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## GOVERNANCE IN CLUSTERS: AN ANALYSIS FROM THE PERSPECTIVE OF SYSTEM DYNAMICS

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**Objective:** The present study analyzes how the relation between the contextual, structural and instrumental dimensions of governance influence the evolution of productive agglomerations in the segment of gems and jewel.

**Method:** Qualitative-descriptive research was, therefore, undertaken, applying the multiple case study method on two clusters.

**Originality/Relevance:** The research fills the gap found in the research on clustering and systems dynamics and with the prospect of obtaining more reliable results on the evolution of the cluster's trajectory. Regarding the systemic view of agglomerations, especially around the topic of governance, there seems to be space for a research that involves multiple variables.

**Results:** In both cases, the existence of natural resources was fundamental for the flow of incentives from the public authorities and the support institutions, and for the definition of scope and cooperation, which resulted in positive results for the participants. Over time, it was seen that the perception of limited collective benefits on the part of the players and the weak coordination resulted in the formation of subgroups, with specific interests.

**Theoretical/methodological contributions:** The study employs a system dynamics approach, that highlights a non-linear relation between elements of a system, since this approach has had limited application in existing studies on the governance dynamics of productive agglomerations. The empirical results confirm the influence of the dimensions of governance on the evolution of the agglomerations, demonstrated by the relationships between the elements that compose them, which can inform the construction of scenarios for designing and anticipating future trajectories of productive agglomerations.

**Keywords:** Clusters. Governance. System Dynamics.

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## GOVERNANÇA DE CLUSTERS: UMA ANÁLISE NA PERSPECTIVA DA DINÂMICA DE SISTEMAS

**Objetivo:** O presente estudo analisa como a relação entre as dimensões contextual, estrutural e instrumental da governança influencia a evolução de aglomerações produtivas no segmento de gemas e joias.

**Método:** Foi realizada uma pesquisa qualitativa-descritiva, aplicando o método de estudo de casos em dois clusters.

**Originalidade / Relevância:** A pesquisa preenche lacuna encontrada nas pesquisas sobre clusters e dinâmica de sistemas e com a perspectiva de obter resultados mais fidedignos acerca da evolução da trajetória das aglomerações. Em relação à visão sistêmica das aglomerações, especialmente em torno do tema governança, parece haver espaço para uma pesquisa que envolve múltiplas variáveis.

**Resultados:** Em ambos os casos, a existência de recursos naturais foi fundamental para o fluxo de incentivos por parte das autoridades públicas e instituições de apoio e para a definição de escopo e cooperação, o que trouxe resultados positivos para os participantes. Com o passar do tempo, observou-se que os atores passaram a ter a percepção de uma limitação nos benefícios coletivos e de fraca coordenação, o que resultou na formação de subgrupos, com interesses específicos.

**Contribuições teóricas / metodológicas:** O estudo emprega uma abordagem de dinâmica de sistemas, que destaca uma relação não linear entre elementos de um sistema, uma vez que essa abordagem teve aplicação limitada em estudos existentes sobre a dinâmica de governança de aglomerações produtivas. Os resultados empíricos confirmam a influência das dimensões de governança na evolução das aglomerações, demonstrada pelas relações entre os elementos que as compõem, que podem subsidiar a construção de cenários para a concepção e antecipação de trajetórias futuras de aglomerações produtivas.

**Palavras-chave:** Clusters. Governança. Dinâmica de Sistemas.



## GOBERNANZA DE CLUSTERS: UN ANÁLISIS EN PERSPECTIVA DE LA DINÁMICA DE SISTEMAS

**Objetivo:** El presente estudio analiza cómo la relación entre las dimensiones contextual, estructural e instrumental de la gobernanza influye en la evolución de las aglomeraciones productivas en el segmento de gemas y joyas.

**Método:** Se realizó una investigación cualitativa-descriptiva, aplicando el método de estudio de casos en dos cluster.

**Originalidad / Relevancia:** La investigación llena laguna encontrada en las investigaciones sobre cluster y dinámica de sistemas y con la perspectiva de obtener resultados más fidedignos acerca de la evolución de la trayectoria de las aglomeraciones. En relación a la visión sistémica de las aglomeraciones, especialmente en torno al tema gobernanza, parece haber espacio para una investigación que involucra múltiples variables.

**Resultados:** En ambos casos, la existencia de recursos naturales fue fundamental para el flujo de incentivos por parte de las autoridades públicas e instituciones de apoyo y para la definición de alcance y cooperación, lo que trae resultados positivos para los participantes. Con el paso del tiempo, se observó que los actores pasaron a tener la percepción de una limitación en los beneficios colectivos y de baja coordinación, lo que resultó en la formación de subgrupos, con intereses específicos.

**Contribuciones teóricas / metodológicas:** El estudio emplea un enfoque de dinámica de sistemas, que destaca una relación no lineal entre elementos de un sistema, ya que este enfoque tuvo una aplicación limitada en estudios existentes sobre la dinámica de gobernanza de aglomeraciones productivas. Los resultados empíricos confirman la influencia de las dimensiones de gobernanza en la evolución de las aglomeraciones, demostrada por las relaciones entre los elementos que las componen, que pueden subsidiar la construcción de escenarios para la concepción y anticipación de trayectorias futuras de aglomeraciones productivas.

