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THE GHOST IN THE MACHINE: SYSTEM-LEVEL BUREAUCRACY AND INTERORGANIZATIONAL COORDINATION IN PUBLIC POLICY

O fantasma na máquina: system-level bureaucracy e coordenação interorganizacional em políticas públicas

El fantasma en la máquina: system-level bureaucracy y coordinación interorganizacional en políticas públicas

André Luís de Castro[1] | ancastro@gmail.com | ORCID: 0000-0001-7031-6877

[1]Universidade Estadual do Paraná, Campus Paranavaí, Colegiado de Administração, Paranavaí, PR, Brazil

ABSTRACT

The objective is to understand how interorganizational coordination occurs in the development of information systems in tax collection and basic education policies in the state of Paraná, Brazil. This implies the analysis of the relationships established between system-level bureaucrats (SYBs) – specialists who work in the development of information systems – and other bureaucracies in the implementation of public policies. Theoretical references on bureaucracy, information and communication technologies (ICTs) in the public sector, and coordination of public policies were mobilized. From a methodological point of view, it is a comparative study, analyzing two public policies: tax collection and basic education in the state of Paraná, and the mixed-ownership company that develops the systems, Companhia de Tecnologia da Informação e Comunicação do Paraná (CELEPAR). Such policies are distinguished by the way in which the relationships between bureaucracies occur. In both, informal learning networks, mutually dependent, allow actors to create and use coping strategies that contribute to the coordination of public policy. These strategies are related to the writing of laws and public notices, the creation of unofficial information systems and resistance to change. They generally reflect beneficial contributions to public policy. The results imply demonstrating that the decision-making processes of policies are changed according to the use of ICTs, and disputes are transferred to other locus, which information systems sometimes hide, sometimes reveal.

Keywords: system-level bureaucracy, interorganizational coordination, public policy implementation, public administration, public information and communication technologies organizations.

RESUMO

O objetivo é entender como ocorre a coordenação interorganizacional no desenvolvimento de sistemas de informação nas políticas de arrecadação fiscal e de educação básica no estado do Paraná, o que implica a análise das relações estabelecidas entre os system-level bureaucrats (SYBs) – especialistas que atuam no desenvolvimento de sistemas de informação – e outras burocracias na implementação de políticas públicas. Foram mobilizadas referências teóricas sobre burocracia, tecnologias da informação e comunicação (TICs) no setor público e coordenação de políticas públicas. Do ponto de vista metodológico, trata-se de um estudo comparado, analisando duas políticas públicas: a de arrecadação fiscal e de educação básica do estado do Paraná; atendidas pela empresa de economia mista que desenvolve os sistemas, a Companhia de Tecnologia da Informação e Comunicação do Paraná (Celepar). Tais políticas diferenciam-se pela forma como ocorrem as relações entre as burocracias. Em ambas, redes informais de aprendizado, mutuamente dependentes, permitem aos atores a criação e a utilização de estratégias de coping que contribuem com a coordenação da política pública. Essas estratégias possuem relação com a redação de leis e editais, a criação de sistemas de informação não oficiais e a resistência às mudanças, refletindo contribuições geralmente benéficas para as políticas públicas. Os resultados implicam demonstrar que os processos decisórios das políticas são alterados em função do uso das TICs e disputas se transferem para outros locus que, por vezes, os sistemas de informação escondem, por vezes evidenciam.

Palavras-chave: *system-level bureaucracy, coordenação interorganizacional, implementação de políticas públicas, administração pública, entidades públicas de tecnologias da informação e comunicação.*

RESUMEN

El objetivo es comprender cómo se produce la coordinación interorganizacional en el desarrollo de sistemas de información en las políticas de recaudación de impuestos y de educación básica en el estado de Paraná. Esto implica el análisis de las relaciones que se establecen entre los burócratas a nivel de sistema (SYB) –especialistas que trabajan en el desarrollo de sistemas de información– con otras burocracias en la implementación de políticas públicas. Se movilizaron referentes teóricos sobre burocracia, tecnologías de la información y comunicación (TIC) en el sector público y coordinación de políticas públicas. Desde el punto de vista metodológico, se trata de un estudio comparativo que analiza dos políticas públicas: la de recaudación de impuestos y la de educación básica en el estado de Paraná, Brasil, y la empresa de capital mixto que desarrolla los sistemas, CELEPAR - Companhia de Tecnologia da Informação e Comunicação do Paraná. Tales políticas se distinguen por la forma en que se dan las relaciones entre las burocracias. En ambos, las redes informales de aprendizaje, mutuamente dependientes, permiten a los actores crear y utilizar estrategias de afrontamiento que contribuyen a la coordinación de políticas públicas. Estas estrategias están relacionadas con la redacción de leyes y avisos públicos, la creación de sistemas de información no oficiales y la resistencia al cambio y reflejan contribuciones generalmente beneficiosas a las políticas públicas. Los resultados implican demostrar que los procesos decisorios de las políticas se modifican en función del uso de las TIC y las disputas se trasladan a otros locus que los sistemas de información a veces ocultan, a veces revelan.

Palabras clave: *system-level bureaucracy, coordinación interorganizacional, implementación de políticas públicas, administración pública, organismos públicos TIC.*

THE GHOST IN THE MACHINE

The relationship between bureaucracies and the processes that interconnect in the development of information systems is not always visible. This ghost can be perceived through information systems and highlights actors and dynamics that scholars in the field of public policy do not always understand. Such a relationship resembles a "supernatural" mystery. In the popular imagination, a ghost is a spirit that manifests indirectly through actions and objects. In this research, the "ghost in the machine" is the essence of a social phenomenon.

