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The diffusion of innovations under normative induction in Brazil

Diffusion of
innovations

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Abstract

Purpose – Hierarchically superior bodies develop normative instructions to induce the diffusion of innovations, stimulating the adoption of management practices in supervised public bodies and seeking public administration efficiency increase. Despite this, the effectiveness of these normative instructions is unknown, as well as its inducing and lasting effects in the diffusion of these innovations, especially in Brazil. This study aims to understand the effects of normative induction.

Design/methodology/approach – The adoption of risk management, integrity & ethics and information security practices was evaluated over a decade (2009 to 2019), including the adoption behavior of more than 200 Brazilian federal agencies. Public open data were collected and analyzed with multinomial logistic regression.

Findings – The normative instructions' effectiveness in propagating the evaluated practices is remarkable; however, its mere development by the superior bodies cannot be considered enough since the general adoption index can be considered good but not excellent. No evaluated practice reached a saturation level above 75%.

Research limitations/implications – This paper contributes to bringing the international literature's generic knowledge on the adoption of innovation to the specific Brazilian public administration context, providing insightful implications for policymakers, public managers and researchers.

Practical implications – This work is unique, as it systematically analyzes multiple innovation adoption and presents excellent opportunities for future researchers by reproducing all scripts and automation developed. Furthermore, all data are available and hosted on public platforms with detailed steps and documentation.

Social implications – The use of open data from governmental sources allows enhanced transparency and the discovery of affecting variables while observing innovation adoption in the public administration.

Originality/value – The presence of normative instructions and their adoption rate is rarely measured in the Brazilian public administration.

Keywords Public administration, Innovation diffusion, Innovation adoption, Management practices, Innovation drivers, Managerial innovation

Paper type Research paper

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Scholars participated in this research project's activities, mainly related to data collection and treatment. The project was developed and coordinated by the author of this work in conjunction with his advisor and with the assistance of the Federal District Research Support Fund – FAP-DF, which took place under the “Spontaneous Demand” modality of edict 03/2016, process n° 193,001,518/2016. The scripts[3], databases[4] and results are available on open websites to allow future research.



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Gustavo de Freitas Alves served as a lead in conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, software, validation, visualization, writing – original draft and writing – review & editing and contributed equally toward resources.

Carlos Denner dos Santos served as a lead in supervision and in a supporting role in conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, validation, visualization, writing – original draft and writing – review & editing.

1. Introduction

Public sector innovation is an essential issue on the agenda of policymakers and scholars when discussing the role of the government in dealing with complex problems in an era of austerity. The Organization for Economic Co-operation and Development (OECD) established several recommendations for their economic partners. Among them, the Oslo Manual provides broad guidelines on innovations, supporting understanding this phenomenon and accumulating experiences (OECD/Eurostat, 2018).

According to Demircioglu and Audretsch (2020), one outstanding contribution for public administration innovation measurement is the Measuring Public Innovation in the Nordic Countries (MEPIN), which is well-documented, its approach is close to the Oslo Manual, providing extensive analysis for innovation in public organizations. However, many questions remain unexamined due to the lack of innovation data. Several innovation scholars have been using the Oslo Manual in their research addressing definitions of theoretical models for innovation (Damanpour, 2014; Spanos, 2009) and practical application of models for innovation (Damanpour, Sanchez-Henriquez, & Chiu, 2018), among other themes. Through OECD recommendations, a foundation can be established to study innovations in different sectors, as well as to understand aspects related to their diffusion and adoption.

Studies by the Brazilian Federal Court of Accounts (FCA) (e.g. the *Annual Survey on Governance and Management*) assess the adoption of various practices through questionnaires applied to the Federal Public Administration (FPA) (BRAZIL, 2016b). Additionally, the Brazilian Office of the Comptroller General (OCG) establishes guidelines, sometimes associated with Normative Instructions or other legislative acts, which determine the adoption of practices in the FPA bodies (BRAZIL, 2016a). Both the OCG guidelines and the FCA recommendations are related to disseminating practices in the FPA for improving its controls and increasing its effectiveness.

The diffusion of innovations in the public sector can be amplified by environmental drivers such as legal imposition or political impulse, encompassing the creation of norms, regulations, laws, decrees, constitutional amendments or government actions (Isidro-Filho, 2017). These environmental drivers are primary stimuli for the diffusion of innovation from external environment pressures. The Neo-institutional theory – concerned with disseminating organizational practices within groups of similar organizations – contributes to the investigation of environmental inducers' relative influence (De Vries, Bekkers, & Tummers, 2016). Additionally, DiMaggio and Powell (1983) identified three general mechanisms of isomorphism: mimetic, normative and coercive isomorphisms, and the latter happens when the organization is compelled to adopt structures or rules.

