The Impact of Innovation Climate on Innovative Work Behaviour:

An empirical investigation into Public Sector Laboratories in Bahrain

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ABSTRACT

This study investigated the impact of innovation climate on innovative work behaviour in public sector laboratories in Bahrain. The study identified five organizational factors and two individual factors that may impact innovative work behaviour. The Big Five Model (BFTM) was used to evaluate personal traits as individual factors. The results showed that extraversion, agreeableness, co-worker support, and work characteristics have a significant impact on innovative work behaviour. Work passion is related to innovative work behaviour but does not show a significant impact on it. Overall, both organizational and individual climates have a significant impact on innovative work behaviour. The study provides a roadmap for managers on how to develop and maintain employees' innovative work behavior. It reduces the knowledge gap in understanding the innovation climate and innovative work behaviour in the Bahrain public sector through a new approach of addressing both individual and organizational factors of the innovation climate.

Keywords: Innovation climate, innovative work behaviour, big-five personality traits, work characteristics, co-worker support

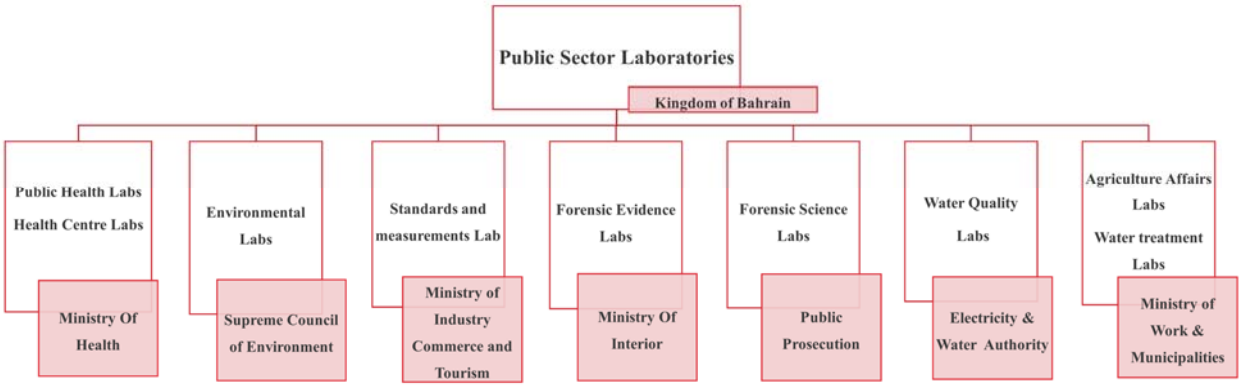
Introduction

Public sector laboratories are technical and practical science facilities within the government with a wide scope of work, serving various clients and end-users by providing technical and analytical services as public goods. The mission of public sector labs is supporting and implementing national policies in agriculture, construction, health, security, and justice sectors through the provision of technical support or infrastructure, such as measurement standards, to contribute to knowledge accumulation and economic competitiveness (Cox, 2002). In the Kingdom of Bahrain, the public sector labs distributed throughout public sector ministries and authorities are illustrated in Figure 1.

Public sector labs share numerous common factors such as the practical and technical scientific nature, and the use of similar or related technologies. The shared missions of public sector labs are to test, analyze, and examine a variety of specimens, interpret results, and provide technical reports to clients and decision-makers. Another common aspect among them is attracting and assigning employees with similar academic qualifications and backgrounds, typically graduates from science and health sciences schools and colleges across a wide range of disciplines. Moreover, public sector labs encounter several challenges such as budget shortages,

a lack of continuous learning and training plans, the necessity to be highly adaptable to inquiries, the adoption of the latest advanced technologies, and responding to scientific research demands. To meet the high requirements of different governmental organizations and entities, public sector labs must be innovative as the public sector in Bahrain faces "wicked problems". Thus, it is worthwhile to understand how public sector labs "climate" impact employees' innovative work behaviour (IWB).

Figure 1: Distribution of Public Laboratories that Participated in the Study among Public Sector Entities



Innovation aims to create novel ideas, devices, processes, and products or services, to create better solutions that meet new requirements, unarticulated needs, or existing needs (Hsieh et al., 2015). Public sector innovation is defined by Albury (2005) as "the creation and implementation of new processes, products, services and methods of delivery which result in significant improvements in outcomes, efficiency, effectiveness or quality". This definition fits public sector labs context to drive towards faster, cheaper, and better-quality public services as public goods. Furthermore, innovation is required in public sector labs as they play a significant role in the research and development functions to make the routine work of public sector labs more efficient and effective. Employees in public sector labs are the central engine of innovation, researchers and scientists should enhance the laboratories capacity to innovate sustainably.

In public sector labs, having innovative employees is both a strategic and operational necessity. Given that the field is constantly evolving, innovation is crucial to revolutionize routine laboratory work and advance research and development. To ensure a successful workforce, it is essential to cultivate and train employees to be innovative in these unique areas. Additionally, providing supportive organizational environment that fosters an innovative climate is key to maintaining employees' innovative behaviour. Thus, organizations cannot rely on creativity alone when hiring employees. Instead, they should establish an environment that promotes and accelerates innovation and encourages employees to enhance their innovative behaviour. Organizational structures designed to facilitate innovative behaviour among employees (Thiruvenkadam and Sampath, 2018). Employees in the public sector in Bahrain often deal with repetitive tasks and daily routine, which can lead to a lack of innovative work behaviour. Therefore, it is essential to determine how the organizational climate affects employees' innovative work behaviour in a context that has not been explored by existing

literature. This raises the question: What is the impact of innovation climate on employees' innovative work behaviour in public sector labs?

This study aims to understand how the innovation climate impacts employees' innovative work behaviour in public sector labs in Bahrain by identifying the elements of innovation climate in the public sector labs and understanding the nature of the relationship between innovation climate elements and innovative work behaviour in that context. Furthermore, this study aims to determine the impact of innovation climate elements on innovative work behaviour.

Literature Review

Innovation is a crucial component for the success of any organization (Hakimian et al., 2016). Nowadays, public sector organizations face various challenges that highlight the importance of innovation (Bysted and Hansen, 2015). There is a need for theoretical and practical inquiry to understand how public organizations can improve their innovation capabilities (Hoch, 2013). Achieving a better understanding and promoting individual innovative work behaviour is crucial for fostering innovation, encompassing both generating novel ideas and successfully implementing them (Scott and Bruce, 1994).

Innovation Climate

Organizational climate is generally perceived to be reflected in the staff's impressions of, or convictions about work environment characteristics that shape assumptions about requirements, possibilities, outcomes, and communications in the workplace (Ekvall, 1996). Organizational climate is understood through the organization members' practices, procedures, and reward systems. It provides indications of how the business operates on a daily basis and reflects the organization's priorities (Ahmed, 1998).

