



**Observatory of the dynamics of interactions between societies and
environment in the amazon
Sustainability and adaptations to global changes**

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INTERACTIONS BETWEEN PUBLIC POLICY INSTRUMENTS: CONCEPTS, GAPS AND FUTURE RESEARCH AGENDA

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PART I - LITERATURE REVIEW

A comprehensive literature is awakening for aspects such as the interactions between public policy instruments, the cross-sectorial interaction, the governance between multiple levels of public action, the conflicts between sectorial agendas and the intern competition for resources. Despite of its multiple origins and different thematic developments, this literature discusses, generally, the implementation of approaches that might avoid fragmentary decisions and prove the integration of different, but interrelated, policies. Different concepts emerge from this debate and they are often used equivalently: *policy integration, policy mix, policy coherence, multilevel policy, cross-sectoral policy, etc.* The multiplication of these terms reflects, mostly, the confirmation of a spread of power in public action, characterized as an entanglement of agencies, organizations, norms and negotiation procedures with an increasing number of actors (Lascoumes & Le Galès 2004).

A series of revisions of this literature is already available (Persson 2004; Flanagan et al. 2011; Nilsson et al. 2012; Ring & Barton 2015; Weitz et al. 2017; Nilsson & Persson 2017). However, these aimed separately each concept and have been applied to distinct subjects. This study presents a comprehensive revision of literature associated with different concepts, aiming to strengthen its understanding, by identifying its points of contact, possible interactions and potential uses, as well as the gaps on existing studies. The results intend to support an ascending debate either in the public policies academic analysis as in the public management scope. We aim, specifically, to support the socio-environmental changes observatories (European Commission /H2020 Program).

In the first section different origins and terminologies are mapped, in order to highlight the most common subjects of the literature. In the second section, the main analytical categories transversally related to the concepts, the main inhibiting and promoting factors of integration according to different approaches, and the methods mobilized by theses studies are presented. At last, the main gaps, limits and opportunities for the use of different concepts in academic debates are summarized. The bibliographical survey was carried out on the most relevant article bases in English language¹. The references considered in the review contained the concepts in their titles, abstracts or key-words. The references unrelated to the subject were excluded, what

¹ Research of the key-words “policy integration”; “policy mix”; “policy coherence”; “cross-sectoral” + “policy”; “multilevel policy”; “policy mapping”; “nexus approach” in the text bases Scopus, Web of Science, Science Direct, World Bank, Willey.

lead us to a non exhaustive base of 415 articles published from 1985 onwards. They were firstly trialed by using textual analyses programs (*QDA Miner* e *WordStat*). Secondly, text bases in other languages² were consulted to strengthen the analysis.

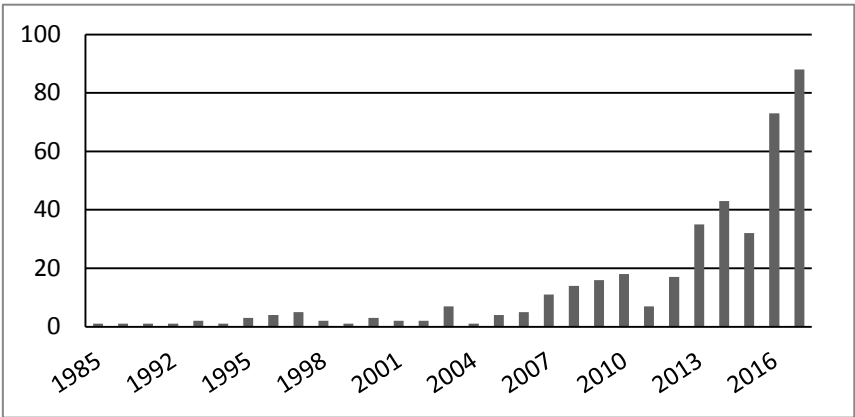
1. MAPPING THE DIFFERENT CONCEPTS

1.1. AUTHORS AND GEOGRAPHICAL FOCUS: A EMINENTLY EUROPEAN RESEARCH AGENDA OF THE 21ST CENTURY

The majority of the studies was published from the year 2000 onwards (“state-centered” models.