Structural aspects, including size, complexity and financial resources availability, influence the innovation adoption at an organizational macro level, whereas individual aspects such as schooling, salary and professional experience, have another level of influence, in this case, micro (Isidro-Filho, 2017; OECD/Eurostat, 2018). Demircioglu and Audretsch (2020, 2017) analyzed how organizational and demographic contextual variables affect the implementation of innovation in the public sector. Among those variables, the organization's size and

performance, the professional's education and tenure (experience) were collected in the Australian Public Service Commission data set to understand the conditions for innovation. They were divided into organizational and individual inducers that can be either positively (*drivers*) or negatively (*barriers*) concerning the adoption of innovations (Bloch, 2011; De Vries *et al.*, 2016). Nevertheless, the bodies have a greater or lesser propensity to adopt innovations given their organizational and individual characteristics.

Considering the diffusion and adoption of the same innovation in different bodies, we propose that there will be a greater propensity in adopting innovation due to the occurrence of solid environmental drivers and organizational and individual inducers. In turn, the low propensity for adoption will be related to low external pressure, weak compliance with regulations and organizational and individual limitations (Kung & Kung, 2015).

It is assumed that the diffusion of practices is directly associated with environmental drivers and increases FPA effectiveness. Thus, it is necessary to understand the adopting profile and their propensity for innovation so that the higher bodies can act precisely and strategically, seeking to develop inductive characteristics in these supervised bodies, going beyond the recommendations, guidelines and audits.

As examples of Brazilian State intervention for adopting standards and practices, we can mention the Joint Normative Instruction 01, of May 10, 2016, prepared by the OCG and the Ministry of Economy, which determined the adoption of enterprise risk management (ERM) practices and the deadline of May 10, 2017, for such adoption. Another case is the Decree 9,203, of November 22, 2017, from the Presidency of the Republic, reinforced by the OCG Ordinance 1,089, of April 25, 2018, setting deadlines and scope for the bodies to establish governance committees and structure integrity & ethics (I&E) programs.

There was also a spread of practices without this imposing intervention, such as the information security (IS) practices, adopted over time. These three cases can be measured and compared among themselves; additionally, relevant information from the FCA Annual Survey can enrich the analysis, increasing scientific production lacking on this theme and *locus*. Finally, the research scope, method and the use of open data from the government used in this work are similar to recent literature on innovation, such as Demircioglu and Audretsch (2017, 2020).

The main objective of this work was to investigate the effects of the inducers upon the adoption of practices of coercive isomorphism; therefore, the following research question was developed: *How did the adoption of ERM, IS and I&E practices occur at the Brazilian Federal Executive Branch, considering the presence or not of normative instructions, and the involved organization's profiles?* The relevance of this research is to enable effective public policies enforcement, both through understanding the behavior of propagating innovation and also developing propensity profiles for innovation adoption in public organizations. Furthermore, this work is unique as it systematically analyzes multiple innovation adoption in the FPA and offers a practical approach to empirically assess innovation using open data sources instead of participant surveys. Finally, it provides insightful implications for policymakers, public managers and researchers.

2. Model and hypotheses

When observing the innovation adoption with a focus on the organization, it is believed that its attributes are the determining factors for categorizing the innovation adoption profile. Depending on the propensity for adoption, new practices tend to be more or less incorporated. In consonance with Demircioglu (2020), these characteristics include the organizational size and performance, the professionals' education and experience, among other measures; according to the author, "Future research may focus on how contextual, historical, demographic, and institutional differences affect innovative activities in public

organizations.” Consequently, using the organization’s attributes to understand their adoption aptitude can contribute to the innovation diffusion and adoption literature.

2.1 Organizational drivers for innovation adoption

The internal organizational environment is constantly under control and refers to the company’s business model, production and innovation capacities, as well as financial and human resources. Using the levels proposed by [De Vries, Bekkers, and Tummers \(2016\)](#), organizational and individual inducers can occur, both related to the adopting organization and, in turn, to its ability to incorporate innovations.

According to the Oslo Manual (2018), the organization’s size is a commonly used predictor of innovation activities and the propensity to innovate. The most common organization size measures include the number of employees in the organization ([Damanpour & Aravind, 2012](#); [Damanpour & Schneider, 2009](#); [Demircioglu, 2020](#)). Thus, the organization’s size is one of the most recurrent and significant innovation variables.

For [Damanpour and Aravind \(2012\)](#), large organizations are more likely to innovate because they have economic reserves to dilute the risk of failure and absorb the costs of innovation, the ability to establish and maintain scientific facilities, resources to hire skilled workers and the ability to invest in innovation. In short, the organization’s size influences the amount and diversity of innovations. Therefore:

H1. The organization’s size will positively relate to the adoption of management practices.