Dimensions of Innovation Climate

Organizational climate includes several dimensions. Thiruvenkadam and Sampath (2018) considered creativity climate and innovation climate as one subject, and they determined innovation climate by a variety of factors including characteristics of work, support of management and co-workers, emotional safety, resource availability/accessibility, diversity, risk-taking capabilities and dynamism, and systems and processes followed in the organization. Despite all these factors positively correlating to an innovative climate, work characteristics and diversity were found to be the most significant contributors. These factors were originally published in a seminal work by Ekvall (1996). In contrast, John (2011) studied innovation climate in public sector and non-profit organizations from employees' and managers' perspectives, focusing on elements that included organizational value, willingness to take risks, high levels of trust from managers, low levels of red tape, a sense of pride in working for an organization, high quality of work, performance incentives, and high ethical standards. They found that job flexibility, the quality and reputation of the entity, and the importance of the job in the employee's lives were positively related to innovation climates. They concluded that organizational factors were just as crucial as individual factors in fostering innovation in the public sector. On the other hand, Sherief (2019) conducted qualitative research and recommended eight organizational climate factors that enhance the creative behaviour of

employees in the public sector. These factors included meaningful work, organizational vision, autonomy, slack resources, supervisory support, deliberation, diversity, and organizational willingness to take risks. Moreover, Walker (2015) identified twelve major dimensions that shape the innovation climate of innovative individuals, such as valuing creativity and innovation, team cohesion, autonomy, goal awareness, resources, risk, expertise, achievement, ideation system, internal networks, and internal and external collaboration.

Innovative Work Behaviour

The concept of innovative work behaviour refers to an employee's actions related to generating, applying, and implementing new ideas, products, processes, and methods within their job position, department, or organization (Torres et al., 2017). The differences in innovative work behaviour between public and private sectors are less significant compared to the variation between sub-sectors (Bysted and Hansen, 2015). This emphasizes the need for future studies to focus on sub-sectors and job functions within the public sector to understand innovative behaviour better. The innovation climate in public organizations, such as the education and health sectors, requires thorough investigation (Kanter, 1988; Scott and Bruce, 1994; West and Farr, 1990). Measuring innovative work behaviour involves evaluating how employees express innovative behavior at work. Scott and Bruce (1994) developed a six-item scale to assess IWB as a unidimensional measure, while Krause (2004) and Dorenbosch et al. (2005) used a two-dimensional measure, acknowledging that IWB consists of creativity and implementation as separate dimensions. In contrast, De Jong and Den Hartog (2010) originally proposed a ten-item scale with four dimensions for measuring IWB: opportunity exploration, idea generation, idea promotion, and idea implementation.

In essence, the literature has not yet reached a consensus on global and unified measures for IWB. Some researchers advocate for measuring innovative work behaviour in terms of a single dimension, while others argue that two or four dimensions are necessary. The discrepancy in the measurement process can be attributed to two main reasons: firstly, innovative work behaviour is still a relatively new concept in literature and lacks established definitions. Secondly, the measurement approach may vary depending on the specific sector where the research is conducted. In certain contexts, a single dimension of innovative work behaviour may suffice to offer a clear understanding of employees' innovative behaviour, whereas in other cases, multiple dimensions may be essential. Consequently, innovative work behaviour is influenced by various individual and organizational factors.

Researchers have yet to agree on a standardized way of measuring organizational climate. Previous studies have employed different methods and factors to evaluate innovative organizational climates. However, Bahrain offers a unique environment for innovation, and there is a lack of research investigating the innovation climate in public sector labs.

Personal Traits as Individual Factors

The employees' innovative capacity is not an isolated behaviour but a function of their traits (Torres et al., 2017). Innovation mostly starts at an individual level with the generation of ideas. Personal values form the foundation for innovative work behaviour and are crucial for its development (Purc and Laguna, 2019), guiding people' goals and actions (Schwartz, 1992). This

is closely related to individual's motivations as it helps to explain innovative behaviour (Cieciuch and Strus, 2018).

Researchers focus on five fundamental personality factors that underlie people's approach to thinking and feeling, which form the basis for studying personality known as the "Big Five" (Hughes et al, 2013). These factors predict individuals' personality, character, and behaviour. The big five personality trait model (BFTM) traits are openness to experience, conscientiousness, extraversion, agreeableness and neuroticism. In this context, Kumar and Bakhshi (2010) argued that dispositional factors are synonymous with the BFTM of personality. Furthermore, the BFTM supports the prediction of work behaviour (Chau et al., 2018).

Open to experience individuals are ingenious, inquisitive, artistic and innovative (McCrae and John, 1992). These traits commonly include being inventive, cultured, forward-thinking, intellectual, and imaginative. Conscientiousness is the predisposition to be reasonable, trustworthy, persistent, punctual, hardworking, and attentive. Conscientious individuals are focused on results and tasks (Templer, 2012). Extraverted individuals are supportive and engaged in teamwork (Boštjancic, 2010). Niu (2014) found that extraversion reflects this trait's ability to form friendships with others. Agreeable individuals exhibit characteristics such as kindness, cooperativeness, forbearance, bigheartedness and reliance (Judge et al., 2002). Most agreeable individuals tend to be more sympathetic, obliging, and broad-minded. Agreeableness is one of the most significant factors of personality organization; it reflects individual differences in social coordination and cooperation (Yang and Hwang, 2014). Individuals with high scores in neuroticism tend to be moody and feel worried, anxious, fearful, frustrated, angry, depressed, envious, jealous, guilty and lonely (Judge et al., 2002). Employees with low scores in neuroticism are more emotionally stable and less reactive to pressure (Yang and Hwang, 2014).

According to Hughes et al. (2013), openness to experience is the most significant trait that correlates with creativity and innovation. This trait reflects a person's curiosity, and willingness to explore new ideas and embrace new values. However, the other four traits have varying levels of predictive power in specific domains. In the scientific creativity domain, openness to experience and conscientiousness have a strong positive correlation, as found in the study by Batey and Furnham (2006). This domain is crucial for laboratory employees as it involves using various scientific tools and skills in their daily work routine.

Work Passion as an Individual Factor

Passion is one of the most crucial motivating factors for creativity and innovation at the individual level (Amabile, 1996). Intrinsic task motivation is a passion that refers to the motivation to undertake a mission or solve a problem because it is interesting, involving, personally challenging, or satisfying, rather than doing it out of extrinsic motivation experience (Amabile and Fisher, 2012). Koednok and Sungsanit (2018) assert that employee work passion is a key factor in stimulating innovation and innovative work behaviour and highlight a lack of studies that connect passion for work to innovative behaviour, our study aims to address this gap in the literature.

Organizational Factors of Innovation Climate and Innovative Work Behaviour

Work characteristics. Work or task characteristics refer to how a specific work is structured to create effective employees who are adaptable and engaged in their roles (MacCormick and Parker, 2010). Task characteristics are a key component of work design and include several elements such as task variety, task significance, task identity, feedback from tasks, and autonomy (Morgeson and Humphrey, 2006). Furthermore, task characteristics have a positive impact on employees' innovative work behaviour (Suseno et al., 2019).

Management support. Management or supervisory support refers to the belief about the extent supervisors value an employee's contributions and care about their well-being. This support serves as a motivator for employees to put more effort in tasks, particularly innovative ones when supervisors show consideration toward their subordinates (Rhoades and Eisenberger, 2002). There is a positive relationship between supervisory support and IWB, which is only significant when there is high co-worker support (Montani et al., 2012). Arora and Kamalanabhan (2013) found that support from supervisors and co-workers to employees gives them the ability to engage themselves in IWB. Creativity and innovation are fields where supervisors can strongly impact employee creativity (Shalley and Gilson, 2004). Supervisors need to encourage, promote, and support creativity to help innovative behaviour (Shalley and Gilson, 2004).

Co-worker support. Co-worker support refers to assistance provided by colleagues in work tasks when requested, through sharing knowledge, expertise, and offering encouragement and support (Zhou and George, 2001). A high level of co-worker support directly influences innovative work behaviour (Montani et al., 2012).

