from 1 (absolutely do not agree) to 5 (absolutely agree). The rotation converged in six iterations and the results of the reliability analysis for this construct are outlined in Table 11.

The factor loadings of 19 items for share of creative occupation fall under five main components. In Table 12 it can be seen that items 7, 12-14 belong to component 1, items 8-11 belong to component 2, items 16-19 belong to component 3, items 4, 5 and 6 belong to component 4 and item 2 and 3 belong to component 5. Due to low factor loading, items 1 and 15 were removed. The values of the Cronbach alpha for the sub-constructs 1 to 5 are 0.929, 0.929, 0.848, 0.873 and 0.864, respectively, and the value for the consolidated five components is 0.910. It may be noticed that the final components of share of creative occupation, which follow the research if Mongey (2013), and Rivera-León, Simmonds, Roman (2012), are appreciation, inspiration, personal proactiveness, trust and independence, and competencies.

The descriptive statistics for the Share of Creative Occupation construct are presented in Table 13. Accordingly, it may be concluded that "Competencies" is rated the best, while "Appreciation" is rated worst.

Table 11 Rotated Component Matrix for Share of Creative Occupation

No.	Rotated Component Matrix					
		Component				
		1	2	3	4	5
1	The job I do is very important to me					
2	I feel competent to perform the tasks					0.914
3	I am confident in my own abilities and skills necessary to perform the assigned tasks					0.866
4	I have the authority to make the necessary decisions to do my job well				0.803	
5	My supervisor trusts me and allows me to make the right decisions at work				0.763	
6	I have opportunities for independence and freedom in how I do my job				0.791	
7	Creative work is appreciated and recognized in my institution	0.763				
8	My manager or supervisor serves as a good role model		0.815			
9	I can talk freely and openly with my manager		0.799			
10	My manager builds the identity and morale of the team		0.819			
11	My manager inspires confidence with his arguments		0.798			
12	Advancement in a position depends on how well the employees do their job	0.872				
13	The rewards in my work unit depend on how well the employees do their job	0.900				
14	Creativity and innovation are rewarded	0.889				
15	I get timely praise for my ideas/ work					
16	I have creative ideas at work all the time			0.799		
17	In the workplace, I try to implement new ideas			0.850		
18	In the workplace, I develop adequate plans and schedules to implement new ideas			0.852		
19	In the workplace, I am able to try new ways to solve the problems I encounter while working			0.670		

Source: Author's work.

Table 12 Final Items for Share of Creative Occupation

Items	Cronbach Alpha for the Sub-Construct
Component 1: Appreciation	0.929
Creative work is appreciated and recognized in my institution	
Advancement in a position depends on how well the employees do their job	
The rewards in my work unit depend on how well the employees do their job	
Creativity and innovation are rewarded	
Component 2: Inspiration	0.929
My manager or supervisor serves as a good role model	
I can talk freely and openly with my manager	
My manager builds the identity and morale of the team	
My manager inspires confidence with his arguments	
Component 3: Personal proactiveness	0.848
I have creative ideas at work all the time	
In the workplace, I try to implement new ideas	
In the workplace, I develop adequate plans and schedules to implement new ideas	
In the workplace, I am able to try new ways to solve the problems I encounter while working	
Component 4: Trust & independence	0.873
I have the authority to make the necessary decisions to do my job well	
My supervisor trusts me and allows me to make the right decisions at work	
I have opportunities for independence and freedom in how I do my job	
Component 5: Competencies	0.864
I feel competent to perform the tasks	
I am confident in my own abilities and skills necessary to perform the assigned tasks	
Cronbach Alpha for the Construct	0.910

Source: Author's work.

Table 13 Descriptive statistics for Share of Creative Occupation

	N	Min	Max	Mean	Std. deviation
Component 1: Appreciation	214	1	5	2.50	1.15
Component 2: Inspiration	214	1	5	3.41	1.08
Component 3: Personal proactiveness	214	1	5	3.79	0.76
Component 4: Trust & independence	214	1	5	3.68	1.03
Component 5: Competencies	214	1	5	4.53	0.63

Source: Author's work.