[Walker, Damanpour, and Devece \(2011\)](#) argue that managerial innovations depend on the organization’s characteristics and investigated the mediating role of management in organizational performance. The authors assumed that innovations positively influence the performance of organizations and that managerial innovations play a fundamental role in the process of changing, facilitating adaptation to the external environment and increasing the efficiency and effectiveness of their internal processes. On the other hand, higher performance organizations are more likely to adopt innovations, and, in turn, the organization’s performance can present different dimensions measures and metrics ([Boyne & Chen, 2008](#); [Sincorá, Oliveira, Zanquetto-Filho, & Ladeira, 2018](#)).

The *FCA Governance and Management Index* is associated with public organization performance. Although it does not directly reflect the organization’s performance, this composed index aggregates several secondary indexes and dimensions, assuming that good governance and internal arrangement result in better performance, acting in fact as a proxy for performance, as proposed by [Boyne and Chen \(2008\)](#). It is worth noting that the FCA measure is based on surveys ([BRAZIL, 2016b](#)).

Due to the diversity of the public services offered, added to the absence of holistic performance indicators for the Brazilian public sector, the use of other metrics that refer to performance is crucial, such as the *Index* above, which is used in recurrent surveys on the implementation and the adoption of management best practices ([BRAZIL, 2016b](#)). Thus:

H2. The organization’s governance performance will positively relate to the management practices adoption.

2.2 Individual drivers for innovation adoption

For [Swiss \(2005\)](#), governmental organizations can use different individual and group rewards, including salary increases, individual and group bonuses and promotions. [Boyne and Chen \(2008\)](#) state that the relationship between financial incentives and the achievement of goals has been little explored in empirical studies focused on public service. Monetary incentives positively

impact employee behavior and productivity, and the value of financial incentives must be considered when testing the relationship between goals and performance.

Higher-paid employees tend to avoid looking for new careers or jobs (Oliveira & Costa, 2019). Thus, the accumulated knowledge in the same workplace provides an organization deeper understanding. On the other hand, professionals with lower salaries tend to change jobs and take their experience with them, together with the possibility of applying their knowledge to the problems and challenges faced in the original organization. Therefore:

H3. The organization's members' salary will positively relate to the adoption of management practices.

Several studies relate education to the capacity for managerial innovation (Bezdrob & Šunje, 2015; Demircioglu, 2020; Hassan & Al-Hakim, 2011; Mol & Birkinshaw, 2014). A key indicator of workforce skills is the composition of education levels, and a simple measure is the share of employees with higher schooling. The OSLO Manual (2018) recommends collecting this information from all organizations subject of analysis, regardless of their innovation status, using the respective International Standard Classification of Education (ISCED) levels, which range from 5 to 8 in the classification of higher levels (OECD/Eurostat, 2018; UNESCO, 2011).

As innovative activities include creating new ideas in the form of new or improved products, services, processes or policies, education can provide knowledge and skills for innovation. Educated employees are more knowledgeable and may understand innovative activities and processes better than employees with lower education, increasing employees' "boundary-spanning activities." Therefore, employees with higher education are more innovative and tend to be specialists, so they may better understand the procedures and the details of innovative activities (Demircioglu, 2020). Thus:

H4. Higher schooling in the organization will positively relate to the adoption of management practices.

In public service organizations, which are often unionized and have managers with longer tenure, seniority is respected, and more experienced public administrators have better insights into the process of performance improvement (Damanpour & Schneider, 2009). More experienced employees are more familiar with the issues and processes for implementing innovations, and they have more knowledge and understanding of innovations. Similarly, the length of service increases legitimacy and knowledge of how to accomplish tasks, manage political processes and obtain desired outcomes, so tenure is positively associated with innovation (Demircioglu, 2020).

In contrast, the organizations' age captures their overall experience over time. According to the Oslo Manual (2018), the organizations' age should be measured whenever possible by the number of years in which they (as organizational units) are economically active. One cannot disregard the cases in which junctions or mergers happen, as in 2019 with the new Brazilian government changing FPA. Agencies may have extremely remote dates, such as the 1694 Mint, and other cases that may have recently been dismembered or merged, such as the Brazilian Ministry of Economy, which recently incorporated four different ministries. Thus, an organization's age presents flaws, reinforcing the need to use tenure as a proxy for experience.

According to Demircioglu (2020), the length of service or tenure is crucial because experienced employees are more familiar with the issues and processes for implementing innovations. Therefore:

H5. The professional experience years will positively relate to the adoption of management practices.