**Palabras clave:** Clusters. Gobernabilidad. Dinámica de Sistemas.



## 1 INTRODUCTION

Although the literature on clusters has discussed this type of configuration for decades and shows the benefits deriving from positive economic externalities, a new angle to this subject is represented by the increasing number of studies identifying the need for a dynamic approach to examining agglomerations (Isaksen, 2016; Li, Bathelt, & Wang, 2011; Lin, Tung, & Huang, 2006; Martin, 2010; Menzel, & Fornahl, 2010; Prado, Ferragi, Boaventura, & Telles, 2013; Smith, & Brown, 2009; Sunny, & Shu, 2017; Suire, & Vicente, 2011; Xu, Xiao, & Rahman, 2018). In particular, the arguments are centered on how and why the advantages associated with business concentration change over the course of the agglomeration's history (Boschma, & Ter Wal, 2007; Isaksen, 2016; Menzel, & Fornahl, 2010; Shin, & Hassink, 2011; Vernay, D'ippolito, & Pinkse, 2018).

Implicit in this dynamic context of clusters (or what can be called by "productive agglomerations"), the term governance has a special significance since these arrangements are based on the complementarity of resources. Trust between the parties involved the articulation of these players around common goals. These relationships require adequate mechanisms of coordination, that is, of governance, which can produce inter-firm and collective efficiency (Cario, & Nicolau, 2012; Queiroz, 2013) in a systemic logic, in which all players can intervene and make sustainable competitive advantages viable (Isaksen, 2016; Souza, & Cândido, 2012; Sunny, & Shu, 2017; Suzigan, Garcia, & Furtado, 2007)<sup>4</sup>.

In the literature on cooperative organizational designs (agglomerations, clusters, networks, alliances), there are some analytical approaches that provide support for specific dimensions of governance analysis (Albers, 2005; 2010; Humphrey, & Schmitz, 2000; Jones, Hesterly, & Borgatti, 1997; Markusen, 1995; Mueller, & Jungwirth, 2016; Provan, & Kenis, 2007; Vernay et al, 2018).

Despite the adoption of different research lenses, most of the studies seek to analyse the context and nature of inter-firm relations of the arrangement, whether directed to governance at the macro or micro-scales. In the latter, the focus is on observing the internal mechanisms of the governance system and what impact they may have on the agglomeration's efficiency and outputs (Wegner, 2012).

Adopted as the study object of this research, the minerals segment, more specifically, the gems and jewels sector, in seeking gains in collective efficiency and competitiveness throughout its productive chain, has been organized into company agglomerations in many states of Brazil (Henriques, & Soares, 2005). The clusters present in Belém, state of Pará, and

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<sup>4</sup> The concept of collective experience goes beyond the concept of external economies that is generated by the agglomeration of enterprises (Krugman, 1991; Marshall, 1982). It presupposes a shared existence of the firms located in the same geographical region (joint action), which, together, generate synergy capable of producing advantages that would not be possible if they acted in isolation (Schmitz, 1997).



Soledade in Rio Grande do Sul, were chosen from among the productive agglomerations in the gems and jewellery segment as a particular focus here.

It is intended that the present study fill the gap found in the research on the subject of productive agglomerations and system dynamics, confirmed by the survey carried out by Prado et al. (2013), and with the prospect of obtaining more agile and evolutionary results.

Regarding the systemic view of agglomerations, especially around the topic of governance, there seems to be space for a research that involves multiple variables, trying to understand the peculiarities of each cluster. This point of view has been adopted by scholars (Buendía, 2005; Dangelico, Garavelli, & Petruzzelli, 2010; Jan, Chan, & Teng, 2012; Lin, Bathelt, & Wang, 2006; Ma, & Huang, 2008; Prado et al., 2013; Smith, & Brown, 2009; Sunny, & Shu, 2017; Teekasap, 2009; Zaccarelli, Telles, Siqueira, Boaventura, & Donaire, 2008, Xu et al., 2018) who have opted for system dynamics to carry out their research on clusters and the main factors that affect them, under the argument that the literature is lacking in research from this perspective. Taking these observations as a starting point, the present research adopts elements of system dynamics to investigate governance in productive agglomerations and attempts to answer the following question: how do relations between the dimensions of governance influence the trajectory of gems and jewellery agglomerations?

It was designed a study to investigate how the relations between the dimensions of governance - contextual, structural and instrumental - influence the trajectory of agglomerations of firms in the gems and jewels sector. From the general objective, the following specific objectives were formulated: a) report, from the perspective of the dynamic approach, the causal relations between the contextual, structural and instrumental dimensions of governance in the agglomerations investigated; and b) indicate how the causal relationships between elements of governance influence the different forms of governance and how they impact on the trajectory of the agglomerations of firms in the gems and jewels sector.

This article is divided into five sections, including this introduction. The second section presents the theoretical framework by reviewing the state of the art of literature in the dynamic approach to the analysis of the governance of productive agglomerations. The third section describes the methodology used in empirical research. The fourth section, "data analysis", introduces the application of the dynamic approach to the analysis of governance in the selected clusters. The fifth and final section concludes the discussion and records the final considerations of this work.

## **2 THEORETICAL REFERENCES**

### **2.1 A Dynamic Approach to Cluster Analysis**

In order to stimulate discussions about the behavior of agglomerations over time, authors have proposed the examination of different dimensions of this type of arrangement and used



typologies based on their developmental stages, ranging from growth to maturation (Isaksen, 2016; Hassink, Fornahl, Menzel, & Tödtling, 2012; Shin, & Hassink, 2011; Sunny, & Shu, 2017; Xu et al., 2018). By doing so, the agglomeration is analysed from an evolutionary perspective, as suggested by Van Klink and De Langen (2001) and Menzel and Fornahl (2010).

