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Peer-reviewed author version

Callens, Chesney; Wynen , Jan; BOON, Jan & Verhoest, Koen (2022) Internal and external exploration for public service innovation-Measuring the impact of a climate for creativity and collaborative diversity on innovation. In: Public Policy and Administration,.

DOI: 10.1177/09520767221135686

Handle: <http://hdl.handle.net/1942/38924>

Internal and external exploration for public service innovation – Measuring the impact of a climate for creativity and collaborative diversity on innovation

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Abstract: Public service innovation involves a process of creative exploration of new ideas, knowledge and perspectives. The article poses that creative exploration emerges from the combination of a climate for creativity that is active *inside* the organization, and collaborations with diverse actors that are present *outside* the organization. We test the effect of these conditions on innovation using data from the Australian Public Service. Our findings demonstrate that both a climate for creativity and collaborative diversity are positively related to innovation, yet a tipping point exists at which the positive effects of collaborative diversity on innovation turn negative.

Key words: public sector innovation; exploration; climate for creativity; collaborative diversity; Australian Public Service

INTRODUCTION

Across the globe, public sector organizations are faced with increased demands to execute their tasks more qualitatively, effectively and cost-efficiently (Windrum and Koch 2008). These demands are not easy to meet, since they are voiced in a context of significant economic and social-demographic challenges, such as ageing populations, strong declines in government legitimacy and trust, and budget scarcity (de Vries et al. 2018). In order to turn things around, practitioners and scholars agree that public sector organizations need to reinvent themselves to increase their problem-solving capacities and, ultimately, their performance (Osborne and Brown 2013). Innovation, in the form of new or improved products, services, processes, or policies that break with the past, is of critical importance; both as a practice and as a topic of scholarly endeavour. Innovation drives transformative change in organizations, as it introduces novelty and directs the organization away from entrenched trajectories. Innovation is of critical importance for public sector organizations to solve wicked problems, to respond to the increasing demands for customized services of citizens, to strive for better service quality, and to confront the scarcity of resources through smart solutions (Sorensen and Torfing 2011).

However, achieving innovation is far from obvious for public sector organizations. A couple of reasons can be given. First, governments and public sector organizations can be challenging breeding grounds for innovation because of their hierarchical, command-and-control, and bureaucratic structures, which limit open exploratory processes, and the presence of institutional artefacts, which contribute to the stability of the organization, but also to its inertia (Hartley, Sorensen and Torfing 2013). Second, competitive pressures to ‘innovate or die’, which are a central motor of innovation in the private sector (cf. ‘creative destruction’, Schumpeter 1942), are mostly absent in the public sector (de Vries et al. 2015). Third, public sector organizations tend to be more risk averse than private sector organizations, because of their use of public resources, the strong external control on how these resources are spent by

external stakeholders such as politicians, the media, and the general public, and the absence of (punishing effects of) decreased revenues when performance degrades (Gullmark 2021).

The challenging setting in which public sector innovation occurs, has spurred research into the stimulating conditions of innovation in the public sector. Multiple conditions have been considered, such as innovation climate (Jung and Lee 2016), innovation leadership (van der Voet and Steijn 2020), innovation capabilities (Gieske, Duijn and van Buuren 2020), innovation training (Brogaard 2017), innovation pressures from the institutional field (Osborne 1998; Verhoest et al. 2007), and collaborating or co-creating with external stakeholders such as users (Hartley, Sorensen and Torfing 2013; Nesti 2018). Remarkably, most of these conditions are either focused on the internal attributes of the organization (e.g. capabilities, leadership, training), or correspond to external antecedents of innovation (e.g. institutional pressures, external collaborations, co-creation). This approach is beneficial to uncover key aspects of innovation, but it also blurs the relative importance of internal and external conditions. In other words, questions regarding the type of conditions (internal or external) in which an organization should primarily invest, and what the relationship between these conditions is, remain unanswered due to this approach. Only very recently, scholars have begun to approach conditions for innovation in a more integrated fashion, for instance by including internal drivers for innovation such as leadership, with external drivers such as external networking (e.g. Lewis et al. 2018).

Such an integrated approach is particularly useful when the same underlying mechanism is responsible for the creation of innovation. For instance, one of the most successful mechanisms to explain how innovation emerges is that of the innovation process, in which sequential phases of idea generation and idea implementation allow the translation of creative ideas into innovative solutions (Damanpour and Schneider 2008; Sorensen and Torfing 2011). A crucial aspect of the initial ideation stages of the innovation process is the ability to generate creative

ideas by exploring new ideas, knowledge and perspectives (Katila and Ahuja 2002). This creative exploration can originate from both inside and outside the organization, as both employees and external stakeholders can be the source of new ideas. However, largely separated literature streams have looked at internal and external exploration, with organizational creativity research considering the former and collaborative innovation literature studying the latter. This article develops a theoretical model of exploration that combines internal and external exploration for innovation. The framework allows to empirically test whether the source of innovation is mainly found in agencies' internal climate for creativity, their external collaborations, or a combination of both. We propose the following research question:

How do conditions related to the internal and external exploration of new ideas, knowledge and perspectives influence public service innovation?