This work explores the production of technology and the individuals behind its creation. Specifically, it delves into the role of system-level bureaucrats (SYBs) responsible for developing and modifying public policy information systems (Bovens and Zouridis, 2002). SYBs are system experts, including systems designers and technicians, legislative specialists, public policy legal support staff, and systems managers involved in these processes, along with system user support personnel. SYBs are mid-level bureaucrats who collaborate with bureaucrats from the different levels of the state apparatus. They collaborate with managers and coordinators overseeing public policy processes – essentially, other mid-level bureaucrats (Cavalcante & Lotta, 2015; Pires, 2018); with those who directly interact with the citizens or users benefiting from the policies – street-level bureaucrats (Lipsky, 2019); and with leaders appointed to head governmental departments, i.e., high-level bureaucrats (Loureiro, Abrucio, & Rosa, 1998).

The process of developing information systems for public policies involves organizations and bureaucracies that interact continuously throughout policy implementation. The effective coordination of these interactions is crucial to deliver successful public policies. Peters (1998) states that coordination is a complex political endeavor involving negotiation within networks, group aggregation, and informal mechanisms. The author contends that centralized coordination at the highest levels of the hierarchy may not always be sufficient to attain policy objectives.

Therefore, bureaucrats operating at any level of the state apparatus are engaged in constant negotiation. This research argues that negotiation between SYBs and other bureaucrats, motivated by the development and maintenance of information systems, favors policy coordination. The main analytical elements of this study are connected based on this assumption, considering the relationships around the negotiations among SYBs and other bureaucrats in developing information systems to generate information and actions for the coordination and implementation of policies.

These actions often transform into improvisations and adaptations, resulting in the development of repertoires frequently employed by bureaucracies, known as coping mechanisms (Lipsky, 2019) or coping strategies (Vedung, 2015). These strategies are instrumental in addressing limitations and failures within information systems and policy processes.

The research question guiding this study is: how does inter-organizational coordination occur in the development of information systems in tax collection and basic education policies in the Brazilian state of Paraná?

The study of processes regarding information systems in Paraná entails examining the Paraná Information and Communication Technology Company (Celepar). Celepar is a mixed-

ownership company operating in the development and maintenance of most information systems used in tax collection and basic education policies.

The decision to conduct a comparative study is based on the premise that negotiations among actors may vary depending on the nature of public policies. Peters (1998) argues that policies with substantially different characteristics often involve distinct networks and interorganizational relationships.

Definition of System-Level Bureaucracy

Policies cannot be effectively implemented without the mediation of information and communication technologies (ICTs) (Meijer, 2007). These technologies can play a pivotal role in achieving coordination, control, democratic accountability, and increased effectiveness and efficiency in policymaking. These outcomes are of significant interest to politicians, bureaucrats, and citizens alike.

According to Bovens and Zouridis (2002), information and communication technologies (ICTs) are crucial for public organizations to record and store data and execute and control entire processes. The authors define SYBs as the bureaucrats involved in working with ICTs within policies. SYBs can be coordinators, programmers, analysts, support technicians, information systems developers, and users. Users can take on roles such as process managers, legislative experts, supervisors, and street-level bureaucrats who directly serve citizens.

Bovens and Zouridis (2002) and Buffat (2015) aim to draw a parallel between the role of SYBs and street-level bureaucrats, particularly when considering their interaction with citizens through information systems. Lipsky (2019) defined street-level bureaucrats as front-line government employees who work in direct contact with citizens and wield substantial power to carry out their duties (Lipsky, 2019, p. 37). SYBs are public servants who work in government agencies, state-owned enterprises, and mixed-ownership companies exclusively serving the state. Such institutions in Brazil include the Federal Data Processing Service (Serpro), a state-owned enterprise under the Ministry of Finance, and Celepar.

SYBs play a significant role in shaping the interaction between the state and citizens. Some of the tasks traditionally performed by street-level bureaucrats have now been replaced by online applications, enabling direct access to public services by the population (e.g., registering and monitoring electronic invoices). Consequently, the responsibilities of SYBs have expanded to include facilitating state-citizen interactions. Scholars like Buffat (2015) have recognized this evolving context and emphasized the importance of new empirical research to explore e-government's impact on the actors at the forefront of public policy.

These bureaucrats possess considerable discretion. Bovens and Zouridis (2002) delve into this discretion, highlighting how SYBs make decisions when it comes to codifying laws within information systems. They raise questions about accountability and political control to determine who governs the developers and the systems they construct. Consequently, understanding the discretion exercised by SYBs becomes a crucial aspect of their role.

Although Bovens and Zouridis (2002) categorize SYBs as somewhat akin to street-level bureaucrats, it is important not to accept this viewpoint uncritically. The authors themselves acknowledge that SYBs occupy many positions within the state apparatus. For example, this study identifies SYBs in roles within mid-level bureaucracy, such as team managers or area directors in state-owned ICT companies, where these bureaucrats engage with other organizations and influence policy coordination.