Li et al. (2006) suggest a dynamic approach to agglomeration analysis, as do other authors (Buendía, 2005; Dangelico et al., 2010; Jan et al., 2012; Kasabov, & Sundaram, 2016; Lin et al., 2006; Ma, & Huang, 2008; Prado et al., 2013; Smith, & Brown, 2009; Sunny, & Shu, 2017; Teekasap, 2009; Zacarelli et al., 2008; Xu et al., 2018) who have opted for system dynamics to carry out their research on company agglomerations and on the main factors that affect them. System dynamics is an approach concerned with the complex relations between the elements of a system and with how those constituent elements are structured. There is a consideration of the non-linear connections, or feedback mechanisms, by which systems are assembled (Lin et al., 2006; Sunny, & Shu, 2017). To date, the authors suggest that there are still relatively few studies that adopt such an approach that considers the broader system-level structure and the qualitative-descriptive nature of different elements and their relations.

In a literature review by Prado et al. (2013), on company agglomerations and system dynamics, It was confirmed the lack of studies related to analysing systems as complex ensembles, demonstrating that there is a need for more work of this nature. Prado et al. (2013), for example, provide a limited set of references authors (Buendía, 2005; Dangelico et al., 2010; Jan et al., 2012; Lin et al., 2006; Ma, & Huang, 2008; Prado et al., 2013; Smith, & Brown, 2009; Teekasap, 2009; Zacarelli et al., 2008) for the adoption of system dynamics in cluster analysis, both as a conceptual approach as well as applied to particular cases.

Given that productive agglomerations are based on the complementarity of resources, trust between the parties involved and the articulation of these players around common objectives, and the need for adequate coordination mechanisms, the governance theme emerges as a core element of inter-firm articulation. Moreover, to be effective, such governance must operate in a systemic manner, whereby all players can intervene and increment sustainable competitive advantages (Souza, & Cândido, 2012).

With the ideas presented until now, it's important to considerate the nature of governance dynamics. Therefore, one can proceed to the discussion of governance in agglomerations of companies, which has been adopted as the main focus of this study.

## 2.2 Governance

Jones et al. (1997) argue that network governance, based on informal and horizontal relations, is a distinct form of coordination of economic activity, contrasting and competing with market action or trade anarchy and hierarchies (Provan, & Kenis, 2007; Williamson, 1985). According to the authors, this form of governance presupposes inter-firm cooperation and is



an alternative to the sporadic conditions of exchange, based only on market prices, because they involve social control mechanisms of business activity. In this respect, it is likely that this form of governance has advantages over the "market" and "hierarchy" forms for firms' performance in relation to adaptation, coordination and the safeguarding of exchanges.

To explain the emerge and consolidation of this form of governance, Jones et al. (1997) suggest a "General Theory of Network Governance", that combines elements of Williamson's (1985) transaction cost economics (which emphasizes exchange between a dyad) and social network theory (which considers a broader network system architecture). With regards to the former, Jones et al. (1997) draw on transaction cost economics (TCE) to identify key elements that constitute the "conditions of exchange". They are conditions that can establish which form of governance is most efficient. For Jones et al. (1997), the interaction of these conditions leads to "structural embeddedness", a concept that is drawn from social network theory and refers to the extent to which a "dyad's mutual contacts are connected to one another" (Granovetter, 1992, p. 35). "Structural embeddedness" gives rise to "social mechanisms", namely restricted access, macro-culture, collective sanctions and reputation (Jones et al., 1997) - all of which play a role in the coordination of the network.

Like Jones et al. (1997), Albers (2005) focuses on research related to micro-governance from the perspective of structural and instrumental dimensions (see also Wegner, 2012), and Mueller and Jungwirth (2016) in contextual and structural ones. The structural dimension, considered a static phenomenon, refers to the fixed and formal aspects of governance, that is, to the conditions established either through contractual agreements or the institutional features as reflected in the variables of centralization, specialization and formalization (Albers, 2005). The degree of centralization refers to the locale of authority and its dispersion among the players (Albers, 2010; Mueller, & Jungwirth, 2016), that is, the distribution of authority and power among the members.

A governance structure is centralized if authority over relevant aspects is concentrated in the hands of one or a few. With regards to specialization, a governance structure is considered specialized if the partner companies establish dedicated positions or management units to carry out the tasks of the collective grouping (Albers, 2005, 2010). The formalization of the governance system addresses the degree to which relations are regulated and agreed upon and the level to which appropriate responses to contingencies are predefined (Weber, & Pádula, 2013; Albers, 2005, 2010; Mueller, & Jungwirth, 2016).

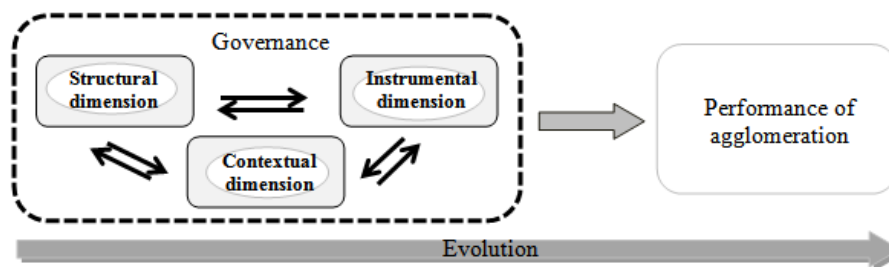
In contrast to the structural dimension, the instrumental dimension is concerned with the dynamic phenomenon and includes the delineation of the grouping's activities, in other words, the governance process, identified as the functional part of the relations. More specifically, it concerns mechanisms of coordination, control and incentives (Albers, 2005). Coordination mechanisms serve the function of orienting and influencing the behavior of its members



(Albers, 2005, 2010; Vernay et al., 2018). Control, another element of the instrumental dimension, is understood as the monitoring and measurement of the players' performance concerning the expected results and behaviors, in addition to occurrence of sanctions for those who do not comply with established rules (Albers, 2005).