Different theoretical models can be elaborated a priori based on the different relationships between the constructs and their variables, and also considering the researcher's theoretical knowledge in formulating the hypotheses (Shumacker & Lomax, 2008). Additionally, the data availability is also related to the research execution. We should emphasize that the raised variables need adjustments in the empirical model application, as in the Federal Executive Branch case, in which several variables work differently for private organizations, requiring a theoretical model adaptation for empirical application. Figure 1 illustrates our empirical approach and its relationships under test.

3. Method

Nonexperimental research projects incorporate quantitative techniques in which there is no manipulation on any study variable because manipulation is not possible or viable (Creswell, 2014; Plonsky, 2017). According to Freedman (2009), causal inferences are more solid when performed based on randomized controlled experiments. However, these experiments tend to be expensive or impossible due to ethical or practical reasons; thus, statisticians turn to observational or nonexperimental studies.

We sought for a cause-comparison relationship to assess the adoption of managerial innovations in public organizations. As it is impossible to manipulate or influence the actions of public agencies regarding innovation adoption, the present research is configured as nonexperimental and the adopting organizations as the treatment group or exposed group. Among the three different practices, two (ERM and I&E) were an imposition, so the practice without imposition (IS) will be used as another point of comparison, expanding the study's scope and allowing new analyses.

For the dependent variable data collection, all the information necessary for this study is in the planning documents, policies, ordinances, regulations and instructions available on websites or is public and can be requested via the Access to Information Law (AIL). These documents are usually signed by the organ's highest authority so that there is sponsorship in the practice implementation. These are unstructured or semistructured documents that we analyzed. The scope was the Federal Executive Branch, encompassing Direct and Indirect Administration, encompassing approximately 250 organizations.

The independent variables were collected from three sources: SIAPE [1], PEP [2] and FCA's governance surveys. The effort to collect data for the independent variables was low, although it was complex crossing data from different sources since no unique identifiers or primary keys correlate these different sources.

Regarding the data analysis technique, multiple linear regression was applied. According to James (2013), multiple linear regression is an extension of simple linear regression used to predict a result variable (y) based on several different predictor variables (x). If the variable y is not continuous, another technique other than the Ordinary Least Squares (OLS) – must be used. Instead of using the linear approach, a nonlinear form needs to use an iterative algorithm to solve them with matrix equations (Hair & Fávero, 2019). The maximum likelihood estimate is asymptotically optimal when estimating unknown parameters of a model (Freedman, 2009).

The predicted (dependent) variable, present in the AIL requests, were categorized into "Yes/No" (Binary) answers whether the organization had adopted innovation practices or not. Similarly, Demircioglu (2020) used a count variable as a dependent variable (the number of dimensions/parts affected by the single innovation), justifying that using OLS may cause biased estimates; thus, a logit model is preferable.

Five independent variables were used to predict the practice adoption. First, the organization size, available in the SIAPE data set, measures the average quantity of public