COPING STRATEGIES AND COORDENATION BETWEEN BUREAUCRACIES

Pressman and Wildavsky (1973) identified problems in coordination as one of the primary causes of the mismatch between the formulation and implementation of public policies. Much of what remains unclear during the formulation phase is determined by bureaucrats during implementation, including the coordination of actions (Lindblom & Woodhouse, 1993; Hill, 2006). Understanding coordination can help mitigate the distance between formulation and implementation. Effective coordination occurs when different organizations or sectors involved in a policy adjust their actions to prevent issues between the processes, such as redundancy, lacunae, and incoherences appointed by Peters (1998).

The ongoing exchange of information and resources among interconnected organizations requires discussions about coordination in public policies. The link between bureaucrats and policy coordination hinges on negotiation. Peters (1998) considers that, in practice, coordination primarily manifests as a product of negotiations occurring at lower organizational levels, focusing on specific themes or clients. According to the author, while the dominant response to coordination issues may be a hierarchy, negotiation and bargaining still play a role in formulating or implementing policies. In another study (Peters, 2004), he emphasizes the importance of decentralization in policy coordination.

Negotiation and bargaining, in a general sense, often fall outside the formal aspects of organizations. In a study focusing on the internal coordination of teams within highly complex and unpredictable organizations, Zanini, Conceição, and Migueles (2018, p. 452) refer to these as "elements of informal coordination." According to the authors, these discussions were initially regarded as "non-structural aspects" by Barnard (1938) and later characterized as "political and symbolic aspects of organizations" by Guerreiro Ramos (1981) and Williamson (1995).

In this context, coordination emerges as a robust policy exercise that involves the aggregation of groups (Peters, 1998). Lindblom (1965) defines coordination as a systematic relationship between decisions that aims to yield positive outcomes for participants while averting negative consequences. Peters (1998) argues that as organizations are compelled to engage directly in implementation matters, they tend to coordinate more effectively than other actors or organizations lacking such interaction. The discretion of actors and the ability to improvise tasks in response to specific situations are integral to informal coordination mechanisms. Schneider (2005) identifies spontaneous coordination through interactions between actors guided by institutional standards.

Peters (1998, p. 307) highlights the "substantial latitude for local action," which involves decentralizing decisions to local governments or lower levels of organizations. This substantial latitude implies providing space and trust, and, for this reason, it is closely linked to the discretion of implementing actors – a space where these actors make decisions in the policy implementation process.

Such negotiations play a crucial role in determining the effectiveness of coordination efforts. Effective coordination is reflected in policies characterized by a minimal degree of redundancy, lacunae, and incoherence. Redundancy occurs when two organizations or sectors within the same policy engage in identical activities, resulting in unnecessary duplication of tasks and increased costs for the organizations involved. Lacunae refers to situations when organizations or sectors fail to carry out essential activities, leaving certain aspects of a policy unaddressed. Finally, incoherence occurs when policies with the same target audience have different objectives, which also generates high costs for the government as different organizations or sectors are taking conflicting actions (Peters, 1998). Pressman and Wildavsky (1973, p. 134) highlight the relevance of negotiation in coordination: "Bargaining must take place to reconcile the differences, with the resilt that the policy may be modified, even to the point of compromising its original purpose. Coordination in this sense is another word for consent." For the authors, negotiation aims to seek consensus to reconcile differences and enable policy coordination. In this process, bureaucracies create ways to learn how to overcome problems.

This informal learning process involves improvisations and adaptations that lead to the actors' recurring repertoires. Lipsky (2019) refers to this practice as "coping mechanisms," while Vedung (2015) uses the term "coping strategies." The necessity for coping strategies arises from factors such as limitations inherent in the organizational structure, resource constraints, and high demands for service provision. These institutionalized resources enable overcoming limitations and shortcomings in information systems and policy processes. Pozzebon and Van Heck (2006) note that improvisations or local adaptations can emerge for a variety of reasons.

The coping strategies adopted by implementing actors can contribute to achieving the policy's objectives, even though they may not be foreseen in the policy formulation phase or are different from those planned. As Santos (1979) highlighted, social inventions are unpredictable and, therefore, cannot be previously grasped in a standardized or routinized way.

METHODOLOGY

This comparative study places special emphasis on the inter-societal, institutional, or macro-societal aspects of societies and social analysis (Eisenstadt, 2003). As Przeworski and Teune (1970) noted, many comparative studies are rooted in examining differences between social systems and assessing these differences' impacts on various social phenomena within a given context. Accordingly, this research selected two policies with distinct substantive natures

and scrutinized the relationship between bureaucracies while developing and maintaining information systems.

Table 1 presents the categories created to facilitate the elaboration of interview questions and guide information collection.

Table 1. Categories of the comparative study

CATEGORIES	EXAMPLE OF INFORMATION COLLECTED OR INTERVIEW QUESTIONS
Information about policies	Regional state education offices; regional offices of the state tax authority
Work daily activities	What are the responsibilities of your coordination?
Coordination and relationship between bureaucracies in system development	How is your relationship with public servants working at the Secretary of Finance?
Information systems and working teams	Which are the systems used in your work?

Source: Elaborated by the author.

To collect primary data, we conducted 40 semi-structured interviews with mid-level and street-level bureaucrats from various entities. These interviews were distributed as follows: nine interviewees from Celepar, nine from the Secretary of Finance of the state of Paraná, six from the regional offices of the state tax authority in Curitiba, two from Maringá, six from the Secretary of Education of Paraná, three from the regional state education offices in Curitiba, and five from Maringá. In total, these interviews amounted to 18 hours of recorded conversations. The cities chosen for the study represent the capital and the third-largest city in the state.