The mechanisms of incentive or reward are those capable of generating motivation, which can be defined as the degree to which the player, voluntarily, decides to engage in specific behaviors that benefit the interests of the group (Albers, 2005, Albers, 2010; Vernay et al., 2018). In addition, Albers (2010) presents a set of contingencies pertinent to the adoption of a particular governance model, which relate to company size and experience, size and scope, levels of confidence or uncertainty among the members, consensus about objectives of the internal environment, as well as the complexity and stability of the external environment.

A conceptual framework was developed and contributes to conduct the empirical research, as described in Figure 1.



**Figure 1: Conceptual framework**  
Source: Based on Albers (2005)

The conceptual model is composed of dimensions and elements, as described in Figure 2, which were adopted as an analysis table.

Dimension	Elements	Research Topics
Contextual	Environment	The context in which the agglomeration is inserted regarding its market, resources, complexity.
	Sharing	Sharing of information, resources, joint action, interaction, conflict.
	Macroculture	Sensitization of the players and diffusion of a culture focused on collective efficiency, cooperation.
	Trust	Level of trust; influence of trust on cooperation.
	Characteristics of firms	Identification of the size and experience of the firms that make up the agglomeration.
	Size and Scope	Size of agglomeration; scope and consensus in relation to objectives
Structural	Centralization	Distribution of authority and dispersion of power among the members of the agglomeration.
	Specialization	Existence or not of dedicated positions in the firms for agglomeration management.
	Formalization	Whether relationships are regulated and agreed upon, and whether there are predefined strategies, described and set for contingencies.
Instrumental	Coordination	Guidance and influence relative to performance parameters and desirable behaviour
	Control	Existence of monitoring and measurement of the players' performance in





		relation to expected results and behaviors and occurrence of sanctions for those who do not comply with established rules.
	Incentives	Existence of mechanisms capable of motivating the players for engaging the interests and benefits of the agglomeration.

**Figure 2: Dimensions and elements of research deduced from the conceptual framework**  
**Source: Based on Albers (2005)**

By presenting the elements that make up the governance structure and mechanisms, it seems plausible to suggest that these elements are interrelated and, if analyzed with a dynamic approach that recognizes this interrelated nature, it is possible to identify cause and effect relationships that shape governance dynamics. An understanding of such relations is significant in that it can inform decision making on the operational characteristics of governance with the potential for increasing the efficiency of productive agglomerations.

The next section presents the methodology that guided the empirical research.

### 3 METHODOLOGICAL PROCEDURES

In the present study, a qualitative perspective was adopted to analyse governance in productive agglomerations by means of the dynamic approach, since, considering the context studied, such a model is justified by its openness, emphasizing the particular scope of a reality (Godoy, 1995).

It was chosen to study multiple cases in order to enhance the quality of the research (with quality defined in terms of a combination of validity - construct, internal and external - and reliability), as suggested by Yin (2005). In addition, the study of multiple cases is intended to reduce vulnerability and to widen the analytical benefits as different realities are investigated (Eisenhardt, 1989; Yin, 2005).

From the list of arrangements of stones, gems and jewels, the productive agglomerations of Belém in Pará and Soledade in Rio Grande do Sul were chosen as the unit of analysis. The selection of cases was intentional and justified by the fact that these agglomerations enjoy nationwide economic and social visibility, are recognized by the literature as clusters (Alamino, Villa Verde, & Fernandes, 2014, Batisti, & Tatsch, 2012, Castro, & Baldi, 2010, Chaves, 2014, Costa, & Jornada, 2013; Zanin, Costa, & Feix, 2013), and enshrined in public policy-making, especially in their own states.

For this study, it was used multiple sources of evidence, such as in-depth interviews, a review of documents, informal conversations and participation in events to allow, for triangulation, the cross-checking of findings from different sources that increases the reliability of the research. The primary source of data was interviews with players who represented a cross-section of participants (direct or indirect) of the productive agglomerations. It was adopted a semi-structured interview script, based on the conceptual framework, which generated broad questions of inquiry related to the three dimensions of governance and their respective elements.



The data were collected from 23 interviews carried out at the *São José Liberto* jewel pole, in Belém, Pará, and at the international fair of gems and jewels, in Soledade, Rio Grande do Sul. The document-based research used reports issued by government agencies, trade unions and gem and jewellery associations specialized website content and scientific articles that adopted the gems and jewel segments of Pará and Rio Grande do Sul as objects of study.

The data analysis phase involved the use of content analysis techniques and the application of the system dynamics approach. It is a content analysis, based on the dimensions proposed in the conceptual framework of the research, focusing on the history of the arrangements and careful attention to the findings that could emerge from the documentation.

The content analysis did not present new dimensions or elements of the dimensions (Figure 2) that could be added to the theoretical model formulated to analyse the research data. However, it was possible to identify more specific characteristics of items related to the elements. For example, in the element "Environment", the importance of the presence of natural resources was clearly verified. In the same way, it was observed to emerge the item "formation of new groups", related to the elements "macro-culture", "confidence" and "size and scope", attach to the contextual dimension, as well as to the element "coordination", belonging to the instrumental dimension.

Atlas TI software was used in systematization and codification. In the light of the empirical evidence, aspects of system dynamics were used to prepare diagrams of causal cycles, which sought to express the causal relationships between the elements of governance and explain their influence on the performance and evolution of the agglomerations. The soft system dynamics approach was adopted, which is oriented towards a more participative modelling and anchored in qualitative aspects. The software Vensim® PLE, version 6.3, was used, which is specific for the preparation of dynamic models and causal diagrams. The analysis of the causal cycle diagrams was performed considering the interactive influences among the elements of the governance dimensions (contextual, structural and instrumental), for the purpose of providing explanations for the performance and evolution of the agglomerations.