Reward and appreciation. The reward system is a crucial component of the organizational climate, and can foster innovation (Ahmed, 1998). Board (2007) stated that "incentives, rewards and recognitions are the prime factors that impact employee motivation." Batey (2018) suggested that "reward schemes for creativity and innovation should reward employees for taking part in creative thinking and innovative doing, not only the successful completion of a project". Janssen (2003) found that employees tend to be more innovative when their supervisors fairly reward their efforts.

Resources. Sufficient resources are one of the elements of organizational climate (Amabile and Grykiewicz, 1989; Sherief, 2019), where resources need to be mobilized for designing and executing any innovation (Sherief, 2019). In this context, Sherief found that surplus accessible resources are related to public servants' creative behaviour. Additionally, Ekvall and Ryhammer (1999) found a direct association between the availability of extra resources and creative behaviour.

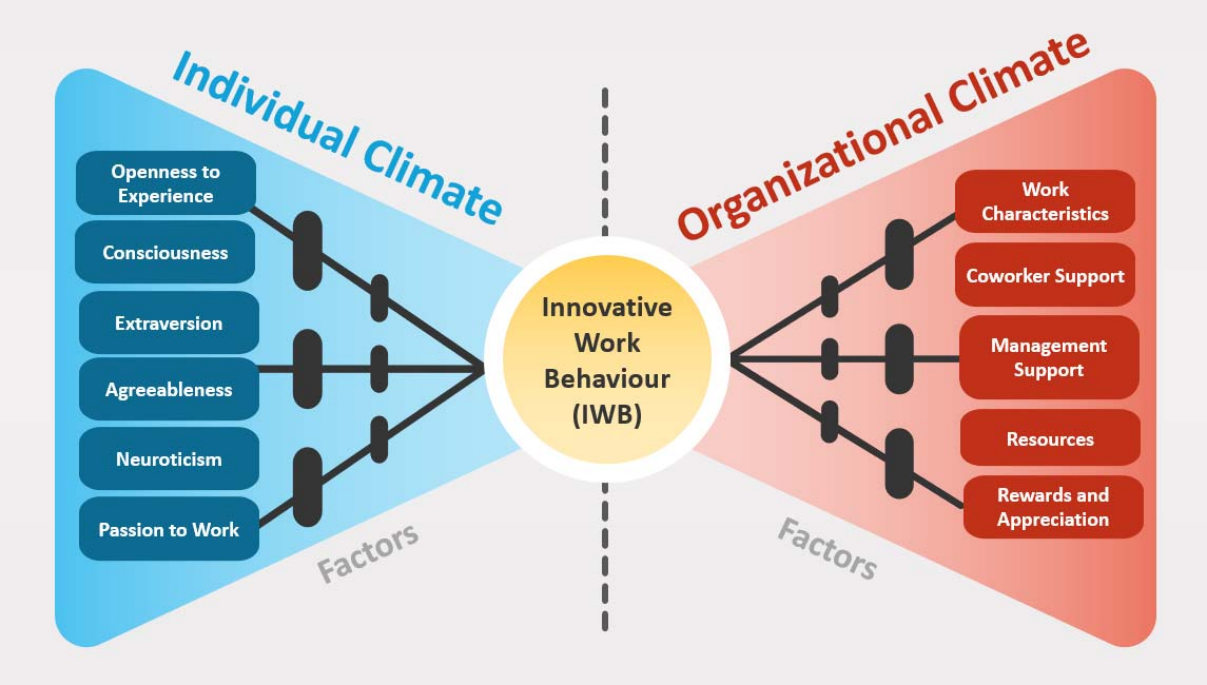
Methodology

Based on the literature review on innovation climate, innovative work behviour, and pilot interviews with public sector labs seniors and officials, the proposed research model is illustrated in Figure 2. The model divides the innovation climate into two parts: organizational climate,

which consists of organizational factors, and individual climate based on individual or personal behavioural factors.

Organizational climate and individual climate factors play a significant role in shaping employees' innovative behaviour in the public sector labs. While much of the existing literature focuses solely on organizational climate factors, it is essential to consider individual behavioural factors in conjunction with organizational factors. Thus, innovation climate is formed through the interaction of both organizational and individual climate factors.

Figure 2: Research Conceptual Model



The study examines a combination of organizational and individual factors that affect innovative work behaviour. The authors posit that public sector labs differ from other public organizations, making it necessary not to solely rely on factors explored in the existing literature. To achieve the research objectives, this study adopts a mixed-methods approach, incorporating both qualitative and quantitative methods. The literature review identified numerus organizational factors impacting innovative work behaviour. However, no prior studies have been conducted specifically in public sector labs. Therefore, this study seeks to comprehend the local context and the unique characteristics of public sector labs by conducting multiple interviews with public sector lab officials. Previous research has utilized questionnaires as primary data collection tools. According to Patterson et al. (2005), questionnaires are used to measure organizational climate when making comparative assessments across organizations. Hence, the questionnaire approach method is suitable for assessing organizational climate if the study aims to discern the general trends within a specific sector and later extrapolate the findings to other sectors.

Qualitative Method

Ten short pilot call interviews were conducted between October 15th and November 26th, 2019. The targeted interviewees were public officials or seniors from eight laboratories distributed across the public sector in Bahrain (Figure 1). Five males and five females were interviewed. The interviews lasted between 10 to15 minutes. The interview guide includes four questions that orbit around elements of innovative work behaviour, the most significant factors that affect innovativeness, and the challenges that act as obstacles to innovativeness (Appendix A).

Quantitative Method

The quantitative method cross checked the factors identified in the telephone interviews.

Population and sampling. The target population consisted of all employees working in laboratories within the public sector in Bahrain. The estimated population size ranges from 450 to 500 employees (N=500) across 7 ministries and governmental authorities (Ministry of Health, Ministry of Interior, Ministry of Industry Commerce and Tourism, Ministry of Works and Municipalities, Public Prosecution, Electricity and Water Authority and Supreme Council of Environment). According to Kerjcie and Morgan (1970), the representative sample size for this population was 217 respondents. Out of 300 questionnaires distributed, only 104 valid responses were received, representing a response rate of approximately 35% (34.66%) and about 21% (20.80%) of the total population. This response rate was deemed acceptable for this type of study (Hair et al., 2016).

Measuring instrument. The survey included 57 questions (listed in Appendix C) distributed across four sections: demographic variables, organizational factors, individual factors, and innovative work behaviour. All questions in sections 2, 3, and 4 of the survey were answered using Likert Scale with linear choices from 1 to 5 (1= Strongly Disagree, 2= Partially Disagree, 3= Neither Agree Nor Disagree (neutral), 4= Partially Agree, 5= Strongly Agree).

Demographic variables. Demographic variables included five questions representing five demographic parameters: gender, age, nationality, educational level, and years of experience (0 to above 20 years). Age was categorized into seven classes based on five-year intervals (20 to above 45 years). Work experience was divided into five classes based on five-year intervals (high school to doctorate), and nationality was broadly classified as Bahraini and non-Bahraini.

Individual Factors Measures

Individual factors, personal traits and work passion were assessed using a set of 15 questions (Appendix C). To evaluate the personality traits of BFTM, a Big Five Inventory questionnaire (BFI-10) was utilized. This questionnaire, developed and validated by Rammstedt and John (2007), consists of a 10-item measure to gauge the five major personality traits. The BFI-10 is particularly useful in situations where a brief assessment of personality needed, and time was limited for conducting the research (Gosling et al., 2003). The BFI-10 covers both the high and low ends of each trait, incorporating one true-scored and one false-scored (reversed) item for each of the five traits. When creating the online questionnaire, it was important to include both positive and negative statements to prevent respondents from providing expected

answers. The other individual factor, work passion, was evaluated using five out of six items from a scale developed by Vallerand et al., in 2003.