Conclusion

The main aim of this paper was to provide some empirical support regarding the reliability of the instrument which was developed in order to measure PSI, by using exploratory factor analysis. This research empirically supported some previous research results regarding the main constructs in measuring innovation performance in the PS. Various notable initiatives have happened in Europe and outside with the aim to enhance the understanding of public sector innovation and to examine the data collection tools, but rather narrow data was collected, so that additional research is advisable.

The results indicate that the questionnaire used to measure innovation capabilities, wider sector conditions for innovation, sources of information and the share of creative occupation construct is reliable. The factor analysis produced four factors for innovation capabilities, two for wider public sector conditions for innovation, two for sources of information and five factors for share of creative occupation. Each component was able to explain from 65% to 78% of the construct. The reliability analysis results showed that items from all four constructs are relevant for this research setting and contribute to the general reliability instrument with a high Cronbach's alpha value, ranging from 0.832 to 0.932.

The main analysis results showed that innovation capabilities were measured by using four sub-constructs, which are leadership, people management, proactiveness and networking. Prior research by Head (2013) and Taylor (2018) also confirmed that factors that can influence the innovation performance in the PS, among others, encompass superior leadership and project management skills, networking. Furthermore, Mongey (2013) explained the management is the one who supports innovation, improves people management, and the establishes a common entrepreneurial objective within the institution.

The wider public sector conditions construct was measured through two sub-constructs that are internal and external. Mongey (2013) also explained that every successful institution requires an overall understanding of the internal conditions affecting innovation. Bland et al. (2010) emphasised that resources, talent and quality skills are necessary in order to place innovative ideas into practice. The support of the whole institutional structure is a key for a successful implementation of the innovative institutional activities. Furthermore, Andersen, Jakobsen (2018) verified that in order to understand the public sector performance, it is also important to consider the external factors, as the political pressure, horizontal factors as compliance pressures, citizen needs and others.

The sources of information construct were measured using two sub-constructs, which are receiving and searching information. Daglio, Gerson, Kitchen (2014) verified that searching and sharing information is essential for the improvement of innovation. Furthermore, Abukhait, Bani-Melhem, Zeffane (2019) also explained that knowledge sharing includes a mutual exchange of task information and working expertise in which it enhances innovative employee behaviour and fosters critical thinking.

The share of creative occupation was measured through five sub-constructs that are appreciation, inspiration, personal proactiveness, trust and independence, and competencies. Mongey (2013) also underlined that PS institutions should inspire, encourage and appreciate their employees in innovating. Inspiration is, in most cases, intrinsic, but it is also highly dependent on the working environment, whereas opportunity refers mostly on the provision of trust and independence, and resources. Rivera-León, Simmonds, Roman (2012) explained that it is probable that innovation will occur in institutional cultures, which stimulate and provide rewards based on competencies and personal endeavour.

These results facilitated the identification of suitable factors and number of factors reflecting innovation capabilities, wider sector conditions for innovation, sources of information and the share of creative occupation in the FBiH public sector. Even though the Cronbach's alpha value of each construct exceeded the minimum threshold which was set by Awang et al. (2015), the conduction of a more rigorous analysis may be recommended in order confirm the validity and reliability, for example by using the confirmatory factor analysis.

Nevertheless, this research is a good starting point as it has provided and analysed the first instrument in measuring public sector innovation performance in FBiH. Furthermore, as the area of public sector innovation in FBiH is still vague this instrument can be used to assess the current situation and decide on some further steps in order to enhance PSI in the entity and the country.

The main contribution of this paper was the development of the first measuring instrument of PSI performance in the context of Federation of Bosnia and Herzegovina. This research provided an empirical support on the reliability and the identification of several factors of each construct and deepened the understanding on measuring public sector innovation performance in the current literature and in a developing country context.

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