## **4 RESULTS PRESENTATION AND ANALYSIS**

### **4.1 Application of the Dynamic Approach to Governance in Productive Agglomerations**

Through the theoretical basis and the analysis of the data collected, the most relevant relationships were extracted from the researchers, which does not mean the possibilities of observation on the subject under study were exhausted, given the dynamism of the real world (Li et al., 2006). It is emphasized that a dynamic perspective holds that elements can be classified as "dependent" (i.e. those that are influenced), "independent" (i.e. those that influence) or "interdependent" (i.e. those that influence and are influenced) (Weick, 1979).





culture based on trust, cooperation and information sharing and common marketing space. Now, the pole was being structured. These factors represented fundamental pillars, which exerted a positive influence in its development.

While the pole was being run by the *São José Liberto* Association (ASJL), there was more opening for its members to participate, with a low level of centralization. This phase coincides with the emergence and growth cycle of the pole, when there were fewer members, and more motivation to achieve common goals and, as consequence, more progress was made.

Over time, the same elements that had had a positive influence at the beginning seem to have started to produce the opposite effect, with government investment taking on the form of a “subsidy” for expenses to maintain the jewel pole. This caused complacency by the participants, and the pronounced motif of the products ended due to a contraction of the consumer market, which started to demand universal and less specifically designed pieces. Furthermore, there was the question of the low investment in technology, also caused by the complacency mentioned, that resulted in stagnation of the businesses existing in the pole.

As for macro-culture, the current perception is a low degree of confidence, which contributes negatively to the cooperation between the participants in the pole and to the low intensity of the relationships. This latter item reflects the lack of sharing of resources and information and the current inter-firm relationship, which is now characterized by market exchange. In this scenario, it is possible to highlight only one positive initiative, which is the formation of the private consortium denominated *Joias do Pará*. These players continue to practice cooperation and, consequently, seem to be building bonds of trust in pursuit of a common goal, which in their case is the entry into the international market.

Regarding the size and scope of the jewel pole, it was seen that, after reaching a significant number of participants, access of new members has become restricted, especially in the occupation of the individual trading space in the *São José Liberto* jewel pole. The *São José Liberto* jewel pole does not adopt a system of rotation of the shopkeepers, which seems to have caused a certain passivity in the entrepreneurs who are already physically installed in the pole and, at the same time, a certain lack of motivation in those who intend to develop their enterprise but suffer from this limitation. This situation affects the macro-culture of the pole since it does not promote information exchange, cooperation and the search for common objectives, which results in weak ties of trust, instead of the desired contrary effect. On the other hand, it should be noticed that, even if only timidly, the presence of new participants through the trade show “*Loja Una*” has provoked a positive effect of combating complacency, by invigorating the pole’s dynamics with producers that have been trained and are up-to-date, who have increased competitiveness within the agglomeration.

Although, it is possible to see negative influences among some elements at the present time. This does not seem to interfere with the size and scope of the pole, especially regarding



its good reputation with the environment, which confirms the social, economic and historical-cultural relevance of the *Associação São José Liberto*. This contributes to the maintenance of the flow of incentives by the government and partner institutions.

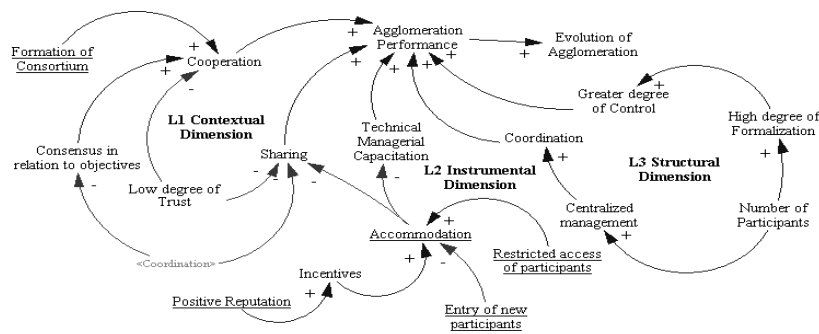
At the Pará jewel pole, there is a strong **centralization** of decisions in the hands of the managing body, which is subject to interference from the state government through the rules imposed in the management contract provided by the government. This condition, as it does not encourage participation in decisions, has a negative effect on the agglomeration's macro-culture and makes the development of bonds of trust more difficult. This is because it represents a barrier to information exchange among participants and, therefore, limits the possibility of dissemination of knowledge. In addition, the presence of the public authorities within the pole, which at first seems to have been a commendable initiative, currently represents lock-in for the participants, through fixed levels of funding and interfering in the issues related to the size and scope of the agglomeration.

As far as the impact of formalization in the context of the jewel pole is concerned, the advances in standardization of processes implemented by the new management provided more clarity and transparency in the formal relations and generated a positive effect for the coordination of the arrangement. Furthermore, the elaboration of rules and regulations, defining the expected behaviour of the players, began to allow the pole members' actions to be controlled by a set of pre-defined parameters.

Regarding incentives, the role of the state government, which since the beginning of the pole has been investing continuously in the program through funding approved in its annual budget. The form of investment made by the government seems to have had a positive effect on the emergence of the pole, contributing to the training and segment organization of gems and jewels. However, over time, maintaining the incentive without a clear definition of what is expected in return from the entrepreneurs seems to have generated perverse stability and, consequently, the stagnation of the pole.