Organizational Factors Measures

Organizational factors include 26 questions that cover various factors. These questions are adapted from the Creative Climate Questionnaire (CCQ) developed by Ekvall (1996) and encompass factors such as work characteristics, management support, co-worker support, resources, rewards, and appreciation. The final factor, organizational processes and systems, is derived from a broader factor in the original CCQ.

Innovative Work Behaviour Measure

De Jong and Den Hartog's (2010) IWB measure consist of 10 questions, used to measure innovative work behaviour based on four-dimensions that include: idea exploration, idea generation, idea championing and idea implementation.

Data Analysis and Results

The digital FormsApp from SurveyHeart LLP was utilized to collect responses. Subsequently, the response data was exported to Microsoft Excel 2013 for refinement and coding. The data was then analyzed statistically using the IBM Statistical Package for Social Sciences (SPSS®) version 26 to calculate frequencies, descriptive statistics, conduct the Alpha Cronbach reliability test, perform a Pearson Bivariate correlation, and run linear regression.

Results and Analysis of Interviews (Qualitative Analysis)

The qualitative pilot phone interviews aimed at identifying the main factors influencing innovative work behaviour in public sector labs are presented in Table 1. These factors vary in importance based on their frequency among the ten interviewees. Management and supervisory support emerged as the most significant factors affecting employees' innovative work behaviour, with 8 out of 10 interviewees highlighting its importance. Resources were identified as the second most crucial factor, mentioned in 6 interviews. Job autonomy was described using various terms such as freedom, freedom of opinion, and trust in employees. According to the interviewees, resources encompass financial support enabling employees to implement their ideas and the necessary slack time for innovation. However, limited research materials and instruments in laboratories due to authorization issues or material shortages create a resource challenge. Job autonomy, reflecting the level of freedom in the job, ranked third in importance. Personal traits of employees were emphasized by 5 out of 10 interviewees as a key individual factor influencing innovative work behavior. Vision and strategy, regulations, organizational structure, and job autonomy were considered as part of work characteristics, leading to the creation of the eight-item scale.

Table 1: Innovation Climate Factors Identified from the Pilot Interviews

Factors	Occurrences/frequencies
Management Support	8
Resources	6
Job Autonomy	5
Personal traits	5
Work passion	3
Coworkers support	3
Appreciation and rewards	2
Vision and strategy	2
Regulations and structure	2
Work characteristics	2

Results and Analysis of Survey (Quantitative Analysis)

The total sample consists of (n=104) responses to all 57 questions in the survey, which means that there is no missing data among all the respondents and all factors.

Reliability test results. Cronbach's Alpha test was used to evaluate the reliability of the scales chosen in the survey, specifically internal consistency among the scale items measuring each research variable. The reliability measuring coefficients indicate the extent to which the items of the scale in a set are positively correlated to each other. A Cronbach's Alpha value of 0.70 or above implies acceptable reliability of the scale (Cronbach, 1951). Alpha values for most innovation climate factors surpass the minimum value of 0.70.

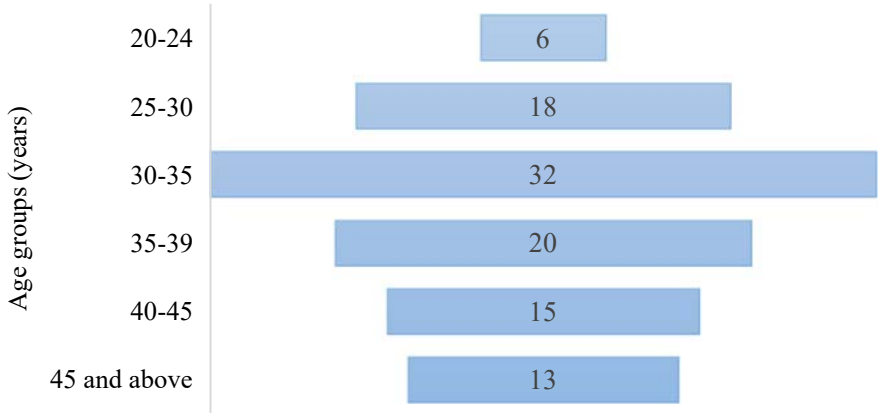
Descriptive Statistics of demographic variables. In terms of demographic statistics, 72.1% of 104 respondents were female, and 27.9% were male employees (Table 2). The results indicate that most employees in public sector labs in Bahrain were females. They are a preferred choice due to reasons such as a shortage of qualified males in some specific specialties and employers view in this significant sector.

Table 2: Gender Distribution in The Sample (N=104)

GEN	Frequency	Valid (%)
Female	75	72.1
Male	29	27.9
Total	104	100.0

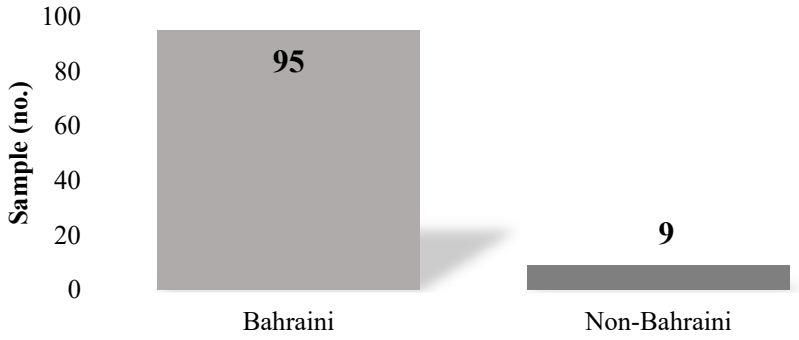
In terms of age of respondents, the results in Figure 3 show that the largest age range was 30-34 (30.8%), followed by the age range of 35-39 (19.2%), indicating that half of the sample consists of young employees. Additionally, 23.1% of respondents were in their twenties. Overall, most respondents were young, reflecting a dynamic employment trend in the public sector labs, which constantly requires new talent to meet the growing demand for public sector labs services.

Figure 3: Age Grouping of the Sample (N=104)



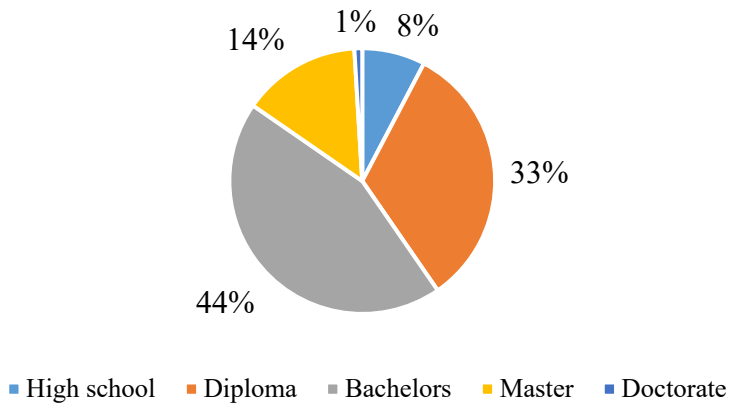
Nationality was measured and broadly classified into Bahrainis and non-Bahrainis to determine the demographic composition of the sector. The results revealed that 91.35% of respondents were Bahraini nationals, while 8.65% were non-Bahrainis (see Figure 4). This outcome was anticipated due to the sensitive nature of the information handled in public sector labs, necessitating employees with clear security backgrounds and citizens. The sector demonstrates a strong dependence on Bahraini citizens. In addition to localization policy of public jobs in Bahrain.