We also conducted interviews with a director at Celepar in the state capital, Curitiba. However, data collection in Londrina, the second-largest city, was abandoned due to ongoing arrests and corruption investigations at the regional office of the state tax authority located in that city. These widely reported events posed significant limitations to our data collection efforts.

The interviews were conducted during two periods, each lasting 15 days: at the end of July 2016 and the beginning of November 2016. While they took place a few years ago, the research remains highly relevant as it addresses current aspects and incidents within government bureaucracies. The questions aimed to uncover the dynamics between bureaucracies in the implementation of policies

The selection of interviewees occurred through a combination of methods. Part of the process involved using the snowball technique, where one interviewee referred another who could provide relevant insights for the research (Biernacki & Waldorf, 1981). Additionally, the researcher requested interviews with individuals responsible for various positions within the organizations by analyzing the organizational charts. The interview reports were analyzed using empirical categories and then compared with the theoretical foundation.

DATA DESCRIPTION AND ANALYSIS

Description of tax collection and basic education policies

The tax collection policy of the state of Paraná is overseen by the Secretary of Finance (Sefa), with the primary goals of generating revenue and ensuring the proper allocation of resources, as stated on the state government's website (Governo do Paraná, 2018). The Secretary is responsible for budget formulation and control, financial administration, coordination of economic matters, and overseeing state revenue. The State Revenue Coordination implements the tax collection policy, which aims to "administer taxes with integrity, applying legislation to facilitate state collections" (Governo do Paraná, 2018). This coordination is decentralized through 12 regional offices of the state tax authority.

Celepar, a mixed-ownership company, develops and maintains the majority of Sefa's information systems, a total of 120. From Celepar's perspective, Sefa is the largest client in terms of financial resources, and tax collection is the largest investment of the state government in ICT. The *Nota Paraná* program, responsible for overseeing invoice issuance in the state, boasts the largest system user base, with more than two million registered users, as per information available on the program's website. Celepar employees who are involved in tax collection policy play a crucial role as part of the SYBs. This group includes development managers, customer service coordinators, business analysts, systems analysts, and IT analysts. The Celepar team dedicated to serving Sefa comprises a total of 71 individuals, and these employees work in the same building as the secretariat. For other clients and policies relying on Celepar systems, the company's personnel work from Celepar's headquarters.

The education policy in the state of Paraná primarily focuses on providing free basic and vocational education to students within the state. These initiatives are carried out by the State Department of Education (Seed). The Seed comprises a central board of directors overseeing six departments related to basic education. The decentralization of programs and actions is facilitated through 32 regional state education offices across cities spanning the entire state.

These education offices are comprised of teachers and school secretaries, who are nominated by their colleagues within the office. The exception to this nomination process includes the heads of the offices and their technical assistants, who may be individuals from outside the state's staff and are appointed by Seed. The regional offices encompass various departments, two of which engage extensively with both public and private schools, the Department of Structure and Operation, and School Documentation. The former assesses the operational authorization of schools, verifying documentation presented by schools, which falls under the purview of other bodies and entities such as the fire department, health surveillance, and the city hall. The latter, the Department of School Documentation, is responsible for enrolling students and managing all their records.

Approximately 23 Celepar employees are dedicated to developing and maintaining information systems for Seed. From Celepar's perspective, Seed is its largest client in terms of the number of state employee users, exceeding 100,000 users. This team manages around 40 systems for Seed and an additional 20 systems for the State Secretary of Culture.

Coordination between bureaucracies

The relationship between SYBs, mid-level bureaucrats, and street-level bureaucrats demonstrates coordination within both the tax collection and education policies. Schneider (2005) suggests that interactions among actors in policymaking are shaped not solely by formal institutional political roles but also by informal connections, such as resource exchange and strategic interaction.

In the tax collection policy, interviewees emphasized the crucial role played by Celepar's SYBs. The multitude of systems within the Secretary of Finance (Sefa) and their interconnectedness underscore the significance of Celepar's SYBs and their extensive influence within the agency. They serve as fundamental elements in policy coordination, helping to mitigate issues like redundancy, lacunae, and incoherence, as described by Peters (1998). A Celepar manager responsible for tax collection elaborated on this dynamic during the interview:

> *Given my broader perspective on the systems, both in terms of expenses and revenue as well as their interconnections, I am often called upon to play this role. The client, the Secretary of Finance, comprises several specific sectors. So the area responsible for expenses is very closed, and the budget area as well. Within the revenue area we have the inspection, collection, and taxation area, each focusing on its own domain, isn't it? So, what permeates the areas are the systems and their integrations. As we provide support and evolve these systems, sometimes it is easier for them to talk to Celepar, which has a vision of the interrelationships between systems and can assess the impacts on the areas (Interviewee FA13-SYB).*

The interviewee's point of view is aligned with the description of the dynamics of the mid-level bureaucracy as presented by Pires (2018, p. 202), who argues that bureaucrats who operate between various levels of bureaucracies play an important role in managing connections, influencing information flows, distributing resources, and determining the most suitable or legitimate partners for involvement in the execution of government initiatives.

In the context of the basic education policy, the significance of Celepar's SYBs in coordinating the policy primarily arises from the frequent turnover of positions within the Secretary of Education (Seed). This relationship between SYBs and other bureaucracies in education plays a crucial role in ensuring policy continuity during government transitions or changes in political compositions, which often involve the reassignment of numerous mid-level bureaucrats and policy managers. This exchange of experiences enhances the overall coordination of the policy. Multiple interviewees (ED3-BNM, FA15-SYB, FA16-SYB, FA10-SCB) from Sefa, Seed, and Celepar underscored the vital role that Celepar's SYBs play in maintaining the policy's continuity and stability amidst the constant personnel changes in appointed positions within the state secretariats.