The control element seems to be present within the Pará jewel pole and has been driven by the formalization of processes. The existence of partial control of product quality can be identified, restricted to the parts sold in Loja Una and to those that are shown at fairs and exhibitions. This initiative has a positive impact on the environment, especially concerning the credibility of the products within the market. Management, based on formal and informal agreements at the pole, also monitors participants' behaviour. This monitoring, even if in an unsystematic way, contributes to compliance with the rules, which consequently assists in the performance of the agglomeration.

Figure 4 describes the causal relationships presented by the productive cluster - Pará jewel.



**Figure 4: Causal relations between the dimensions of the governance of the Pará Jewel Pole**  
Source: Elaborated by the authors (2018)

### 4.3 Application of the generic model to the cluster of stones, gems and jewels of Rio Grande do Sul

The stones, gems and jewels agglomeration of Rio Grande do Sul (RS), with its abundance of natural resources, and mineral deposits of gems, drove the emergence, growth and organization of the sector around, at first, the extractive activity, followed by the chain of processing of the stone and adding of value. As well, it is important to mention the historical character, understood by Marshall (1982) as being an initial accident that explains the emergence of the activity in the territory.

Combined with the existence of mineral deposits, this historical aspect includes the arrival of German settlers from Idar-Oberstein, a region known for being a traditional center for the extraction, cutting and tinting of gems, specializing in work with agate (Costa, & Jornada, 2013). These settlers, in addition to discovering the Rio Grande do Sul deposits, also brought mining and processing techniques to the region, contributing to the genesis of this industry in Rio Grande do Sul (Costa, & Jornada, 2013). From the conjunction of the "natural resources" and "skilled labor" factors, the specificities inherent to the process of extraction and processing also generated Marshallian external economies. The relevance of the activities related to the segment of stones, gems and jewels in Rio Grande do Sul led to the creation of incentives by the government, by means of public policies to stimulate the evolution of the sector. At the same time, there was the mobilization of several players that contributed to the agglomeration effect, mainly through technical and managerial training.

The prominent position of the stones, gems and jewels segment in the state, with the market and typical local economic activities, attracted the interest of entrepreneurs, often from the region itself, who started their businesses in the sector. In this respect, it is understood that over time, the entry of new participants in the agglomeration, each with its distinct characteristics in terms of size and position in the production chain, led to a dispersion of consensus in relation to common objectives.

Considering macro-culture, trust was shown to be present, as well as the intensity of relationships based mainly on social contracts and a sense of belonging, which enabled a



certain degree of cooperation among the participants. In this scenario, it should be noted that the coordination and credibility of the management entity at the time, the Universidade de Passo Fundo (UPF), an important Brazilian university, together with other institutions of governance, such as SEBRAE (a Brazilian small business support service), contributed to the consensus and willingness to cooperate, aimed at positive performance and the evolution of the agglomeration.

Regarding centralization, despite the existence of the coordinating figure of the governance entity, which characterized an administrative organization of the agglomeration, the decisions in the stones, gems and jewels agglomeration have always been taken collegially among entities. During the period (five years) that the management was exercised by the UPF, coordination had an important role in facilitating sharing, due to the creation of the technological center, participation in events and training. The stimulus for information exchange, joint action and consensus, was also motivated, as previously mentioned, by the credibility of the UPF management.

Throughout the agglomeration's development, the low degree of formalization in the stones, gems and jewels agglomeration in RS seems to have partially compromised the control mechanisms, especially that of results, since no evaluation indicators or goals came to attention. This seems to have led to low involvement of participants in cooperation, thus influencing agglomeration performance.

Regarding **incentives**, the important role of the state government, which since the beginning has been continuously investing in this kind of productive configuration, was identified through grants to support programs. In addition, the UPF, SEBRAE, Technological Center and other support entities also contributed significantly to the development of the agglomeration. Such incentives have positively influenced the entry of new participants as participants could see, even if not always clear, the benefits they could enjoy by being part of the group.

With the beginning of a new agglomeration management *APPESOL* (Associação dos Pequenos Pedristas de Soledade), which occurred due to a legal imposition by the government, some actions have started to indicate new directions for the gems and jewels sector. Despite the intensity of the relationships, based mainly on social contracts and a sense of belonging, there is currently no high level of cooperation among participants. There is a lot of warmth and respect among peers, but members conduct their businesses individually, establishing relationships of trust based primarily on long-standing friendships. There seems to be an interest among participants in promoting cooperative work, involving mutual aid and common goals. However, they fail to put this desire into practice and, as said earlier, this appears to be partly responsible for the low coordination level on the part of the management entity *APPESOL*.

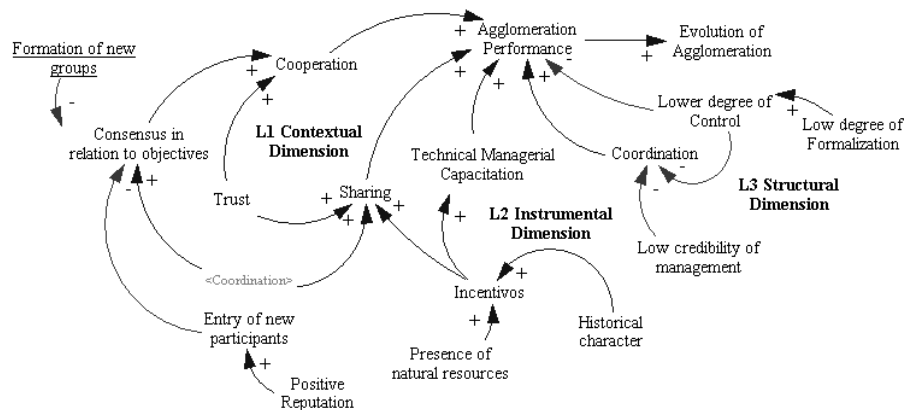


There is a very positive expectation on the part of the participants regarding the future of the agglomeration, even with the feeling that effective results have not yet appeared from the action that has already been taken. Despite this optimism, it can be seen that the breadth of the segment's productive chain has led to the formation and/or strengthening of small groups with specific interests, even though in a veiled and sometimes even unconscious way, which lead, for example, to the formation of the consortium *Rede Sul de Joias*.