Figure 4: Nationality of the Study Sample



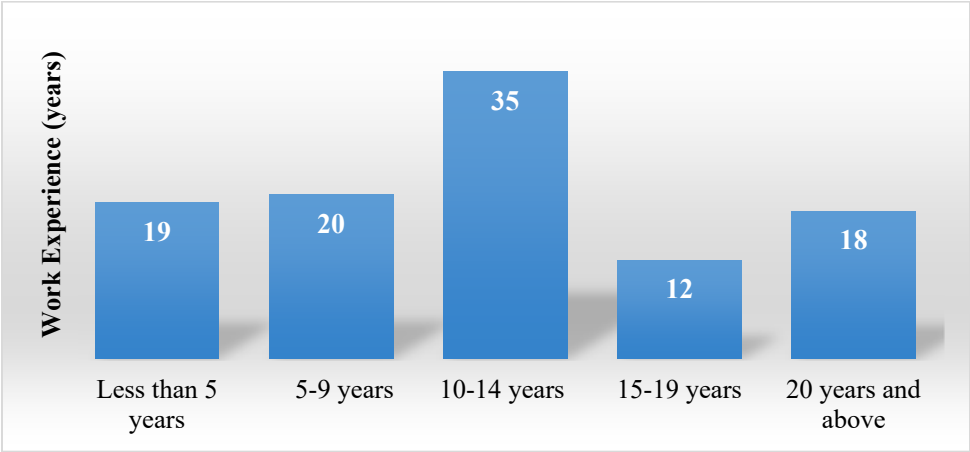
According to Figure 5, the respondents' educational background was as follows: 44% held a bachelor's degree, 33% held a diploma, 14% held a master's degree, 8% had completed high school, and almost 1% held a doctorate (Figure 5). Most respondents (77%) held either a bachelor's degree or a diploma, indicating the high demand for qualified professionals in this critical field, which is also in line with the government's focus on employing skilled individuals.

Figure 5: Educational Level of the Study Sample



The last demographic variable tested was years of work experience. The results showed 33.7% and 19.2% for 10-14 years and 5-9 years respectively (Figure 6). These percentages indicate that the respondents were mid-career with moderate experience (career life span in Bahrain public sector is 30 years in average). Juniors with less than 5 years work experience accounted for 18.3%, while seniors with work experience of 15-19 years and 20 years and above represented 11.5% and 17.3% of the sample, respectively.

Figure 6: Work Experience Grouping of the Study Sample



Descriptive Statistics of Research Variables

Descriptive statistics of individual factors in innovation climate. Table 3 presents the means and standard deviations of all the independent factors and their corresponding question items. Among the individual factors, extraversion demonstrates the highest average ($\mu = 4.28 \pm 0.794$), indicating unanimous agreement among respondents regarding this trait. This suggests that respondents prefer being surrounded by people rather than being alone, aligning with and confirming a key characteristic of Arab culture. Another noteworthy finding is the high level of work passion ($\mu = 4.08 \pm 0.803$).

That could mean that employees who participated in the study loved their work in public sector labs. Neuroticism, conscientiousness, and a showed results close to a neutral response with (μ= 3.54 ± 0.775), (μ= 3.29 ± 0.775), and (μ= 3.24 ± 0.873) respectively.

Neuroticism generally possessed a neutral response (neither agree nor disagree) (μ= 3.04 ± 0.77). The only disagreement was found in the individual factor openness to experience, with a mean of (μ= 2.24 ± 0.773), suggesting that employees at public sector labs are controlled by strict rules and policies.

Table 3: Descriptive Statistics of Individual Factors (N=104)

Individual factors	Mean (μ)	Standard Deviation (SD)
Consciousness	3.29	0.775
Openness to experience	2.24	0.773
Extraversion	4.28	0.794
Agreeableness	3.24	0.873
Neuroticism	3.54	0.775
Work Passion	4.08	0.803

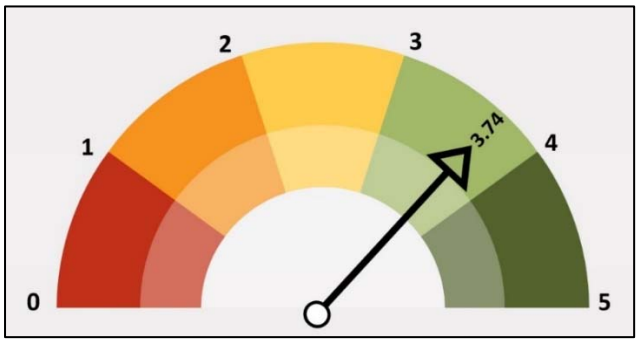
Descriptive statistics of organizational factors of innovation climate. Table 4 depicts the descriptive statistics of the five factors that impact organizational innovation climate. The highest average score was achieved by work characteristics, scoring 3.78 ± 0.702. This indicates that there are positive work design practices, well-defined job descriptions, and a clear vision and mission for employees in public sector labs. Co-worker support also received a significantly high score of 3.30 ± 0.702. However, the other organizational climate factors like management support, resources, and rewards and appreciation were perceived negatively. These factors are essential for fostering innovation, and their absence or inadequacy in the organization can hinder employee innovativeness.

Table 4: Descriptive Statistics of Organizational Factors of The Study

Organizational factors	Mean (μ)	Standard Deviation (SD)
Work characteristics	3.78	± 0.702
Management Support	2.85	± 1.082
Coworker support	3.30	± 0.926
Resources	2.7	± 0.891
Rewards and Appreciation	2.74	± 1.145

Descriptive statistics of innovative work behaviour. Figure 7 shows that the mean for the ten questions on the innovative work behaviour scale in the sample (n=104) was 3.74 out of 5 on the Likert scale. The range of the means among the ten questions varied from 3.23 to 4.03. The results indicate that employees in public sector labs demonstrate an acceptable level of innovativeness overall. Additionally, the study focused on analyzing the data of IWB, without delving into the four dimensions that make up the scale, as this was beyond the scope of the study.

Figure 7: Mean of Innovative Work Behaviour (IWB) Scale for Public Labs Employees (3.74 ± 0.705)



Bivariate Correlation Between Climate Factors and Innovative Work Behviour

The bivariate correlation between innovation climate measures data (individual and organizational factors) and IWB data was analyzed using Pearson's correlation statistical test (Table 5). The SPSS results revealed that extraversion (0.371**), work passion (0.328**), and agreeableness (0.276**) are individual innovation climate factors that have a significant positive statistical relationship with IWB. In contrast, only work characteristics (0.259**) and co-worker support (0.264**) have a significant positive statistical relationship with innovative work behaviour. The remaining factors have a very weak or no relationship with innovative work behaviour.

Table 5: Pearson Bivariate Correlation Between Different Individual and Organizational Factors of Innovation Climate and Innovative Work Behaviour (IWB)

Innovation Climate	Factors [a]	Pearson's correlation
Individual Climate	Conscientiousness	0.082
	Openness to experience	-0.151
	Extraversion	0.371**
	Agreeableness	0.276**
	Neuroticism	0.105
	Work Passion	0.328**
Organizational Climate	Work Characteristics	0.259**
	Management Support	0.048
	Coworker support	0.264**
	Resources	0.14
	Rewards and Appreciation	0.046

[a] All correlations tested with IWB, ** Correlation is significant at the 0.01 level (2-tailed)

Hypotheses Testing and Multiple Regression Analysis

Multiple regression analysis is a form of linear regression that examines the impact of a set of independent variables on a single dependent variable. In this study, data on individual factors alone and the organizational factors data alone were analyzed using this method. The analysis measured the significant impact of the multiple factors on the dependent variable (IWB) through various statistical parameters, including adjusted R^2, F value, significance (sig. ≤ 0.05) and t-test ($t \geq 1.96$).