Dias (2008), in his dissertation, also highlights the importance of SYBs from public ICT companies in managing political discontinuities:

> The analysis of the contributions of state-owned IT companies, such as Prodesp in São Paulo State [Companhia de Processamento de Dados do Estado de São Paulo], must take into account the preservation of knowledge within a structure that can withstand administrative discontinuities and ensure the continuity of infrastructures. This consideration is especially pertinent given the potential for opportunistic contracts with third parties, as permitted and sometimes even required by bidding laws. These state-owned IT companies also serve as reservoirs of IT skills and processes for other government departments (Dias, 2008, p. 118).

The dynamics observed in another state corroborate the findings of this research, underscoring the importance of considering SYBs in public policy analyses. While the relationship between SYBs and other bureaucracies contributes to the coordination of both policies, interviewee reports highlighted a greater number of coordination issues within the education policy. Empirical analysis suggests that the reasons for these issues are interconnected: the size of Celepar's SYB team dedicated to education and the lesser proximity between SYBs and other education bureaucracies. In the context of tax collection policy, they are co-located in the same building. Moreover, Peters (1998) suggests that more cohesive "epistemic communities" are more capable of generating coordination than areas with conflicting or less substantial views. It can be argued that, at certain points, the tax collection policy benefits from 'epistemic communities'—networks of professionals who share knowledge, methods, and practices on specific issues (Haas, 1992)—that are more cohesive than those within the education policy. The work of Abrucio and Sano (2013) highlights differences between the National Council of Secretaries of Education (Consed) and the National Council for Financial Policy (Confaz), Brazilian interstate councils that bring together professionals to share solutions to specific problems. On the one hand, the authors emphasize Confaz's role as a disseminator of innovations across states. On the other hand, they raise concerns about Consed's lack of institutionalization in policies despite its role in convening representatives from state secretaries of education.

However, some education policy initiatives show an increase in horizontal relationships. One of the most prominent examples is the sharing of education information systems developed by Celepar with other states, as mentioned by the interviewees. This level of collaboration is not as prevalent in the tax collection policy.

In addition to the theoretical assumption of relationships characterized by tension and complementarity identified empirically, field research highlighted other characteristics of these relationships within both policies. These include aspects of formality and informality, as well as proximity and distance. The most significant disparity between the policies lies along the proximity and distance axis, where Celepar's SYBs maintain a close relationship with mid-level bureaucrats working in tax collection. This proximity occurs because they share the workspace, which fosters increased interaction and expedited problem-solving.

Conflicts within the education policy were identified more frequently. These issues include what Peters (1998) refers to as "incoherence," i.e., conflicting activities, objectives, and requirements within the policy.

Coordination problems are frequently highlighted in requests to Celepar, as mentioned by interviewee ED4-SCB:

> *We still struggle with the lack of good communication and integration. Because sometimes, there are requests that come without bringing together all those interested, and then problems arise. We always try to hold meetings gathering who made the request, Celepar, and us. So everyone does their part. Because the requesting party brings only their own view. If you bring a situation related to the student's record, it will impact not only documentation but also school meals, school transport, and vice versa. Hence, the importance of coordination.*

Interviewee ED14-SYB, working within the education policy, discusses the conflicts they aim to mediate with the secretary. Referring to this type of activity, Zanini et al. (2013) call "elements of informal coordination" the non-structural aspects of organizations that contribute to fostering engagement and trust, ultimately ensuring cooperation "in pursuit of internal adjustments necessary for swiftly responding to environmental challenges" (Zanini et al., 2013, p. 452). According to the interviewee, the problems within the Secretary of Education are linked to "*the absence of a policy to maintain the same individuals in their roles for extended periods*." The issue of turnover is reiterated.

Alongside incoherence, redundancy emerged as another coordination issue within the education policy. As mentioned by interviewee ED-SYB14: "*The questions are always repeated*." The high turnover of appointed positions within the secretary exacerbates this situation.

Regarding the revenue policy, some interviewees from Sefa highlighted the primary problem as the delay in Celepar's response to their requests. According to these interviewees, one potential solution lies in establishing a dedicated department within the secretariat for systems development. This approach has already been initiated in recent recruitment processes, where candidates were required to possess ICT knowledge to work in the secretary.

Coping strategies

Formally established teams within Sefa – such as study groups composed of mid-level bureaucrats and street-level bureaucrats working at the regional offices of the state tax authority who are familiar with the daily operations – aim to enhance procedural practices and suggest improvements to systems. Similarly, Confaz features a thematic group in the technology sector that fosters such communities, facilitating exchanges between states and the federal government. In contrast, informal networks, cultivated through ongoing interaction between Celepar SYBs and other Sefa bureaucrats, enable individuals to engage in daily discussions regarding solutions for the systems and processes in which they are involved, particularly pertaining to policy coordination.

No formally established study groups focusing on policy processes or information systems were found within Seed. Likewise, there are no specific discussions within Consed related to administrative information systems in the education sector. However, similar to the Sefa context, informal networks involving Celepar SYBs and Seed bureaucrats play a pivotal role.