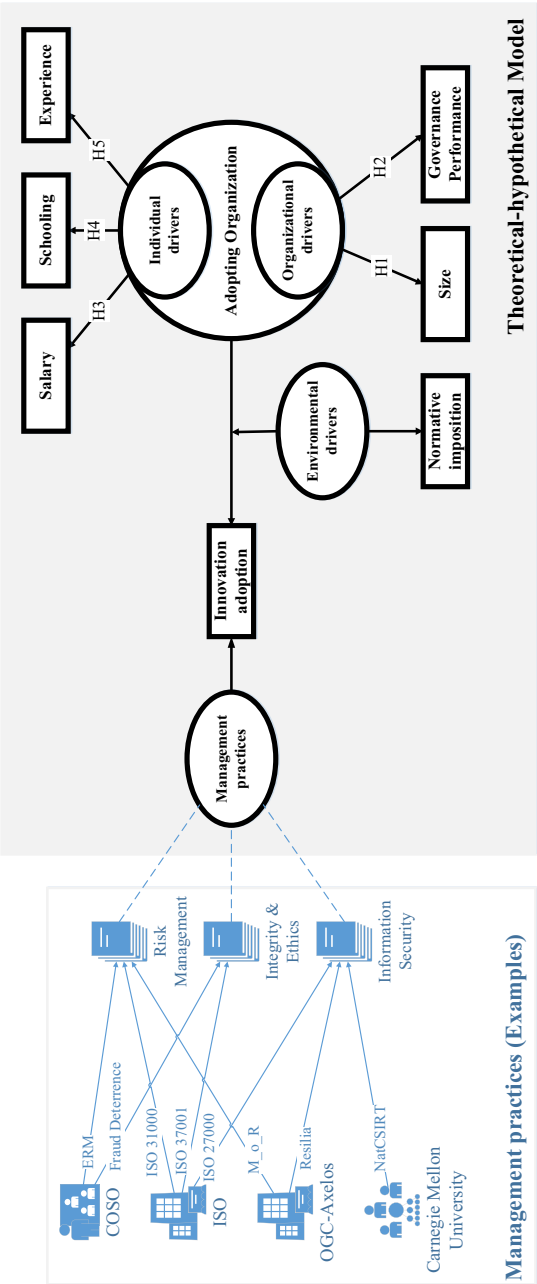


Figure 1.
Operational model

servants in a given organization. This variable was transformed using a natural log due to its magnitude. Second, the governance performance, collected from the FCA *Annual Survey*, is a composed index ranging from 0 to 1, in which organizations closer to 1 presented better governance. Third, the public servant average salary was collected from the SIAPE data set and transformed using a natural log. Fourth, the schooling variable was obtained in the PEP data set and presented a percentage of professionals with higher education (graduation, postgraduation, master's or doctorate degrees) in the organization. Finally, the experience variable was also collected from the SIAPE data set and represents an average of the working years a public servant stayed in each organization. The descriptive statistics of these variables are registered in [Appendix](#).

For [Lu and White \(2014\)](#), a "robustness check" examines how core regression coefficient estimates behave when the regression specification is modified by adding or removing regressors. Structural validity is maintained after regressors changes in the models. To test whether multicollinearity was present, we estimated each variable's variance inflation factor (VIF). The highest VIF score is 1.883 in the GRC model, and the mean VIF is 1.457. In the I&E model, the highest VIF score is 1.777, and the mean VIF is 1.396. Finally, the highest VIF score in the IS model is 2.021, with an average score of 1.560. Thus, because none of the VIF scores is higher than 10, multicollinearity is not an issue in this study.

Regarding the diagnoses and indexes for comparing multinomial logistic regression models, Akaike Information Criterion (AIC) and McFadden's R^2 stand out. The model selection procedures using the AIC function works better under suitable regularity conditions and may have overfitting. A rule of thumb is that McFadden's pseudo R^2 ranging from 0.2 to 0.4 indicates a perfect model fit. It is also important to note that McFadden's pseudo R^2 is best used to compare different specifications of the same model, that is, nested models ([Demircioglu & Audretsch, 2017](#)).

4. Results

From a macro perspective, 299 organizations were assessed by their policies, plans and committees' published dates, observing the behavior curves of adopted practices over time. Results are recorded in [Table 1](#). Only 214 records were complete.

Observing these practices and considering the imposition intervals, one can notice a substantial increase associated with the environmental inducer in two practices ([Figure 2](#)).

Data from SIAPE (Size, Experience and Salary), PEP (Schooling) and the FCA Governance Survey (Governance Performance) were gathered to allow comparisons among organizations, seeking to identify patterns and adoption profiles. According to [Garson's \(2012\)](#) golden rules, outliers with high kurtosis were removed for the regression analysis, keeping the values within the normal range between -2 and $+2$. A total of 178 organizations were analyzed. The correlation between these variables, their density, histogram and significance are recorded in [Table 2](#).

It is noticeable that the most significant correlation occurred between the two FCA Governance Survey (FCA_IGG_2017 and FCA_IGG_2018) variables, of 0.85^{***} , showing a high significance. The high correlation is natural since it refers to very similar surveys carried out in different years. The second strongest correlation was -0.41^{***} between Experience and Schooling, with high significance, indicating that the greater the professional experience, the lower the education. The third strongest correlation was -0.35^{***} between Size and Experience, also with high significance. Among the observed correlation values, only the correlation between the FCA Governance Indexes showed a strong correlation. Therefore, they should not be used simultaneously in the same regression model.

Diffusion of innovations

Year	Po	Co	Pl	Co	Po	Co
	ERM		I&E		IS	
2004	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	1	1	0	0	1	0
2007	0	0	0	0	0	0
2008	0	0	0	0	0	1
2009	0	0	0	0	4	0
2010	0	0	0	0	3	2
2011	0	0	0	0	8	6
2012	0	0	0	0	14	15
2013	1	1	0	0	27	9
2014	1	2	0	1	16	9
2015	1	3	1	0	19	5
2016	10	11	5	3	10	9
2017	68	71	18	12	22	14
2018	51	55	83	81	28	12
2019	11	12	20	10	8	13
Grand total	144	156	127	107	160	95
Nonadopters	70	58	87	107	54	119