Multiple regression analysis of individual innovation climate factors. Table (6) showed that there is a significant positive impact on Individual innovation climate factors on IWB (Adjusted R^2=0.142, F=3.833, Sig.=0.02).

Table 6: Multiple Regression Analysis of Individual Climate Factor

R	R^2	Adjusted R^2	Std. Error of the Estimate	F Value	Sig.
0.438[a]	0.192	0.142	0.653374	3.833	0.002

a. Predictors: (Constant), WP, CO, NEU, AG, OP, EX b. Dependent Variable: IWB

Table 7 presents the individual factors influencing innovative work behaviour. Extraversion (Beta=0.235, t=2.044 ≥1.96, sig=0.044 ≤0.05) had a significant impact, while agreeableness (Beta=0.183, t=1.925 ≥1.96, sig=0.057 ≤0.05) had a marginal impact. Furthermore, work passion showed a significant correlation with innovative work behaviour but did not have a significant impact (Beta=0.144, t=1.271, sig=0.207) on innovative work behaviour. Openness to experience and neuroticism did not significantly affect the innovative work behaviour of public sector lab employees.

Table 7: Detailed Multiple Regression Analysis of Individual Climate Factors

Individual Climate Factors	B	Std. Error	Beta	t	Sig.
(Constant)	1.751	0.636	-	2.750	0.007
Conscientiousness	0.027	0.091	0.030	0.297	0.767
Openness to experience	-0.016	0.096	-0.017	-0.165	0.869
Extraversion	0.209	0.102	0.235	2.044	0.044
Agreeableness	0.148	0.077	0.183	1.925	0.057
Neuroticism	0.013	0.090	0.014	0.146	0.884
Work Passion	0.126	0.099	0.144	1.271	0.207

Multiple regression analysis of organizational innovation climate factors. Table (8) shows a positive significant impact of organizational factors on IWB (R^2=0.131, Adjusted R^2= 0.086, F value=2.951, Sig.=0.016).

Table 8: Multiple Regression Analysis of Organizational Factors on Innovative Work Behaviour

R	R^2	Adjusted R^2	Std. Error of the Estimate	F Value	Sig.
0.362[a]	0.131	0.086	0.674034	2.951	0.016

a. Predictors: (Constant), RA, WC, CS, RS, MS b. Dependent Variable: IWB

Table 9 presents the organizational factors that influenced innovative work behaviour. Coworker support (Beta=0.278, t=2.241, sig.=0.027), work characteristics (Beta=0.226, t=1.934, sig.=0.056), and management support (Beta= -0.310, t= -1.962, sig.=0.053) were identified in that order. Resources, rewards, and appreciation did not exhibit any significant impact on

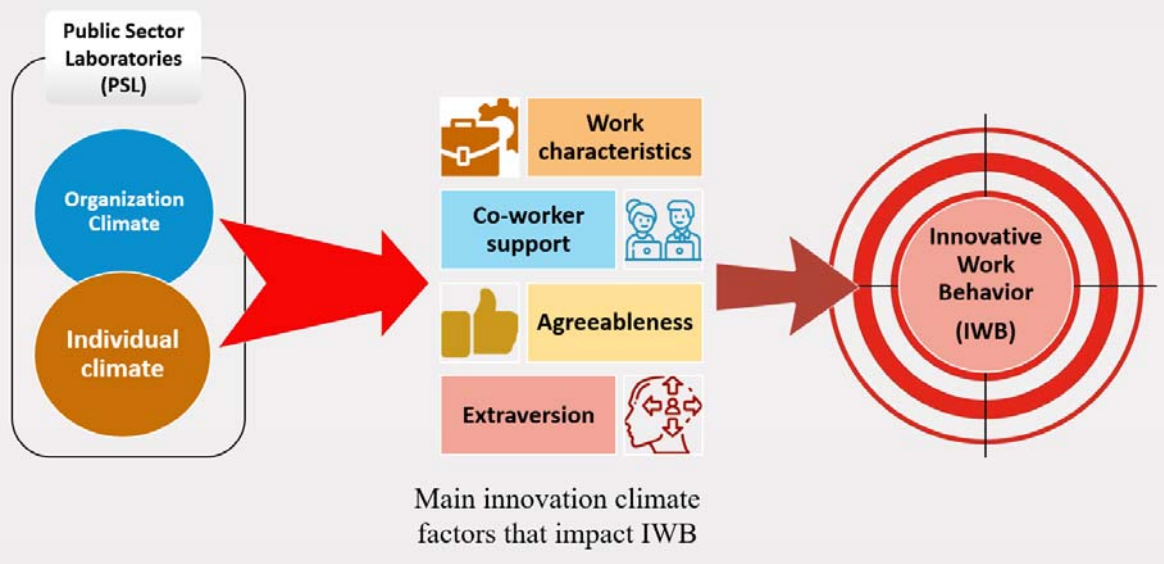
innovative work behaviour. Surprisingly, management support had an impact despite lacking a significant correlation with innovative work behaviour.

Table 9: Segregated Multiple Regression Analysis of Organizational Factors on Innovative Work Behaviour

Organizational factors	B	Std. Error	Beta	t	Sig.
(Constant)	2.526	0.381	-	6.634	0.000
Work Characteristics	0.227	0.117	0.226	1.934	0.056
Management Support	-0.202	0.103	-0.310	-1.962	0.053
Coworker support	0.212	0.095	0.278	2.241	0.027
Resources	0.075	0.119	0.094	0.626	0.533
Rewards and Appreciation	0.012	0.087	0.019	0.134	0.893

Overall, the study findings elaborated in illustration in Figure 8 combine all significant factors found in the analysis of the results that had a direct impact on innovative work behaviour in public sector labs in Bahrain.

Figure 8: The study findings



Discussion

Interview Results

The pilot qualitative short phone call interviews with several officials working at public sector labs from different public organizations were beneficial in limiting and restricting a broad variety of innovation climate factors mentioned in the literature review. This helped to overcome the challenge of the lack of literature on an innovation climate that is suitable for the public sector context in Bahrain, specifically in laboratories. Most of the factors mentioned in the

interviews were organizational (8 of 10) (Table 1), highlighting the significance of the organizational climate in innovative behaviour. Interviewees euphemized the importance of integrating innovation into the vision and strategy of their organizations, regulating it through rules and procedures, and establishing a structure that encourages the employees to innovate. Job autonomy was highlighted by interviewees as a driver for innovative work behaviour. Strategy, structure, autonomy, and regulations are considered parts of a larger domain factor, work characteristics (Ekvall, 1996).

Half of the interviewees, five of ten, identified personality traits as a possible factor that can encourage innovative work behaviour. On the other hand, a smaller number of interviewees, three out of ten, mentioned work passion. This outcome highlights the significant role that these two individual factors play in promoting employees' IWB. These types of individual factors may receive attention in the recruitment process, which consider the employees' identity (Batey et al., 2018). The interviews provided key insights into exploring which personal traits could predict IWB in the quantitative part.