Over time, certain SYBs have become experts in specific areas and serve as references for their colleagues, as highlighted by interviewee FA12-SYB: "*I know the entire process, often down to the finest details*." With 43 years of service at the company, this interviewee operates as a consultant across various processes and coordinates efforts based on their extensive knowledge and experience gained from involvement in major company projects. Interviewee FA16-SYB adds, "*There are analysts who have been working with the system for over 30 years, and their understanding of the business surpasses even that of the Sefa tax auditors themselves.*"

When considering the interviewees' characteristics, the average service length for Celepar employees is 27 years, while for bureaucrats involved in basic education and tax collection policies, it stands at 21 years.

Interviewees at Celepar who are exclusively dedicated to the tax collection policy tend to be older, with an average age of 52 years, and have longer tenures at the agency, averaging 31 years of service. In comparison, Celepar employees serving the education policy have an average age of 46 years and an average length of service of 23 years.

In both tax collection and basic education policies, certain Celepar SYBs are regarded as authorities not only in information systems but also in specific aspects of policy implementation. Tensions often arise between Celepar and the state secretariats, particularly when SYBs, in addition to their expertise, possess information that is not readily accessible to other secretariat bureaucracies, as reported by multiple interviewees. Both policies generate similar coping mechanisms or strategies (Lipsky, 2019; Vedung, 2015) with only a few distinctions.

In their research on local adaptations in the implementation of generic application systems, Pozzebon and Van Heck (2006) argue that the term "local adaptation" possesses a bidirectional nature, encompassing changes in business processes and organizational rules, as well as adaptations in the system's resources itself. These adaptations, or coping strategies, developed through the coordination and learning processes of SYBs with other bureaucracies, similarly exhibit this bidirectional character in various actions, manifesting as modifications in either the business rules or the system itself. Table 2 illustrates the coping strategies empirically identified through interviews in tax collection and education policies.

Table 2. Coping strategies in tax collection and basic education policies.

COPING STRATEGIES	PUBLIC POLICIES	
	TAX COLLECTION	BASIC EDUCATION
Creation of non-official information systems	It is more frequent in the tax collection policy. Street-level bureaucrats of regional offices of the state tax authority emphasized the role of sharing the systems created	It is less frequent in the basic education policy. Some cases refer to the creation and use of databases by street-level bureaucrats of regional state education offices. It was observed a more widespread use of free software.

(continue)

(Concludes)

Table 2. Coping strategies in tax collection and basic education policies.

COPING STRATEGIES	PUBLIC POLICIES	
	TAX COLLECTION	BASIC EDUCATION
Law-writing	In certain situations, normative instructions and other documents with a force of law are written based on the information system's capability	It mainly focuses on the preparation of hiring exams and counts on the participation of Celepar's system-level bureaucrats to check errors and possible reasons for appeals by candidates.
Resistance to IT implementation	Not observed	Observed mainly at the political end of regional state education offices and schools. In a reported situation, it contributes to policy by maintaining important information, but it is not always beneficial.

Source: Elaborated by the author.

The creation of unofficial information systems occurs when a bureaucrat or a group within a particular state entity, often at the forefront of policymaking, such as the regional offices of the state tax authority or the regional state education offices, develops an information system outside of Celepar without its approval. Interviewee FA4-SCB mentioned that this type of solution can pose challenges. There are instances when Celepar faces overwhelming requests and cannot afford to wait for the development process. Also, the public servant who created the system may retire, leaving many users dependent on a system without adequate support or documentation. According to Celepar interviewees, the company eventually adopted a system under such conditions. Documentation was prepared, and Celepar officially approved the system.

Diniz, Bailey, and Sholler (2014) highlight that the user of such systems is not a "passive recipient." When the context or situations are more flexible than the technology, users can act on them and contribute to the success of the technology implementation. When users have technical skills, they can modify the system (or both the context and the technology).

A mid-level bureaucrat at Sefa described the law-writing coping strategy, "We are constantly making adjustments to the law, writing terms that the system can accommodate, and not the other way around" (FA5-BNM). The interviewee explained that, in certain situations, the secretariat, legislative assembly, and state government face challenges proposing changes to the law due to legacy systems, time constraints, and limitations in implementing such changes. As a result, these political actors often seek guidance from Celepar on the types of changes that can be made based on the system's capabilities. Regarding the adaptation of practices to information systems, Gaulejac (2007), in a discussion of private sector companies, provides the example of Logical Systems, Applications, and Products in Data Processing (SAP), which sets its standards for finance, human resources, logistics, and various other company functions.

An interviewee from Celepar (ED14-SYB), with 32 years of experience at the company and currently working with Seed, mentioned that he is frequently called upon due to his

experience and continuous work history to participate in the drafting of public notices the secretary releases when opening competitive hiring processes through exams. Their expertise helps prevent potential appeals from applicants participating in such exams. This underscores that certain Celepar SYBs have become recognized references for secretaries in both technology and business areas.

Regarding resistance to the implementation of technologies, there were cases identified that resulted in delays in system implementation, as mentioned by interviewees ED1-SCB, ED2-SCB, and ED17-SCB. Surprisingly, one of these cases of delays in implementing a new system ultimately benefited public education policy.