The article contributes on two aspects to the current literature. Theoretically, the framework brings together earlier insights that suggest that exploration processes can manifest themselves in two ways. On the one hand, literature on organizational creativity suggests that organizations which possess an internal climate for creativity are better able to stimulate creative ideation processes, because divergent thinking in employees is encouraged, which allows the employees to explore new ways of doing things (Anderson, Potočnik and Zhou 2014). Important drivers for innovation, such as leadership, often affect innovation by influencing this organizational climate. For instance, Meijer (2014, 203) states that “the entrepreneurial leader has to create a climate that is favourable to the development and realization of new ideas”. This is confirmed by other research into innovation leadership styles (e.g. Osborne and Brown 2005; Jung and Lee 2016; Ricard et al. 2017; van der Voet and Steijn 2020; Gieske et al. 2020), which all seem to point towards leadership styles which support and encourage employees to introduce new ideas. However, unlike leadership, and apart from some recent studies (e.g. Jung and Lee 2016),

few research has examined the effect of a climate for creativity on innovation in the public sector.

On the other hand, collaborative innovation literature suggests that collaboration with a variety of external actors, whether intentionally directed towards the production of innovation or not, enables the exploration of a diverse set of knowledge pools, experiences and perspectives, and stimulates synergies between the involved actors (Torfing 2019). The actor diversity in these collaborations (i.e. collaborative diversity) is perceived as crucial for subsequent collaborative innovation dynamics such as creative ideation and mutual learning (Ansell and Torfing 2014), as it provides opportunities for collaborative synergies (Lasker et al. 2001), and prevents tunnel vision and group think, which can inhibit innovation (Torfing et al. 2020). Although collaboration-related conditions such as information sharing (Lewis et al. 2018) and mutual learning (Lindsay et al. 2017) have received ample attention in the literature, the direct effect of collaborative diversity on innovation, which often enables the former conditions, remains largely unknown in the public sector (Torfing et al. 2020).

Furthermore, as both conditions are related to the same mechanism of exploration, which is inherent to the innovation process, a combination of internal exploration and external exploration might have an even larger effect on innovation. We see some tentative evidence from related large N-sized studies regarding the combined effect of internal and external conditions on innovation. For instance, Arundel et al. (2015) conclude in their study on innovation in European public agencies that agencies which possess *internal* innovation capabilities (e.g. innovation strategies, innovation management, etc.), also often work together with *external* actors to produce innovation. Hence, we consider how the interaction between a climate for creativity and collaborative diversity generates even larger effects for public service innovation.

Empirically, the article contributes by providing empirical evidence for the effect of an internal climate for creativity and external collaborative diversity, and their interaction effect, on innovation in public service organizations. We rely on data from the 2019 wave of the Australian Public Service (APS) employee census, which resulted in a large dataset of 31,501 observations from respondents at the executive level of the APS. Demircioglu (2019) discusses several characteristics in the APS that make it significant for the study of innovation, given that its structures (e.g. Office of Innovation and Science), long term objectives concerning innovation (Australian Government DIIS, 2015), and history (of radical and comprehensive public management innovations) are all conducive to innovation. Although large N quantitative innovation research has slowly been expanding in the last decades (e.g. Borins 2001; Walker 2007; Arundel et al. 2015; Ricard et al. 2017; Lewis et al. 2018; Mergel 2018), we contribute to a research field that is largely dominated by low N case study research (De Vries et al. 2015; Demircioglu and Van der Wal 2021). The theoretical and empirical contributions of the article enrich our knowledge about the enabling conditions of public service innovation, and help practitioners in making informed choices about the practices that enhance innovation in their organizations.

In the remainder of this article, we develop our theoretical model of innovation, by introducing the process of generating public service innovation, and discussing how a climate for creativity and collaborative diversity increases the likelihood of attaining innovation in public sector organizations. Next, we present the data and methods used, followed by the results and a discussion and conclusion section.

THEORY

The process of generating public service innovation

Generating innovative public services is a process that entails multiple phases. For instance, Sorensen and Torfing (2011) argue that the innovation process is composed out of four distinctive stages: 1) generating ideas, 2) selecting ideas, 3) implementing ideas, and 4) disseminating new practices. Other authors propose a two-stage process, with the first stage entailing idea generation and the second stage including idea adoption (Damanpour and Schneider 2008). Such an innovation process might be intentionally established to pursue innovation, but it might also emerge spontaneously from the efforts of individuals or the interactions between individuals (i.e. emergent innovations, Bekkers and Noordegraaf 2016).