Table 1.
Data collected by
practice annually

Notes: N = 214, Po: policy, Pl: plan, Co: committee

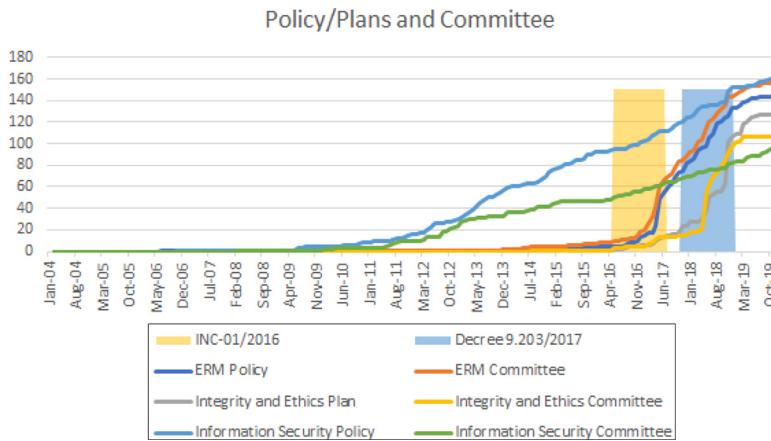


Figure 2.
Behavior of
management practice
adoption curves –
macro perspective

Variable	Mean	STD	1	2	3	4	5	6
Size (ln)	4.81	3.10	1					
Experience (years)	13.50	7.64	-0.35***	1				
Salary (ln)	8.93	0.51	-0.08	-0.08	1			
Schooling (%)	0.76	0.14	-0.02	-0.41***	0.09	1		
FCA_IGG_2017 (%)	0.44	0.19	-0.20**	0.11	0.17**	-0.12	1	
FCA_IGG_2018 (%)	0.47	0.19	-0.20**	0.15*	0.26***	-0.09	0.85***	1

Table 2.
Descriptive statistics,
correlation between
variables and
significance

Notes: N = 178. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

When separating the adopters' and nonadopters' groups, "0-Non-adopters" was used as a reference group. As it is nonexperimental research, it was impossible to manipulate the variables, so the "individuals" (Organizations) classified themselves into different groups (Table 3).

4.1 Hypothesis validation

Regarding the developed theoretical model, it was imagined that the organizational inductors Size and Governance Performance, and the individual inductors Salary, Schooling and Experience had a positive relationship with innovation adoption, considering the preestablished hypotheses and previous works in the literature (Demircioglu, 2020; Demircioglu & Audretsch, 2017, 2020).

4.1.1 Organizational inducers. Regarding *H1*, we found that the organization's size positively relates to the management practices adoption, despite the low statistical significance. A p -value < 0.1 is highlighted for the organization's size for the IS practice, so this hypothesis is not rejected in this case.

It is known that the larger the organization, the greater the chance of distinct specialization; however, large organizations are more complex and given their size, the incorporation of practices tends to be slower. On the other hand, smaller organizations have fewer employees, so the likelihood to accumulate functions and responsibilities is more significant. Due to the smaller staff, there may be an adoption delay; however, there is greater agility in the insertion of practices (Demircioglu & Audretsch, 2017; Mol & Birkinshaw, 2014).

For the Governance Index, associated with *H2*, the IGG_2017 presented a p -value < 0.01 for ERM and a p -value < 0.1 for I&E, so this hypothesis is not rejected for those cases.

Theoretical lines argue that organizations with better performance or better internal arrangement have a more remarkable aptitude to incorporate innovations (Bezdrob & Šunje, 2015; Damanpour & Aravind, 2012; Mol & Birkinshaw, 2009). Others suggest that organizational members will be more innovative if organizations motivate employees to improve organizational performance by creating motivation and innovative ideas that they "developed internally" or "discovered externally" (Demircioglu & Audretsch, 2020). This is justified by several organizational factors, such as the division of labor, hierarchy, administrative scope and personal factors, such as professional achievement, job satisfaction, safety and self-efficacy (Ferreira and Neiva, 2018; Oliveira & Costa, 2019). Other factors influence organizational performance, and the practice adoption absence does not imply lower organizational performance.

Our results show that the organizational drivers positively relate to the innovation's adoption. These organizational-level drivers are related to the slack of resources, allowing them to incorporate innovations, tolerate failures, support innovation costs and explore new ideas before a real need (Damanpour, 1991; Demircioglu, 2020; OECD/Eurostat, 2018).

4.1.2 Individual inductors. Regarding the salary, the p -value < 0.01 for ERM practices and the p -value < 0.05 for IS draw attention as the variable that presented the best results, and in these cases, *H3* is not rejected.

Financial rewards have a positive impact on behavior and productivity. High salaries are associated with psychological security provided by the money, which favors organizational change, decreases the individual's chance of leaving the organization, and, in turn, more knowledge accumulates, favoring innovation (Boyne & Chen, 2008; Swiss, 2005).