According to ED17-SCB, at the end of the 1990s, during the mandate of Governor Jaime Lerner (1995-2003), there was a break with Celepar. The interviewee mentioned that there had been a complementary relationship between Celepar and the regional state education offices. However, with the rupture, a private company took over the provision of information systems for education policy. This private company disregarded previous developments, separated databases without integration, and lacked knowledge about policy processes, possessing only technical knowledge about the systems. This made the work extremely challenging. All offices were required to implement the system within a certain deadline. However, one of the offices delayed implementation as much as possible and instructed its schools to close the year using Celepar's previous system, *Sere* (which is still in use today). At the beginning of the next year, with a change of government, the contract with the private company was terminated, and it no longer provided any support. Celepar resumed using *Sere*, and the private company's system was abandoned. More than two years of information were lost, including class diaries and other documents, which had to be reinserted into the system in other regional state education offices.

Coping strategies are repertoires that actors use recurrently, created through adaptations. Such institutionalized resources enable dealing with limitations and failures in information systems and policy processes.

Schommer (2005) studied the relationship between universities and society in a training program for social managers and discovered a "privileged space for organizational learning." It can be said that this research found a similar space reflected in the coordination of public policies during implementation. At that time, SYBs, mid-level bureaucrats, and street-level bureaucrats exchanged knowledge and experiences, effectively overcoming difficulties in policy implementation.

This work aimed to comprehend the relationships between bureaucracies and their role in policy coordination, specifically in the development of information systems for public policies. Wenger (2002) and others emphasize the contribution of ICTs in enhancing coordination and fostering interdependence in operations. However, these authors also underscore that effective integration necessitates strong human relationships akin to those found in "communities of practice."

Such relationships can distinguish policies. Education policy exhibited more significant coordination problems compared to tax collection. Lowi (1972) emphasized that public policies

shape decision-making and relationships between actors. Therefore, the inherent natures of tax collection and education policy play a crucial role. As Pires (2018, p. 87) puts it:

> The state's capacity depends on a pool of skilled employees and suitable tools for policy implementation. These attributes also fluctuate over time across different areas of public policy and according to the prevailing political and institutional arrangements within each policy domain.

Tax collection policy holds greater importance for the government and displays maturity in all its processes, including information system development. Empirical evidence concerning the organizational characteristics of the secretariats helps explain these differences: higher turnover among Seed bureaucrats, separate physical locations for Seed's SYBs and mid-level bureaucrats, smaller teams of SYBs at Celepar and in ICT management at Seed, fewer hierarchical levels in Sefa (indicating lower complexity), and longer use of information systems in tax collection policy, fostering greater maturity, expertise, and collaborative relationships among its members.

CONCLUSION

The research question was: how does inter-organizational coordination occur in the development of information systems in tax collection and basic education policies in the Brazilian state of Paraná? The results showed relationships between bureaucrats based on complementarity, proximity, mutual dependence, discretion, and informality and focused on learning through coping strategies. This dynamic contributes to the coordination of public policy. There is greater job stability for Celepar's SYBs, who end up having, in many cases, greater expertise in the policy and technologies involved. One of the findings of this work is the role of Celepar as a repository of knowledge for the continuity of public policies.

These results highlight the significance of organizational stability in public policies, particularly considering government initiatives to privatize such companies. At the federal level, key public technology companies like Dataprev and Serpro were included in the National Privatization Program for potential privatization starting in January 2020. However, this process was halted with the change of government after the victory of President Luiz Inácio Lula da Silva in the 2022 general elections and the beginning of his mandate on January 1, 2023.

The research identified differences between policies in the relationships between bureaucracies and policy coordination. Empirical evidence highlights a greater emphasis on efficient management and structural development in the tax collection policy by the executive.

Examining the role of the actors and processes that interrelate in the development of information systems unveils new dimensions for the study of public administration and public policies. This approach allows for several theoretical contributions. Firstly, it identifies and emphasizes the relational role of the bureaucracies under study. These relationships are forged through the development of information systems, which, in turn, engender different types of

inter- and intra-bureaucratic relationships. Another significant theoretical contribution is the notion that these systems give rise to novel forms of dependency. This situation underscores the importance of various aspects such as expertise, domain knowledge, access to systems, passwords, and specialized knowledge. Moreover, the utilization of ICTs in policy decision-making processes leads to changes, often shifting disputes to concealed or highlighted areas within the systems. This dynamic engenders unique coping strategies specific to the use of information systems.

In terms of public policy coordination, this research has contributed to its conceptualization as an integral component of the learning process among implementing actors. It involves recognizing how coordination naturally emerges through informal mechanisms and how it can be intentionally fostered through communities of practice. Within this framework, SYBs are not merely seen as technicians but as crucial actors who possess a reservoir of knowledge and experience in politics. Their expertise extends beyond technical systems to encompass a profound understanding of the intricate relationships between information systems and policies. This multifaceted knowledge empowers SYBs to operate effectively beyond the confines of systems and politics. These individuals are instrumental in mediating and reconciling conflicting relationships among various policy actors in certain instances.

REFERENCES

Abrucio, F. L., & Sano, H. (2013). *Associativismo intergovernamental:* experiências brasileiras. IFCI; Agência Espanhola de Cooperação Internacional para o Desenvolvimento; Ministério do Planejamento, Orçamento e Gestão; IABS.

Biernacki, P., & Waldorf, D. (1981). Snowball sampling: problems and techniques of chain referral sampling. *Sociological Methods & Research*, *10*(2), 141-163. https://doi.org/10.1177/004912418101000205

Bovens, M., & Zouridis, S. (2002). From street-level to system-level bureaucracies: how information and communication technology is transforming administrative discretion and constitutional control. *Public Administration Review*, *62*(2), 174-184. https://doi.org/10.1111/0033-3352.00168

Buffat, A. (2015). Street-level bureaucracy and e-government. *Public Management Review*, *17*(1), 149-161. https://doi.org/10.1080/14719037.2013.771699

Cavalcante, P. L. C., & Lotta, G. S. (2015). *Burocracia de médio escalão:* perfil, trajetória e atuação. ENAP.