A critical aspect of the first stages of the innovation process in these models is the effectiveness of individuals in achieving *novel ideas*. The degree to which new, creative ideas are generated, depends to a large extent on the level of ‘divergent thinking’ that is achieved (Acar and Runco 2012). Divergent thinking means that individuals consider less obvious or conventional notions, and are able to create original and novel ideas. In the first stages of the innovation process, individuals explore a variety of distinct concepts and ideas, which stimulates their divergent thought. For instance, ideas from other individuals may influence and inspire the ideas of the innovator, which stimulates divergent thinking (Harvey 2014). The better the individuals are able to explore a broad range of possible ideas, the more they are enabled to ‘think outside the box’, and the higher the likelihood that some of the ideas that are retained in the subsequent stages of the process, will turn out to be innovative. As such, facilitating the opportunity to explore new ideas, perspectives and knowledge enables public service innovation.

These ideas, perspectives, and knowledge pools can originate from both inside and outside the organization. On the one hand, facilitating exploration opportunities inside the organization

enables spontaneous bottom-up creative ideation amongst the employees (Anderson, Potočník and Zhou 2014). Employees often have great affinity with the existing services of the organization, which means that they should have a realistic judgement of which ideas are feasible (Bekkers and Noordegraaf 2016). This capacity to anticipate the effects of ideas on the service delivery increases the likelihood that the new ideas are eventually implemented in an innovative solution (Rietzschel et al. 2010). On the other hand, facilitating exploration opportunities outside the organization, by collaborating with a wide variety of external stakeholders, introduces excessive variance into innovation processes, as individuals have now access to a broad set of new perspectives and knowledge pools (Hartley, Sorensen and Torfing 2013; Torfing 2019). This excess of variance might then stimulate the organization to produce innovations.

In the following sections, we discuss two conditions related to the exploration of new ideas, knowledge and perspectives. The first condition, ‘climate for creativity’, enables the exploration of the ideas, knowledge and perspectives of *internal* actors, such as employees and managers. The second condition, ‘collaborative diversity’, enables the exploration of the ideas, knowledge and perspectives of *external* actors, such as other workgroups, agencies, governments, and stakeholders. The two sets of conditions are each developed in their own research fields, with the former being part of creativity research, and the latter being included in collaborative innovation research. As both of these conditions are based on the same mechanism of exploration, we also consider the effect the interaction between the two conditions has on innovation in public service organizations.

Climate for creativity

Literature has indicated that organizational climates may foster innovation by encouraging the innovative behaviour of individuals in the organization (Jung and Lee 2016). Organizational

climate can be defined as “the shared perceptions of and the meaning attached to the policies, practices, and procedures employees experience and the behaviours they observe getting rewarded and that are supported and expected” (Schneider et al. 2013, 362). Climates are essential to connect the organizational reality (e.g. strategy, objectives) with the reality of the employees (e.g. activities and behaviour of the employees) (West and Sacramento 2012). As such, the organizational climate affects both the behaviour of employees and the outcomes of the organization (e.g. innovation performance), which makes climates incredibly important enablers for innovation. Moreover, other innovation stimulating conditions such as entrepreneurial leadership (Meijer 2014) and ambidextrous capabilities (Gieske et al. 2020) tend to create climates in which employees are supported and encouraged to develop new ideas, and through these climates, innovation is fostered.

These findings on organizational climates are confirmed by creativity research, which pose that establishing a climate for creativity stimulates divergent ideation as employees are encouraged to explore new things without being at risk of sanctions if things should fail (Anderson and West 1998; Anderson, Potočnik and Zhou 2014). Indeed, features of climates for creativity, such as the freedom of individuals to express ideas, the support and encouragement of the organization or team to come up with new things, and the acceptance that risk-taking and failure is part of innovation (Hunter, Bedell and Mumford 2007), can create a work environment in which divergent thinking is stimulated, which enables individuals to consider more inventive and original solutions for their problems. As creative ideation is an essential component of the innovation process, we propose the following hypothesis:

Hypothesis 1: A climate for creativity has a positive effect on innovation in public sector organizations.

Collaborative diversity

A substantially influential stream of innovation literature has emerged over the last decades in the public sector that focuses on the effect of external collaborations on innovation (Sorensen and Torfing 2011). Collaboration increases a public service organization's ability to innovate as disparate actors engage in joined problem-solving activities, which spur processes of mutual learning and knowledge creation (Sorensen and Torfing 2013; Torfing 2019). A key attribute of collaborative innovation is the involvement of a diverse set of actors in the innovation process. The seminal article of Damanpour (1991), who conducted a meta-analysis on collaborative innovation in the public and private sector, indicates that the diversity of involved actors is amongst the most important enablers of collaborative innovation, in both public and private sector organizations. This is echoed in more recent contributions by Sorensen and Torfing (2011; 2017) who argue that innovation is propelled by the exchange of different experiences, perspectives, ideas and resources. The inclusion of a wide variety of actors in the innovation process increases the breadth of knowledge that is accessed and facilitates creative ideation and innovation (Hartley, Sorensen and Torfing 2013; Touati et al. 2019; Torfing 2019). This actor diversity (i.e. collaborative diversity) also prevents tunnel vision and group think, which can inhibit innovation (Torfing et al. 2020), and is crucial in activating synergies between actors that lead to other collaboration dynamics such as mutual learning and commitment building (Ansell and Torfing 2014). Collaborative diversity might be achieved if an actor works together with different external stakeholders, such as other workgroups, agencies, government levels, and external stakeholders (e.g. citizens, users, firms, etc.). We propose the following hypothesis:

Hypothesis 2: Collaborative diversity has a positive effect on innovation in public sector organizations.

Climate for creativity and collaborative diversity

As indicated, both climate for creativity and collaborative diversity are derived from the exploration mechanism. The conditions only differ in their orientation towards resp. internal and external actors. Hence, a combined pursuit of both conditions might have an even greater effect on innovation. Indeed, establishing a climate for creativity might strengthen the effect of collaborative diversity on innovation further. For instance, individuals that are exposed to a climate for creativity in their own organizations are used to exploring alternative ideas and solutions. When extra variance is introduced in the organization through collaborative diversity, this exploration skill might be harnessed to generate new ideas. As a result, organizations with a climate for creativity might also be more susceptible to adopt new ideas that are created by these collaborations. For instance, Gong, Zhou and Chang (2013) show a positive relationship between the absorptive capacity of organizations and the creativity of employees. We propose the following hypothesis:

Hypothesis 3: The interaction between a climate for creativity and collaborative diversity has a positive effect on innovation in public sector organizations.

DATA AND VARIABLES

Data sample

The data used in this paper stem from the 2019 wave of the Australian Public Service (APS) employee census. The APS is the federal civil service of the Commonwealth of Australia responsible for the public administration, public policy and public services of the departments and executive and statutory agencies of the Government of Australia. It houses a large variation of agencies ranging from agencies active in policy development, such as the Department of Finance, to agencies active in policy implementation, such as the Bureau of Meteorology, to

regulatory agencies such as the Australian Communications and Media Authority, to agencies providing specialist advice to government, such as the National Audit Office.

The online survey captures attitude and opinion data on important issues such as wellbeing, innovation, leadership, learning and development, and engagement of the APS workforce¹. The 2019 APS employee census was administered to all available Australian Public Service (APS) employees. This census approach provides a comprehensive view of the APS and ensures no eligible respondents are omitted from the survey sample, removing sampling bias and reducing sample error (see <https://apsc.govcms.gov.au/appendix-1-aps-workforce-data> for a detailed description of the dataset, and specifically the sampling and coverage issues). 77% of all APS employees (or 104,472 out of 136,527 employees) decided to participate in the survey. Questions regarding innovation were only asked to the executive level 1, executive level 2, and senior executive service band 1, 2, or 3. This reduced our sample to 31,501 observations.

The APS offers an interesting case to explore the role of a climate for creativity and collaborative diversity to attain innovation. Pursuing government innovations has been a matter of strategic importance in the APS since the mid-2000s (Australian Government DIIS, 2015). Demircioglu (2019) indicates the necessity and importance of pursuing innovation for the Australian government. The author argues that the geographic isolation of Australia and its economic dependence on other countries have made the pursuit of innovation a major priority for the country, which is reflected by the fact that the Australian government is one of the principal drivers of innovation and economic growth in the country (Demircioglu 2019). Furthermore, the Australian Public Service is among the frontrunners in promoting collaboration - both within and outside government - as an issue of good governance. Eggers (2008, p. 23) describe the Australian context as follows:

“The hierarchical model of government is in decline, pushed by governments’ appetites to solve ever more complicated problems and pulled by new tools that allow innovators to fashion creative responses. This push and pull is gradually producing a new government model, in which executives’ core responsibilities no longer centre on managing people and programs but on organising resources—often belonging to others—to produce public value. We call this trend ‘governing by network’.”