As for *H4*, schooling presented a contrary result to what was expected, with a p -value < 0.05 for IS; therefore, the hypothesis, in this case, is rejected.

The explanation for the negative effects of schooling on the adoption of innovative practices can be due to several factors. The higher the individual's education, the greater the care in adopting innovations, and consequently, the resistance in adopting new practices. Another factor is that several public tenders require higher schooling, so there is a high level

Variable	Dependent variable		Dependent variable		Dependent variable	
	Adopters	MODEL_ERM	Adopters	MODEL_I&E	Adopters	MODEL_IS
SIZE	0,097 (0,135) [0,021]	0,045 (0,142) [0,009]	0,052 (0,138) [0,010]	0,048 (0,157) [0,007]	0,288* (0,153) [0,050]	0,282* (0,154) [0,050]
EXPERIENCE	-0,059 (0,038) [-0,012]	-0,054 (0,041) [-0,011]	-0,051 (0,040) [-0,01]	-0,063 (0,044) [-0,009]	-0,100** (0,044) [-0,017]	-0,098** (0,044) [-0,017]
SALARY	3,240*** (1,062) [0,693]	2,967*** (1,134) [0,609]	2,722** (1,112) [0,569]	1,304 (1,191) [0,197]	3,268*** (1,236) [0,574]	3,209** (1,265) [0,567]
SCHOOLING	-3,316** (1,526) [-0,716]	-2,398 (1,580) [-0,500]	-2,809* (1,553) [-0,595]	-1,565 (1,775) [-0,230]	-4,918*** (1,844) [-0,873]	-4,817** (1,887) [-0,860]
FCA_IGG_2017		3,867*** (1,312) [0,791]		2,697* (1,489) [0,415]		0,843 (1,302) [0,150]
FCA_IGG_2018			2,575*** (1,169) [0,539]		1,468 (1,312) [0,233]	0,180 (1,219) [0,032]
Constant	-25,611*** (9,187)	-24,924** (9,810)	-22,140*** (9,535)	-9,523 (10,270)	-24,969** (10,564)	-25,675** (10,795)
Akaike Inf. Crit.	231,435	218,404	227,931	180,100	200,719	202,586
Pseudo R ² McFadden	0,338	0,382	0,354	0,471	0,378	0,378
Pseudo R ² Adj McFadden	0,308	0,347	0,318	0,434	0,345	0,333

Notes: * Coefficients in Log Odds are registered in the first row. Inside the parenthesis is the standard error. Inside the brackets are registered the average marginal effects (AME), N = 178. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 3.
Regression models

of education in this sector. A negative effect may mean that the higher the level of education, the greater the orientation toward the development of innovations in relation to the adoption of existing models developed elsewhere (Mol & Birkinshaw, 2009; OECD/Eurostat, 2018; Spanos, 2009).

We noticed that experience showed a contrary result to what was imagined in all cases, inferring that it is negatively associated with adopting the evaluated practice. It showed a p -value < 0.05 for the IS practice, in which case the corresponding hypothesis is rejected.

The greater the professional experience, the greater the resistance to adopting innovations. This may be due to a risk-averse behavior, and maturity can attenuate the adoption of innovations (Janka, Heinicke, & Guenther, 2019). Moreover, previous works show that experience is negatively associated with public sector innovation in Denmark, Norway and Sweden (Bysted & Hansen, 2015).

The individual-level inductors' analysis results showed an interaction of simultaneous positive and negative effects within the same adoption inducer. While average salary showed a positive association, higher schooling and professional experience showed negative signs, acting as barriers to innovation, contrary to previous studies (Bezdrob & Šunje, 2015; Demircioglu, 2020; Demircioglu & Audretsch, 2017, 2020; Hassan & Al-Hakim, 2011; Janka *et al.*, 2019; Mol & Birkinshaw, 2014).

5. Conclusions

Regarding the propensity for adoption, it was noticed that there was no ideal profile for adopting management practices. Furthermore, it was observed that the same organization, influenced by the same environmental, organizational and individual inducers, may present different adoption behaviors depending on the practice. Therefore, we concluded that there is high complexity in the propensity for the organization to adopt innovations, and the logistic regression model results contributed to measuring and understanding these cases.

Simultaneous effects, positive and negative, of the same individual inducer prove the high complexity to determine the adoption propensity. While high salaries are widely accepted in the literature to support the relationship with the highest probability of adoption (Boyne & Chen, 2008; Ferreira and Neiva, 2018; Swiss, 2005), high schooling and experience presented themselves as barriers to the adoption of innovative practices, contrary to studies such as Mol and Birkinshaw's (2014) and Demircioglu and Audretsch's (2017, 2020). It is also possible to discuss the relationship between age and tenure, which instead of linear, can be inverted U-shaped or nonlinear, as proposed by Damanpour and Schneider (2009).