The possibility of participation of all the companies in the segment without the demand for formalization and *quid pro quo*, and the absence of formal rules and regulations, as well as the lack of clear objectives, benefits the low commitment to the initiatives and results of the agglomeration, leaving the responsibility, in particular, to the governance body.

As mentioned above, there is no apparent control of company results, which once again seems to suggest to the lack of direction and clarity of common objectives, a recurring factor in the analyses that have already been carried out in the productive agglomeration of stones, gems and jewels of Rio Grande do Sul. Despite this, participants can be considered as desiring the evolution of the agglomeration and better-defined guidelines, and this in itself demonstrates positive development possibilities.

The Figure 5 above shows the causal relationships observed in the productive agglomeration of stones, gems and jewels of Rio Grande do Sul.



**Figure 5: Causal relationships observed in the productive agglomeration of stones, gems and jewels of Rio Grande do Sul**  
Source: Elaborated by the authors (2018)

## 5 CONCLUSIONS

As was previously presented, it was designed a study to investigate how the relations between the dimensions of governance - contextual, structural and instrumental - influence the trajectory of agglomerations of firms in the gems and jewels sector. Specifically, it was sought to report, from the perspective of the dynamic approach, the causal relationships between the contextual, structural and instrumental dimensions of governance in the agglomerations surveyed, and indicate how these relationships between elements of governance can influence different forms of governance.





When applying the intended approach to the selected research fields, similar trends in the pattern of governance in the jewel pole of Pará and the productive arrangement of stones, gems and jewels of Rio Grande do Sul were observed, despite the specificities of each agglomeration. The inductive analysis of the research data, considering the contextual, structural and instrumental dimensions of governance and their inter-relations, seems to indicate some important theoretical elements.

The first concerns the influence of contextual factors on the trajectory of agglomerations and their relationship with the structural and instrumental dimensions of governance. The agglomerations investigated were marked by abundant natural resources, which, in the cases investigated, served as a propelling factor for the beginning of inter-firm relations in the segment. The strong presence of natural resources and the prospect of regional development around the segment of stones, gems and jewels, made the scope of inter-firm configuration in its formation well defined, and stimulated the contribution of incentives from public institutions and private partnerships.

Indeed, this finding is consistent with Marshall (1982), when he states that the phenomenon of geographic concentrations of companies is influenced by the availability, proximity and quality of natural resources in a given region. A consideration of these attributes complements the list of facilitating factors proposed by Silva, Castro e Antonialli (2014) and follows the recommendation of Ter Wal and Boschma (2011), which indicates the need to include the factors that are specific to the region in the analysis of the life cycle of the arrangements.

In the same proportion, trust and, consequently, more cooperation, were identified in both territories, especially in the emergence stage for each agglomeration. According to Nahapiet and Goshal (1998), players who develop a high degree of confidence tend to cooperate more, as this contributes to the exchange of knowledge and collaboration among partners because they feel secured against opportunistic behaviour (Azevedo, Pardini, & Simão, 2015). It was observed that, in the initial stages of the agglomeration for the two cases investigated, there was a tendency for the players involved to cast a vote of confidence in the people and institutions, which they were joining, and to strive to reach their collective goals (see also discussion in Wegner, De Rossi e Scarano (2014)). This is due to the positive expectation regarding the synergy that can be generated from the meeting of companies of the same segment around the same territory.

Nevertheless, as Sousa, Brito, Silva e Araújo (2015) describe, it seems that if a given stage of trust is reached, it may no longer yield more cooperation, although for a different reason or simply because the participants no longer perceive the benefits of the inter-firm relationship. This situation could be avoided. It is understood that the agglomeration management, through coordination, must act in the preparation of an agenda of value creation



for the participants, and of a plan for its execution, as well as to take corrective measures to improve cooperation (Wegner et al., 2014; Vernay et al., 2018).

The role of formalization in the context of cooperation must also be considered. Here, more emphasis should be placed on the degree to which activities are predefined, regardless of whether these rules are encoded in written documents. The extent to which inter-organizational relationships are formalized or explicitly regulated, through contractual mechanisms, is an important dimension of cooperation (Wegner, & Pádula, 2013; Mueller, & Jungwirth, 2016).

Also concerning cooperation, it was seen that this is maintained by the participants of both agglomerations, even though in smaller doses than in the beginning, due to the maintenance of the good reputation acquired by the agglomerations in the segment of gems and jewels. Encouraged by the costs that might be incurred with loss of reputation, the cases investigated showed that participants in inter-firm configurations employ informal control (Sousa et al., 2015), such as in the careful checking of the origin of the raw material, which has given the arrangements a privileged position in the national and world scene up until the present.

Finally, it is emphasized that interpersonal relationships contribute greatly to the development dynamics of agglomerations and these relationships can often be fostered by external agents, that is, supporting institutions, which have the role of organizing initial actions and promoting cooperation, functioning as a strong incentive for the constitution and evolution of inter-firm configurations (Wegner et al., 2014; Vernay et al., 2018).