Survey Results

The reliability analysis yielded high acceptable values for the organizational factor scales (Ekvall, 1996), work passion scale developed by Vallerand, Houlfort, and Fores (2003), and innovative work behaviour (IWB) scale widely used by De Jong and Den Hartog (2010). However, the BFI-10 scale, as adopted by Rammstedt and John (2007), showed relatively low value in the reliability test. The BFI-10 scale was validated and interpreted in English and German versions and later translated into Arabic. The BFI-10 scale consists of a minimum of two items to measure each trait, which may not always accurately reflect reality as each trait comprises several aspects. From a statistical perspective, the minimum number of items required to measure each research variable, or dimension should ideally fall between 5 to 7 questions to achieve an acceptable level of reliability.

In the future, it is suggested that a wider range of personal traits should be tested. Employees of public sector labs exhibit the highest mean extraversion factor (μ=4.28), the highest mean among all factors studied. According to a study conducted by Costa and McRae (1992), this indicates that these employees are likely to be actively enthusiastic and outgoing. Results show a significant positive correlation between the extraversion factor and IWB (0.371**), which is associated with everyday routine creativity. Extraversion is also the main predictor of IWB among individual factors (Beta=0.235, t= 2.044 $\geq$1.96, sig=0.044$\leq$ 0.05). This result contradicts the findings of Hamdy et al. (2019), who identified among all BFTM, only openness to experience as a significant predictor of innovative work behaviour. The possible justification for this contradiction is that Hamdy et al. (2019) studied Islamic bank employees in Malaysia, in the private sector has a different context. Thus, the different circumstances in the public sector in Bahrain may lead to different results. The agreeableness correlation to innovative work behaviour (0.276**) is also related to the same domain of creativity (Batey and Furnham, 2006) and is a predictor of innovative work behaviour (Beta=0.183, t= 1.925 $\geq$1.96, sig=0.057 $\leq$0.05), which could be justified in the same way when comparing it to Hamdy's study.

Work passion has a direct positive relation to innovative work behaviour but has no significant impact on it. According to Bysted (2013), an employee's passion for work as an

individual factor drives long-term innovative work behaviour, but in Bahrain public sector labs work passion was not sufficient to significantly predict innovative work behaviour.

However, laboratory employees have some personal traits related to innovative work behaviour that are not related directly to the scientific creativity domain but are related to the daily creativity domain. Lab managers should give answers to interpret this result. It could result from the routine and repetitive tasks, work stress and bureaucratic systems in government that lead to driving innovative behaviour of innovative employees into the daily creativity domain rather than innovative behaviour of employees in the scientific domain, which is the most important in that field. In this context, Batey et al. (2018) suggests to the Dubai government regarding creativity and innovation in recruitment processes to select candidates with high levels of openness to experience, fair levels of extraversion, moderate levels of conscientiousness and agreeableness, and low levels of neuroticism. Conceptually, focusing solely on the main effects of personality traits on IWB may be unjustified (Niu, 2014) because the nature and scope of antecedents of IWB are wide-ranging and effects of personality may interact in various ways with other individual and contextual variables (Wood et al., 2017).

Co-worker support (μ=3.3) has the highest significant correlation (0.264**) with IWB and is the best predictor of IWB (Beta=0.278, t= 2.241, sig.=0.027) among all organizational climate factors influencing innovation. This result is in line with previous studies' results that confirmed high level of co-worker support influencing IWB directly (Montani, Odoardi, & Odoardi., 2012). Moreover, work characteristics (μ=3.78) are an organizational factor of innovation climate that has a significant correlation to IWB (0.259**) and is a predictor of IWB (Beta=0.226, t=1.934, sig.=0.056). This result agreed with the results of the Suseno et al. study, that suggested work characteristics have a positive impact on IWB of employees in the public sector (Suseno et al., 2019). Concerning management support, the study found there is neither a significant relation nor significant impact of management support on IWB. This result disagrees with the observation of Shalley and Gilson (2004), who found supervisory encouragement supports creativity to help innovative behaviour be performed. The results also contradict with Attiq et al. (2017), who found that a supportive social work environment including management and co-worker support had a direct positive impact on IWB. Therefore, co-worker support is not paired with management support in this study, and there is a clear lack of a supportive managerial climate for innovative employees in public labs. Organizations could put in place effective plans to improve socially supportive processes to increase their IWB (Ereback, 2019).

Based on the perception of employees of public sector labs, resources, rewards, and appreciation (μ=2.70, μ=2.74) (respectively) are weaknesses in the organizational climate of public sector labs and require action to enhance the innovation climate for employees.

Recommendations

This study provides a set of recommendations to improve public lab managers′ skills and other similar technical and scientific departments to increase innovative work behaviour in their organizations, as suggested below:

- Conduct psychometrics tests for applicants to public sector labs or other jobs that need a high level of innovative work behaviour during the recruitment process to identify passionate people and match their interests based on work requirements to ensure that the applicants are agreeable and extroverted.

- Include innovative work behaviour in the strategies of the public sector generally and public sector labs specifically. The organization's vision, mission, goals, and tasks should include innovation and innovation work behaviour. In this vein, IWB must be considered one of the main official tasks (Nijenhuis, 2015).
- Establish a national scientific committee that represents the entire public sector labs to exchange knowledge, discuss significant issues, build coherent cooperation and coordination, collaborate in scientific research projects, and recommend innovative realistic solutions to their challenges.
- Senior leaders, supervisors, and managers should encourage, motivate and support innovative work behaviour of co-workers through training and capacity-building to improve their skills and direct their behaviour toward being innovative. Thus, public managers should utilize the innovative work behaviour guidelines.

Limitations and Future Work

More research is needed to study the innovation climate and innovative work behaviour in the public sector of Bahrain. The authors suggest that other individual and organizational factors should also be considered in future studies and vertical qualitative studies should be conducted within the public sector labs, that include employees and different levels of management (low, middle, top), to understand their perceptions of the innovative work behaviour of employees and validate the results of the study. Additionally, horizontal cross-sector studies should be conducted across all sectors and sub-sectors of the Bahrain government to study the innovation climate and innovative work behaviour. It is crucial to validate the implications and recommendations of the study by testing their use and value.

This study also raises the need of large-scale national-level research to study the innovation climate in the whole public sector of Bahrain to find the climate weaknesses and strengths, through a longitudinal study. This type of study would help supreme decision-makers in the cabinet and civil service bureau to make policies and to put in place strategies that set up an innovation climate for employees under this umbrella.

Conclusion

Extraversion and agreeableness as individual factors of the BFTM have significant impact on innovative work behaviour. Work passion is the only factor in the innovation climate that has a significant relation with IWB but has no significant impact. According to the feedback from employees in Bahrain's public sector labs, co-worker support and work characteristics play a significant role in the organizational innovation climate, which in turn has a significant impact on innovative work behaviour. Overall, both individual and organizational innovation climate factors have a significant impact on IWB (summarised in Figure 8). Moreover, the innovation climate differs from one company to another and from one sector to another. Boosting innovative work behaviour of employees is a function of a set of organizational and individual factors. There often exists a variation between innovation climate elements in the literature and practices, but a dynamic and supportive innovation climate is required for innovation to occur.

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Appendix A*:* List of questions of the short preliminary phone call interviews with public laboratory seniors and officials.

Q1: In your opinion, what are the elements of Innovative work behavior?

Q2: Do you have Innovative work behavior? (yes/no)

Q3: If yes, what are the motivators to you to have Innovative Work Behavior?