New governance mechanisms for higher organizations can be developed to break the inertia of resistant organizations or overcome the saturation point, ensuring greater reach and effectiveness for public administration. Normative reinforcement instructions, specific actions and task forces can disseminate the practices in the remaining organizations. It is also essential to understand the reasons that led to nonadoption, which may be associated with the lack of human, material and financial resources.

This study's theoretical and empirical applications are listed below, divided into our three primary target audiences, which can assist the understanding of innovations in the public sector.

For public managers in higher bodies, this work not only developed a theoretical-hypothetical approach to measure the effectiveness of normative instructions but also proposed a method for collecting and analyzing data on the dissemination and adoption of management practices, similar to the one carried out by the FCA Governance and Management Survey (BRAZIL, 2016b). This study may complement the survey with information about the adoption behavior, sometimes influenced by normative instructions.

With this new information, OCG can improve its mechanisms to increase the effectiveness of normative instructions, enhancing the adoption of new practices.

For public managers in supervised bodies, understanding their organization's behavior by observing the propensity for adoption in relation to the adopted practices allows the development of actions and task forces so that the innovations' incorporation occurs quickly and fluidly, either by the early training of key people or by recognizing the organization's strengths and weaknesses regarding the adopting practice. In addition, through the research instruments, it is possible to compare similar organizations. Finally, performing this type of benchmark allows the development of a partnership network for joint improvements, increasing knowledge between these bodies and sharing experiences about the practices' incorporation.

For the researchers, in turn, the need to develop "multilevel" theoretical models, as proposed by De Vries, Tummers, and Bekkers (2018), favor a clear understanding and operationalization of variables. Because there are different levels, environmental, organizational, individual and innovation variables are necessary to have a complete overview of the practices' diffusion and adoption. There is an empirical possibility of reusing data sets and codes through scripts and integrated databases to explore new variables and practices. As the research data is available under the AIL, other researchers can reproduce these tests, aggregating new variables and practices to replicate this study at low cost, increasing the discussion on the matter and enabling new perspectives.

There were limitations while executing the research. Regarding the object of analysis, the study was carried out only in the Federal Executive Branch. Other works may increase the scope of these bodies to understand the adoption patterns of other Public Administration sectors. Considering innovations, we evaluated only three practices. This practices' delimitation was necessary to make the research feasible. Another limitation was related to the practices' adoption degree. This definition can be complex and costly; therefore, the date of publication of policies, plans and establishment of committees or working groups was used to define a criterion for adoption. Other studies may use questionnaires to measure this innovation driver and its most relevant characteristics.

For future work, it is recommended to test the theoretical-hypothetical model to study practices related to privacy, in this case, the Brazilian General Data Protection Regulation, Law 13.709/2018, which also determines deadlines and obligations for this innovation adoption. Additionally, other branches can be studied, such as the Judiciary or other government levels, such as State or Municipal. Finally, the normative imposition of higher bodies for adopting innovations proved to be efficient in terms of increasing the rate of innovations adoption. However, it is not yet known whether the effect of this imposition will be long-lasting or whether this governance mechanism will result in increased performance and enhanced internal control so that the agencies provide better services to society.

Notes

1. Sistema Integrado de Administração de Pessoal – Integrated Staff Administration System.
2. Painel Estatístico de Pessoal – Statistical Staff Panel
3. Available at: <https://grc-unb.github.io/post.html>
4. Available at: www.kaggle.com/gestoderiscos/paineis-de-dados-abertos-da-apf

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Table A1.
Descriptive statistics

Appendix

	Size(ln)	Experience	Salary(ln)	Schooling	FCA_iGG_2017	FCA_iGG_2018
N	374	363	367	198	480	496
Mean	4.83	13.43	8.94	0.79	0.44	0.47
SD	3.09	7.60	0.45	0.14	0.19	0.19
Median	5.68	12.72	8.87	0.85	0.44	0.45
Trimmed	4.91	12.84	8.92	0.82	0.43	0.46
MAD	3.58	8.44	0.32	0.09	0.18	0.20
Min	0.00	0.59	7.66	0.32	0.03	0.04
Max	10.80	46.29	10.46	0.98	0.92	0.97
Range	10.80	45.70	2.80	0.66	0.89	0.93
Skew	−0.26	0.78	0.57	−1.40	0.26	0.26
Kurtosis	−1.37	0.83	0.61	1.32	−0.28	−0.47
Std. error	0.16	0.40	0.02	0.01	0.01	0.01

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