Measuring Innovation

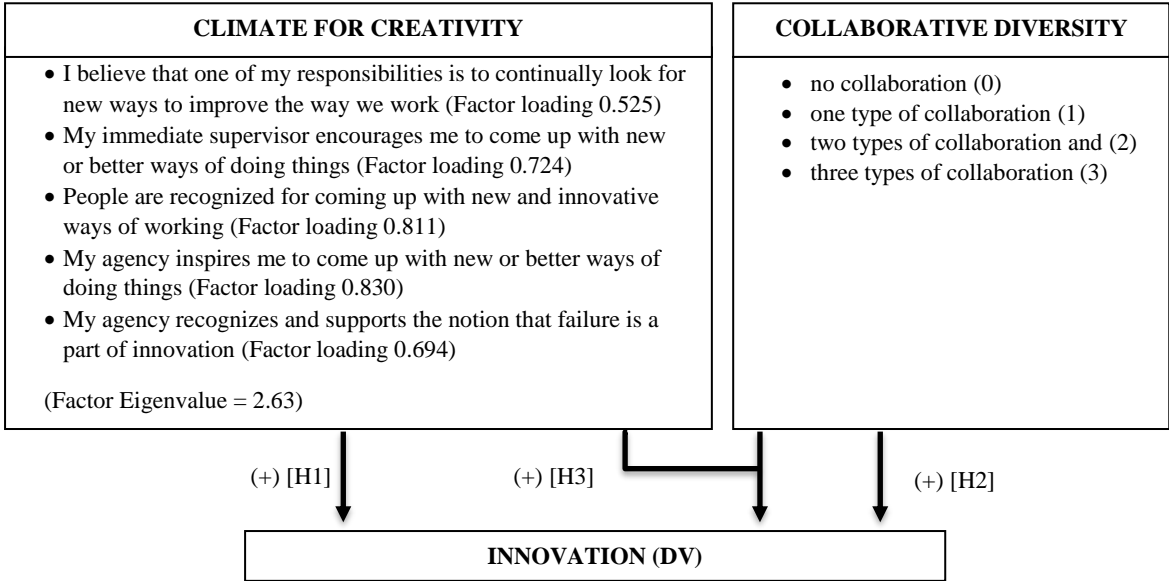
Innovation is in this article perceived as a specific *outcome*, in the form of a new or improved product, service, process, or policy that is significantly different from previous products, services, processes or policies (de Vries, Tummers and Bekkers 2015; Demircioglu and Van der Wal 2021). To distinguish innovation from concepts such as ‘creativity’, we follow the dominant perspective in the literature that innovation is something that needs to be adopted (Rogers 2003; Anderson, Potočnik and Zhou 2014). Hence, innovations studied in this article are solutions that are made available to particular users (e.g. citizens, the own organization). This study only considers relatively recent implementations of innovation (i.e. implemented within the last year). By using a definition of innovation that included all of the criteria above, the respondents were asked if their workgroup implemented any innovations in the last 12 months (No/Yes)².

Measuring a climate for creativity

We define an organizational climate as the cognitive representations or perceptions and believes individuals in an organization have about their immediate work environment (Anderson and West 1998), which reflect experiences at the individual or group level (Hunter, Bedell and Mumford 2007, 70). Five items from the APS survey, related to a climate for creativity, were factorized and are presented in Figure 1. Examples are: ‘I believe that one of my responsibilities

is to continually look for new ways to improve the way we work’ and ‘People are recognized for coming up with new and innovative ways of working’. These items were used recently by Demircioglu and Berman (2018) and Demircioglu (2021) to measure innovation climate, and are in line with existing literature and measurements of a climate for creativity (e.g. Anderson and West 1998; Hunter, Bedell and Mumford 2007). The factor score (Eigenvalue = 2.63) is used in the subsequent analyses.

Figure 1: Relationship between IVs and DV



Measuring collaborative diversity

We define collaborative diversity as the presence of multiple collaborations with different stakeholders. Two steps were used to operationalize collaborative diversity. First, we considered if the organizations collaborated with other stakeholders. Organizations that did not collaborate with other stakeholders received a value of 0. Next, we looked at how many different types of collaborations an organization established. We considered three types of collaboration stakeholders: 1) other workgroups within the same agency; 2) other APS or Commonwealth government agencies; and 3) other levels of government or other external stakeholders. To measure the collaborative diversity, respondents were asked whether they

worked together with one or more of these stakeholders during the last 12 months. Organizations who worked together with one, two, or three types of stakeholders, received resp. a score of 1, 2 or 3. The higher this value, the higher the collaborative diversity. The responses were grouped in one variable, which indicated if they engaged in no collaboration, one type of collaboration, two types of collaboration, or all three types of collaboration (see Figure 1).

Control variables and descriptive statistics

We control for gender, age and classification level of the respondent as well as for organizational size. By controlling for these factors, we want to reduce the possibility that the found influences of our independent variables on innovation are in fact due to the influence of other variables which are not in the model. In Table 1 descriptive statistics, as well as a correlation matrix are presented.