The second theoretical implication of the work refers to the influence of instrumental elements in the trajectory of agglomerations and its relation to the contextual and structural dimensions of governance. In the initial stage of agglomeration, companies interested in being part of the cluster identify common problems and opportunities that can be exploited through cooperative work.

From this, it becomes necessary to promote the internal organization, through a governance structure, that must play the role of orchestrating the activities to be able to reach the collective objectives (Wegner, & Pádula, 2013, Vernay et al., 2018). In the cases investigated, it was inferred that the entities responsible for governance, initially based on a shared model and, later, migrating to something more centralized model related to a Network Administrative Organization (NAO) (Provan, & Kenis, 2007), took on the role of conducting the action aimed at achieving the group's goals.

In relation to both poles, it can be stated that evolution was detected in the segments after formation of the agglomerations and the joint action of the companies, although, in the Pará pole, after entry of the new management, the degree of centralization grew more than in the Rio Grande do Sul agglomeration. In both places also, the coordination activity has not made clear the roles of the players involved.



It seems to be important to define these roles, so that the efforts are directed towards the achievement of common results, a point that is also highlighted in the studies of Oliveira, Damiani e Fischer (2014) and Wegner et al. (2014). This reality may be generated, in the case of the Pará jewel pole, by expanding the scope of the management entity, which has acted in the interest of maintaining the “São José Liberto” space as a tourist/historical/cultural reference. In the Rio Grande do Sul stones, gems and jewels agglomeration, the situation is the opposite. There is more limited action, which is focused on safety, environmental and health issues, and company formalization.

Over time, the relationship between the participants has matured or changed with changes, such as the formation of the subgroups mentioned, arising not only from geographical proximity, but also from the affinity of goals.

In this aspect, cooperative relations were developed and results of collective efficiency in their focus of action were obtained in this subgroups. Thus, due to the dynamic scenario in which the inter-firm configurations are involved, events such as the formation of consortium should be able to cause changes in the agglomeration’s trajectory, allowing the breaking of lock-ins, which will require changes and/or adaptations in governance (Li et al., 2011; Wegner, & Pádula, 2013).

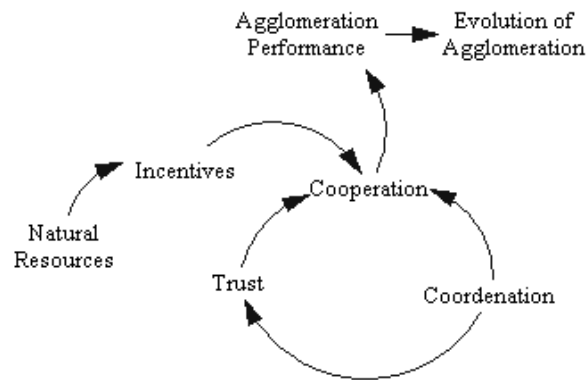
The support of public and private institutions is also a relevant issue for the formation and development of company agglomerations (Wegner et al., 2014; Vernay et al., 2018). In both locations, Pará and Rio Grande do Sul, the public authorities assumed the role of coordination and development of the institutional environment for the creation and evolution of the arrangements investigated.

This incentive, motivated by the striking existence of natural resources and by the foresight shown in promoting regional development through the gem and jewel production chain, was of fundamental importance for the agglomerations’ trajectories.

At the same, as the findings of the cases suggest, the continuation of such a collaborative spirit in the mature stage of development is challenging.

It requires a delicate balance between sustaining the participation and involvement of participants (new and established) and establishing some direction (i.e. “control” or guidelines) needed for coordination.

The results presented allowed the refinement of the generic model elaborated in the light of the dynamic approach and the elaboration of a synthetic model containing the main relations among the elements of governance, which to a certain extent could predict the potential of the agglomerations evolution, according to Figure 6.



**Figure 6: Synthetic model**  
**Source: Elaborated by the authors (2018)**

It was identified that elements of governance, such as cooperation, incentives (in this case, represented by support institutions), coordination, besides trust and environment (on this occasion, portrayed by the presence of natural resources), light of the cases investigated, as conditions for the formation and development of clusters. The emergence of new groups is also highlighted, due to the lack of confidence and lack of alignment with the common objectives.

In sum, the study amplifies the scope of research into productive agglomerations and represents an advance in the research on this specific type of configuration by illustrating how two clusters at opposite ends (spatially) of Brazil, despite the large geographical distance between them, have revealed similar aspects in terms of the behaviour of the institutions and players. The study highlights that the elements of governance, such as cooperation, support institutions (incentives), coordination, trust and resources, as well as their inter-relation, were of prime importance in the cases investigated, as conditioning factors in the formation and development of agglomerations.

It is important to emphasize that the firms that compose these agglomerations are essentially small companies, which seek to strengthen themselves through joint action, which is able to offer these organizations advantages that would not be possible if they acted alone (Schmitz, 1997). Thus, it is understood that the present study also offers a valuable contribution to the entrepreneurship and management of micro and small enterprises, by exposing the relevance of the articulation between the actors involved in productive agglomerations, through adequate governance mechanisms, which enable efficiency collective, in which all these actors can interfere and enable the increment of sustainable competitive advantages.

From a methodological perspective, the procedure applied, characterized by a dynamic approach that combines qualitative-descriptive and systemic analyses, made it possible to understand more precisely the dimensions and elements involved in the governance of arrangements and the impact these have on the agglomerations investigated.

Finally, from the practical point of view, the findings provide insight into the formulation of



growth and development programs by shedding light on how certain governance orientations can enhance or weaken productive agglomerations in the course of their evolution.

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