Q4: If no, what are the difficulties that prevent you to have Innovative Work Behavior?

Appendix B: Tabulated Answers of short phone call interviews for questions mentioned in Appendix A

#	Q1	Q2	Q3	Q4
A1	Understanding leader. Giving a space or a chance for innovation. Supply resources for innovation.	No	-	Management and supervisory support
A2	The organizational support of innovation and scientific research support. Rewards. Resources. Freedom of opinion.	No	-	Lack of innovation vision and strategy. Routine work
A3	Personal Traits and Characteristics. Management support Peers and partners effects Meetings and exploration of others experiences. Routine job headache. Time as a resource Love my work. Feels loyal to the organization. The job satisfaction.	Yes	Management support. Personality. Respect of ideas colleagues.	-
A4	Think out of the box. Fast and good thinker. Job stress affect positively	Yes	Appreciation. Dealing with a new task and mission at work. Need fewer regulations and boundaries.	-

#	Q1	Q2	Q3	Q4
A5	Give chance for suggestions and free thinking. No obstacles in development Dialogue between employee and manager. Management support	Yes	Job autonomy. Peer support. Management support	-
A6	Motivated Environmant. Financial and time Resources. Continuous discussion. Follow up of creative ideas by supervisers and responsible persons. Separation between personal and work environment. personal traits.	Yes	Management Support.	
A7	Give opportunity to be innovative and creative Management and supervisory support Intrinsic motivation (self-esteemed) Love of job type. Rewards and promotions in the hierarchy structure.	Yes	All the factors mentioned above was available for me.	
A8	You have to love what you do and passion about it. Freedom of opinion and high ceiling Respect of new ideas Support of both coworkers and supervisors. Availability of resources that support your suggesstions that able them to transform to real innovations.	Yes	Passion to work and supervisory support and freedom.	-

#	Q1	Q2	Q3	Q4
A9	Trust in employees.Group work. Discussion of ideas. Supervisor support. The intrinsic psychological factor of employees. Appreciation and reward the employees.The cooperation within the team.	Yes	Team work Personal traits and intrinisic motivation.	Shortage of different resources. Miss-cooperation within the team Lack of information.
A10	Work characteristics and job description	No	-	Lack of supervisory support. Routine Work Job stress and pressure. Shortage of staff.

Appendix C: Survey to evaluate the impact of Innovation climate on Innovative work behavior from the perspective of employees working at public sector laboratories.

I.	**Demographic Variables**							
Q1	*Gender*	Female	Male					
Q2	*Age*	Less than 20 years	20-24 years	25-29 years	30-34 years	35-39 years	40-44 years	45 years and above
Q3	*Education Level*	Secondary School	Diploma	Bachelors degree	Master degree	Doctorate degree		
Q4	*Nationality*	Bahraini	Non-Bahraini					
Q5	*Years of Experience*	Less than 5 years	5-9 years	10-14 years	15-19 years	More than 20 years		

II.	**Individual factors:**	**1**	**2**	**3**	**4**	**5**
	Conscientiousness. (BFI-10) Rammstedt & John (2007)					
Q6	I see myself as someone who tends to be lazy. (Reversed score)					
Q7	I see myself as someone who does a thorough job.					
	Openness (BFI-10) Rammstedt & John (2007)					
Q8	I see myself as someone who has few artistic interests (Reversed Score).					
Q9	I see myself as someone who has an active imagination.					
	Extraversion (BFI-10) Rammstedt & John (2007)					
Q10	I see myself as someone who is reserved. (Reversed)					
Q11	I see myself as someone who is outgoing and sociable.					
	Agreebleness (BFI-10) Rammstedt & John (2007)					
Q12	I see myself as someone who is generally trusting.					
Q13	I see myself as someone who is tends to find fault with others (Reversed).					
	Neuroticism (BFI-10) Rammstedt & John (2007)					

Q14	I see myself as someone who is relaxed, handles stress well (Reversed).					
Q15	I see myself as someone who is gets nervous easily.					
	Work Passion (Vallerand et al, 2003)					
Q16	I derive most of my life satisfaction from working hard					
Q17	I love to work hard.					
Q18	I look forward to returning to work when I am away from it.					
Q19	I accomplish a lot because I love to work hard.					
Q20	Sometimes I wish that I could be working harder when I am not.					
III.	**Organizational factors:**	**1**	**2**	**3**	**4**	**5**
	Work Cahracteristics (Ekvalls, 1996)					
Q21	People are assigned to tasks that require them to utilize a wide variety of their skills.					
Q22	I have scope to utilize wide variety of my skills to accomplish the tasks assigned to me.					
Q23	I have enough freedom to execute my job, apart from the regular rules and routines					
Q24	I am aware of my individual roles and responsibilities towards other employees/colleagues.					
Q25	Public labs employees are involved in goal-setting and strategy planning.					
Q26	I am aware about the vision, mission and goals of Public Labs.					
Q27	I feel emotionally involved in my job.					
Q28	I feel that my job is challenging and invest great amount of energy in my tasks					
	Management Support (Ekvalls, 1996)					
Q29	Extends full support to employees considering their competencies and suggestions.					
Q30	Employs an open communication system and provides employees with constructive feedback.					

Q31	Considers employees interests during decision-making.					
Q32	Sets goals/mandate that are oriented towards creativity and innovation.					
Q33	Communicates the goals/mandate clearly to the employees.					
Q34	Employs management practices that enhance creativity and innovation.					
Q35	Considers individual skills and interests as a major factor in team formation.					
Q36	Sees to that the members in a team are complementary personalities.					
	Coworker Support (Ekvalls, 1996)					
Q37	My colleagues support each other by listening, discussing and complementing other's ideas.					
Q38	More energy/efforts are channelized towards achieving the desired innovation output instead of focusing on conflicts among individuals.					
Q39	Colleagues provide each other with useful information instead of keeping information for themselves for their own benefit.					
Q40	Less time is wasted in the form of conflicts or rivalry among individuals.					
	Resources (Ekvalls, 1996)					
Q41	I get sufficient time as part of my job to generate creative/innovative ideas.					
Q42	All the staff in my team/division have the expertise required to complete their job effectively.					
Q43	Funds are made available to members to implement innovative ideas.					
Q44	Material resources and necessary equipments are sufficiently available to all members in my division.					
Q45	A wide range of training opportunities are available to employees.					
	Rewards and Appreciation (Ekvalls, 1996)					
Q46	Innovation in our work is always recognized and rewarded.					
Q47	Performance appraisal systems give innovation its due weightage.					

IV.	**Innovative Work Behavior (IWB):** De Jong and Den Hartog (2010)	**1**	**2**	**3**	**4**	**5**
	Idea Exploration					
Q48	I pay attention to issues that are not part of my daily work.					
Q49	I wonder how things in general could be improved.					
	Idea Generation					
Q50	I search for new practices, techniques or tools to figure out issues.					
Q51	I generate original solutions to problems.					
Q52	I find new ways to perform tasks.					
	Idea Championing					
Q53	I make important organizational members enthusiastic for innovative ideas					
Q54	I attempt to convince people to support a new idea					
	Idea Implementation					
Q55	I introduce systematically innovative ideas into work practices.					
Q56	I contribute to the implementation of new ideas.					
Q57	I put effort into the development of new things.					

Questionnaire Key:

1= Strongly Disagree, 2= Partially Disagree, 3= Neither Agree Nor Disagree, 4= Partially Agree, 5= Strongly Agree.