Table 1: Descriptive statistics

Variable	Survey question(s)*	Mean	SD.		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Innovation	q78	0.702	0.458	(1)	1.000						
Gender	q1	1.525	0.569	(2)	-0.004	1.000					
Age	q2	1.772	0.889	(3)	-0.032	-0.016	1.000				
Classification	q7	1.080	0.272	(4)	0.113	0.014	-0.116	1.000			
Organizational Size	Size	1.245	0.554	(5)	0.037	0.002	0.034	0.029	1.000		
Climate for creativity	q77a, q77b, q77c, q77d, q77e	0.124	0.874	(6)	0.309	-0.105	-0.005	0.172	0.015	1.000	
Collaboration diversity	q88, q90, q92	2.219	0.905	(7)	0.118	-0.020	0.002	0.173	0.067	0.104	1.000

*The survey and accompanying dataset is publicly available at: <https://www.apsc.gov.au/aps-employee-census-2019>

To check for multicollinearity we also calculate the variance inflation factor (VIF). The mean VIF equals 1.06 whereby the highest VIF is 1.15. These values indicate that multicollinearity is not an issue. Note that the questions regarding innovation, climate for innovation and collaborative diversity were only asked to respondents with a classification level of ‘Executive Level 1 (or equivalent)’, ‘Executive Level 2 (or equivalent)’, ‘Senior Executive Service Band

1 (or equivalent)' or 'Senior Executive Service Band 2 or 3 (or equivalent)'. This greatly reduced the sample size from 104,472 observations to 31,501.

METHODS AND RESULTS

In order to estimate our outcome variable, innovation, we make use of a linear probability model (LPM). As Beck (2011) indicates, using linear regression to estimate binary dependent variables is becoming standard practice. This model implies:

$$P[y=1|x] = E[y|x]:$$

$$E[y|x] = \beta_0 + \beta_1 x_1 + \dots + \beta_m x_m = P[y=1|x]$$

Following Angrist (2001) and Angrist and Pischke (2009) a non-linear model may fit the conditional expectation function more closely than a linear model. However when it comes to marginal effects, this should matter little. A downside of this method is that this regression is inherently heteroscedastic (Cameron and Trivedi 2005), which is why we use robust standard errors³. Before turning to the results of the LPM, it is important to stress that the large sample size (31,501 observations) of the dataset poses an additional challenge. With such large samples, estimations based on small-sample statistical interferences can be ineffective at best and misleading at worst. An extremely large sample will make the standard errors extremely small, so that even minuscule distances between the estimate and the null hypothesis become statistically significant (Lin, Lucas and Shmeli, 2011). To overcome this issue, we run our models on a random sample existing of 20% of the initial dataset or approximately 6300 observations. We reiterate this process (drawing a sample with replacement and running the LPM) 50 times. The results of our analyses are presented in Table 2.

Table 2: LPM results for the implementation of innovation

Variable	(1)	(2)	(3)
Gender	0.022 (2,193)	0.022 (2,200)	0.022 (2,198)
Age	14,48***	15,16***	14,73***
Under 40 years	-0,028* (-2,178)	-0,028* (-2,178)	-0,028* (-2,201)
55 years or older	0.002 (0,164)	0.002 (0,171)	0.002 (0,167)
Senior Executive Service	0,077*** (4,783)	0,08*** (4,916)	0,081*** (4,997)
Organizational size	18,60***	17,86***	19,27***
Medium (251 to 1,000 employees)	0,044** (2,757)	0,044* (2,776)	0,045** (2,804)
Small (Less than 250 employees)	0.028 (1,251)	0.028 (1,286)	0.029 (1,296)
Climate for creativity	0,155*** (24,878)	0,174*** (10,959)	0,155*** (24,74)
Collaborative diversity	0,04*** (6,206)	0,04*** (6,214)	0,124*** (3,972)
Interaction collaborative diversity & climate for creativity		-0,008 (-1,332)	
Collaboration diversity (squared term)			-0,022** (-2,792)
Original Sample		31501	
Sample sizes used (with replacement)		20%	
Iterations		50	
Average R ²	0.107	0.109	0.109

Average robust standard errors in parentheses. *p<.1. **p<.05.***p<.01. F tests are used to test the joint significance of Age and Organizational size.

Based on the first column of this table, we notice positive significant effects for climate for creativity as well as for collaborative diversity. This finding is in line with Hypothesis 1 and Hypothesis 2. As an organization's climate for creativity is more strongly developed, the likelihood of implementing innovations increases. The same holds for collaborative diversity. The more diverse the collaborations, the higher the likelihood that this results in innovation. However, surprisingly, the interaction effect between a climate for creativity and collaborative diversity, theorized in Hypothesis 3, is *not significant* (Table 2, second column).

What could explain the absence of the expected interaction effect? We believe that the explanation can be found within the intricacies of the effect of collaborative diversity on innovation. Indeed, literature also suggests drawbacks of collaboration and collaborative diversity, which can cause the relationship with innovation to be non-linear. For instance, literature indicates that collaborations entail a lot of complexities, which creates lengthy and sometimes underperforming processes (Huxham 2003; Klijn and Koppenjan 2016). Furthermore, diversity of organizational cultures, which is stimulated through collaborative diversity, might incite tensions between actors (Diamond and Vangen 2017). Hence, increased actor diversity might stifle the innovation process because of the increased transaction costs (Vivona et al. 2022).