Dias, I. M. (2008). *A relação entre a reforma da administração pública e tecnologias da informação no governo do Estado de São Paulo* [tese de doutorado não publicada]. São Paulo: Universidade Estadual de São Paulo "Júlio de Mesquita Filho".

Diniz, E. H., Bailey, D. E., & Sholler, D. (2014). Achieving ICT4D project success by altering context, not technology. *USC Annenberg School for Communication & Journalism*, *10*(4), 15-29. Recuperado de https://pesquisa-eaesp.fgv.br/sites/gvpesquisa.fgv.br/files/arquivos/eduardo_diniz_-_ict4d_-_1306-3629-1-pb_0.pdf

Eisenstadt, S. (2003). *Comparative civilizations and multiple modernities*. Leiden: Brill.

Gaulejac, V. (2007). *Gestão como doença social:* ideologia, poder gerencialista e fragmentação social. Aparecida: Ideias & Letras.

Governo do Paraná. *Portal*. Recuperado de www.parana.pr.gov.br.

Haas, P. M. (1992). Introduction: epistemic communities and international policy coordination. *International Organization*, *46*(1), 1-35. https://doi.org/10.1017/S0020818300001442

Hill, M. (2006). Implementação: uma visão geral. In E. Saraiva, E. Ferrarezi (Eds.). *Políticas Públicas:* coletânea (pp. 61-89). ENAP.

Lindblom, C. (1965). *The intelligence of democracy*. Free Press.

Lindblom, C. & Woodhouse, E. J. (1993). *The policymaking process*. Prentice Hall.

Lipsky, M. (2019). *Burocracia de nível de rua:* dilemas do indivíduo nos serviços públicos. ENAP.

Loureiro, M. R., Abrucio, F. L., & Rosa, C. A. (1998). Radiografia da alta burocracia federal brasileira: o caso do Ministério da Fazenda. *Revista do Serviço Público*, *49*(4), 46-82. https://doi.org/10.21874/rsp.v49i4.400

Lowi, T. J. (1972). Four systems of policy, politics and choice. *Public Administration Review*, *32*(4), 298-310. https://doi.org/10.2307/974990

Meijer, A. (2007). Why don't they listen to us? Reasserting the role of ICT in Public Administration. *Information Polity*, *12*(4), 233-242. https://doi.org/10.3233/IP-2007-0127

Peters, B. G. (1998). Managing horizontal government: the politics of coordination. Public Administration, *76*(2), 295-311. https://doi.org/10.1111/1467-9299.00102

Peters, B. G. (2004). *The search for coordination and coherence in public policy:* return to the center? Universidade de Pitsburgo.

Pires, R. R. C. (2018). O trabalho na burocracia de médio escalão e sua influência nas políticas públicas. In R. R. C. Pires, G. S. Lotta, & V. E. Oliveira (Eds), *Burocracia e políticas públicas no Brasil:* interseções analíticas (pp. 185-206). Ipea, Enap.

Pozzebon, M., & Van Heck, E. (2006). Local adaptations of generic application systems: the case of Veiling Holambra in Brazil. *Journal of Information Technology*, *21*(2), 73-85. https://doi.org/10.1057/palgrave.jit.2000059

Pressman, J. L., & Wildavsky, A. (1973). *How great expectations in Washington are dashed in Oakland*. Califórnia: University of California Press.

Przeworski, A., & Teune, H. (1970). *The logic of comparative social inquiry*. Nova York: John Wiley.

Santos, W. G. (1979). *Cidadania e justiça: a política social na ordem brasileira*. Rio de Janeiro: Campus.

Schneider, V. (2005). Redes de políticas públicas e a condução de sociedade complexas. *Civitas – Revista de Ciências Sociais*, *5*(1), 29-58. https://doi.org/10.15448/1984-7289.2005.1.33

Schommer, P. C. (2005). *Comunidades de prática e articulação de saberes na relação entre universidade e sociedade* [tese de Doutorado não publicada]. São Paulo: Fundação Getulio Vargas /EAESP/CDAE.

Vedung, E. (2015). Autonomy and street-level bureaucrats' coping strategies. *Nordic Journal of Studies in Educational Policy*, *2015*(2), 28643. https://doi.org/10.3402/nstep.v1.28643

Wenger, E. (2002). *Cultivating communities of practice:* a guide to managing knowledge. Harvard: Harvard Business School Press.

Zanini, M. T., Migueles, C. P., Colmerauer, M., & Mansur, J.. (2013). Os elementos de coordenação informal em uma unidade policial de operações especiais. *Revista De Administração Contemporânea*, *17*(1). https://doi.org/10.1590/S1415-65552013000100007

Zanini, M. T., Conceição, M. N., & Migueles, C. P. (2018). Uma análise dos antecedentes da confiança no líder numa unidade policial de operações especiais. *Revista de Administração Pública*, *52*(3), 451-468. https://doi.org/10.1590/0034-7612167811

CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

AUTHOR CONTRIBUTION

André Luís de Castro: Conceptualization; Data Curation; Formal Analysis; Fundraising; Research; Methodology; Project Administration; Resources; Programs; Supervision; Validation; Visualization; Writing – original draft; Writing – review and editing.