Collaborative diversity might, hence, be expected to support innovation up to a point at which the complexities and interaction barriers inherent to an increasing collaborative diversity begin to inhibit innovation. The relation between collaborative diversity and innovation might therefore be non-linear; more specifically: *inverted U-shaped* (positive up to a certain point after which this effect decreases again). Such an effect explains why the interaction term is neutral or non-significant, as the effect of collaborative diversity on innovation implementation can in some instances be positive while in other instances it will be negative. If this effect is relatively well spread, it could make the interaction term non-significant. To further explore this line of reasoning, we also include a squared-term for collaborative diversity in column 3. The results in column 3 confirm that the relationship between collaborative diversity and innovation is non-linear. Collaborative diversity positively affects innovation, however only up to a certain point (inverted U-shaped). The effect of collaborative diversity until this variable reaches a value of 2.8 (mean of the variable equals 2.2 with a standard deviation of 0.9 and a maximum of 3). When the value of collaborative diversity surpasses this value of 2.8, its effect

on innovation becomes negative. In sum, when collaboration becomes too diverse, it will eventually inhibit innovation.

DISCUSSION AND CONCLUSIONS

This study contributed to literature and practice by combining internal and external exploration of ideas, knowledge and perspectives, and its effect on public service innovation. Two conditions related to internal and external exploration were studied. On the one hand, a climate for innovation inside the organization stimulates employees to explore new ideas without being at risk of sanctions if ideas should fail, which increases the divergent thinking of these employees (Anderson, Potočnik and Zhou 2014). On the other hand, collaborating with a diverse group of external actors increases the variety of ideas, knowledge, and perspectives, which also stimulates divergent thinking as individuals are inspired by each other's ideas (Harvey 2014). Positive relationships were expected between the two conditions and innovation in public service organization. Furthermore, a positive interaction effect between the two conditions was assumed, as collaborating individuals are highly skilled in divergent thinking during the collaboration because of their climate for creativity, and organizations are more likely to adopt new ideas from collaboration partners because of their climate for creativity.

Three main findings can be extracted from this article. First, our results confirmed Hypothesis 1, which means that the presence of a climate for creativity indeed positively affects innovation in public sector organizations. This implies that conditions related to organizational creativity have important consequences for innovation in public sector organizations and it illustrates the need for creativity research in the public sector (Kruyen and van Genugten 2017). It also shows the practical relevance of a climate for creativity in public sector organizations. Managers should recognize that the knowledge and creative potential of their own employees is one of the most important antecedents of innovation in the organization, and that novel and creative

ideas often originate from internal sources (Paulus et al. 2018). Actively creating a climate for creativity should therefore be pursued by the organization's managers.

Second, Hypothesis 2 was also confirmed, which indicates that collaborative diversity enhances innovation, as the knowledge and ideas accessed from external stakeholders facilitate learning processes out of which innovations can arise. This result matches findings from recent collaborative innovation studies in the public sector (e.g. Brogaard 2017; Callens et al. 2021), but it adds to these studies the importance of collaborative diversity in order to create innovation. Whereas the previously mentioned studies focused on collaborative partnerships that produced innovation, our study shows that organizations that have diverse collaborations with different external actors are more successful in acquiring innovation. Hence, not only the diversity in involved actors is important, but also the diversity in collaborations with these external actors. This implies that managers can improve their innovation by collaborating with external actors, and that they should do this by increasing the diversity in types of collaborations (e.g. collaborations with other workgroups, other agencies, other government and other external stakeholders such as citizens and firms). In other words, managers should realize that diverse collaborations with external actors is a way to achieve innovation.

Third, our empirical evidence contradicted Hypothesis 3. We did not find an interaction effect between a climate for creativity and collaborative diversity, in their relationship to innovation. The absence of an interaction effect led us to consider the possibility of a non-linear relation between collaborative diversity and innovation. Although research confirms the positive effects of collaboration for innovation, literature also suggests some drawbacks related to collaborations, which might harm the innovation process. As collaborations with external stakeholders are complex endeavours in which perspectives, interests and resources have to be aligned, substantial efforts arise in managing these collaborations and controlling their transaction costs (Klijn and Koppenjan 2016; Vivona et al. 2022). These complexities might

result into underperforming processes and might damage the innovation process (Huxham 2003; Diamond and Vangen 2017). At first, collaboration with a variety of different actors stimulates and enhances creative ideation and innovation, but an accumulation of complexities and interaction barriers later on in the project, inhibits the positive effects of collaborative diversity on innovation.

Private sector literature has pointed to this paradoxical nature of diversity for innovation, in that diversity stimulates innovation, but can also obstruct innovation as it undermines the stability of organizational processes, which are needed to produce innovation (Bassett-Jones 2005). Empirical research in the private sector has identified non-linear relationships between diverse collaborations and innovation. For instance, Dell’Era and Verganti (2010) found evidence of an inverted U-shape relationship between innovation and the number of products that were developed through collaboration with other companies. A similar inverted U-shape was found by de Leeuw et al. (2014) between alliance portfolio diversity and innovation performance. It seems that a similar mechanism applies for public sector organizations, as our findings indicate that collaborative diversity is positively related to innovation in public sector organizations until it reaches a point at which the drawbacks of the diverse collaborations become too great and innovation is inhibited. This implies that managers should be cautious to not overvalue the potential of collaborative diversity to achieve innovation. The benefits of collaborative innovation should always be evaluated against the costs of the complexities inherent to collaboration.

In sum, this article contributed on two aspects to the current literature and practice related to the conditions of innovation in public sector organizations. First, our focus on conditions related to both the internal and external exploration of ideas, perspectives and knowledge through a climate for creativity and collaborative diversity allowed us to test two distinct theories of innovation in one integrated framework on a large N, quantitative dataset. It enabled us to gain

insights about creativity in public sector organizations and to deepen our understanding about processes of collaborative innovation. Second, our empirical analysis also revealed some critiques about collaborative innovation. It has been argued in recent literature that collaborative innovation is inherently paradoxical. ‘While collaboration thrives in the presence of a certain similarity between the actors in terms of their background, education, values and opinions, innovation flourishes when different experiences, views and ideas complement and disturb each other, stimulating creative problem solving’ (Torfing 2019, 5). The inverted u-shape between collaborative diversity and innovation provides evidence for this paradoxical nature (Torfing et al. 2020), and reveals that there is also a ‘dark side’ of collaborative diversity.

However, this study is not without limitations. First, while the large dataset derived from the 2019 APS employee census used in this study allowed us to bring in much-needed quantitative perspective on public sector innovation (cf. de Vries et al. 2015), this quantitative approach is limited in terms of studying the mechanisms that causally connect our main independent variables (climate for creativity and collaborative diversity) with our dependent variable (innovation). For instance, with regard to collaborative diversity, this paper was particularly interested in the cumulative effect of additional types of collaborations on innovation. Our research design did not allow to shed light on the underlying mechanisms of the observed non-linear relationship between collaborative diversity and innovation. Future research might untangle this relationship, for instance using more refined measurements on the precise types and combination of external stakeholders (public organizations, interest groups, citizens,...) that drive the retrieved effects.

Second, the APS is well suited to examining the theorised effects in a setting that has long recognized the critical importance of pursuing innovation through collaboration (Demircioglu, 2019; OECD 2019). Australia belongs to the cluster of Anglo-American political-administrative cultures (Verhoest et al. 2012), which are generally characterized by a

majoritarian government, a strong executive, and a professional civil service. In terms of administrative culture, individualism and masculinity are relatively prominent in Anglo-American nations, leading to a high willingness to take risks and be innovative or entrepreneurial. Also, the development and enactment of legislation and administrative decisions is generally less problematic and lengthy compared to countries with a legalistic tradition (Verhoest et al. 2012). Anglo-American countries were frontrunners to implement large-scale doctrines (both the NPM-style agency model and post-NPM efforts to restore coordination and collaboration). We thus expect the results from this study to be mainly transferable to other countries that belong to the Anglo-American tradition (United Kingdom, Ireland, New Zealand, Australia and the United States of America). That said, we also believe that the studied mechanisms - that is: innovation being linked to an internal climate for creativity and a certain degree of diversity in external collaborations - build on a strong base of theoretical and empirical research that has proven valid across a wide range of administrative contexts.

Third, although the APS data are unique in offering an insight in the innovation processes of a large sample of public organizations, they only allow for cross-sectional analyses. Such analyses are limited in terms of demonstrating causality and are sensitive to common method bias. While the risk of common method bias was minimized by relying on objective items wherever possible (e.g. asking respondents whether innovations or collaborations occurred, rather than their subjective perceptions on the quality of these innovations or collaborations), future studies should address these risks by relying on panel data which can even more confidently rule out common method bias and endogeneity risks.

Funding

This work was supported by Fonds Wetenschappelijk Onderzoek (1244720N). This article has benefited from the interaction within the GOVTRUST Centre of Excellence (University of Antwerp, Belgium).

Endnotes

¹ Further information on the survey methodology is available at: <https://www.apsc.gov.au/aps-employee-census-2019>

² The items used were formulated in the following way: Please rate your level of agreement with the following statements regarding your immediate workgroup: [This survey uses immediate workgroup, workgroup and team interchangeably. Your immediate workgroup, and/or team are the people you currently work with on a daily basis]

³ Note that we also estimated logit and probit models. These models led to identical outcomes. Given that interpretation becomes more difficult for maximum likelihood models (one has to employ odds ratios or marginal effects), we prefer to present the LPM. Our preference for this type of model is further strengthened by the fact that we employ a squared term. An addition that makes interpretation more complicated (especially for maximum likelihood models).

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