Figure 1), despite the former origin of some of them. As shown below, this is the case of concepts as “policy mix”, emerged in the 1960’s, or even “integrated natural resources management”, that originated the “water-energy-food nexus”. However, the idea of a coherent articulation of public actions and actors has become more relevant in the last decade, marked by the critic of traditional “state-centered” models.

FIGURE 1: NUMBER OF ACADEMIC PUBLICATIONS PER YEAR

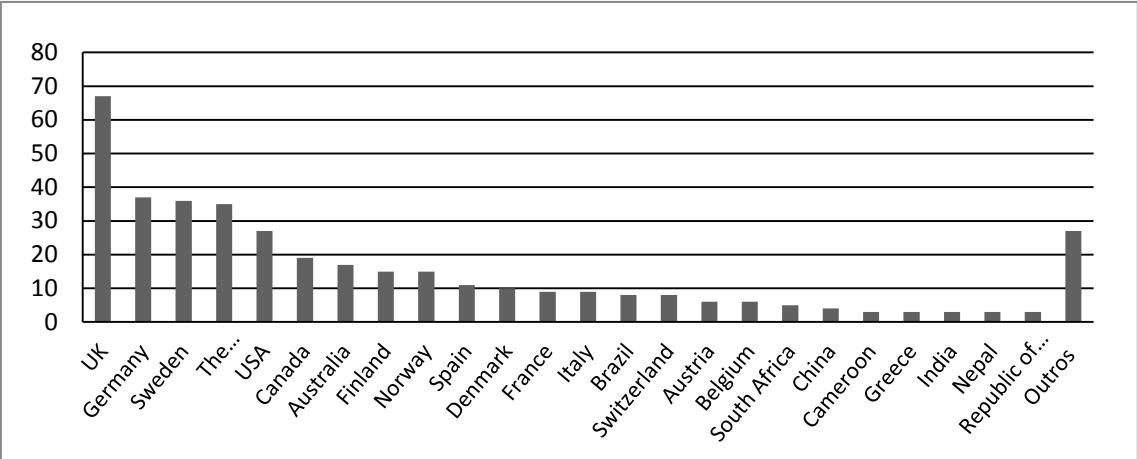


Source: Prepared by the author

² Scielo, Cairn, BDTD

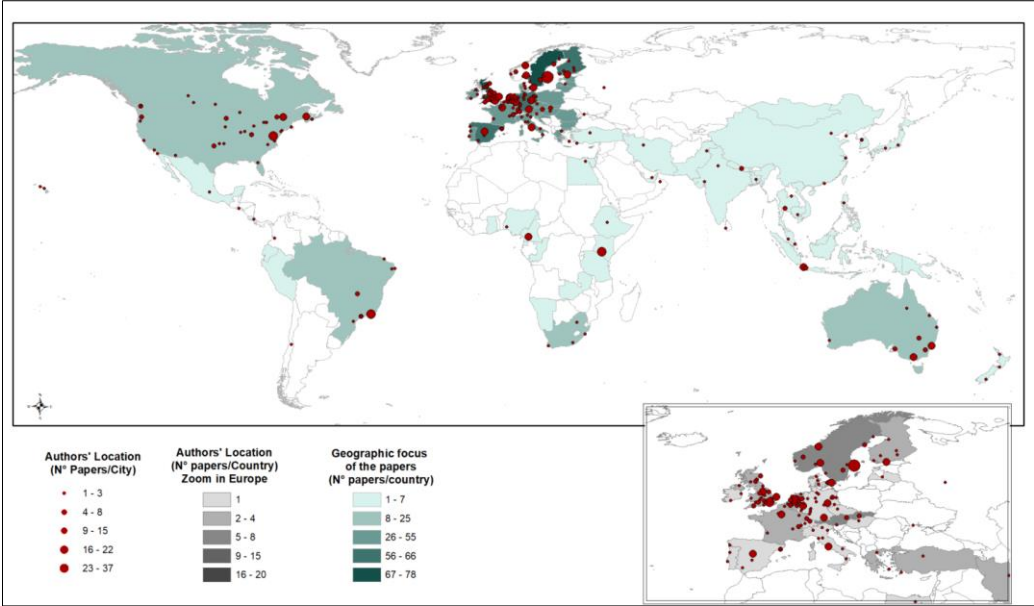
In spite of increasing relevance of this literature, we can affirm that this was mainly an European agenda. Most authors are located in Scandinavian countries and United Kingdom, and the main focus of these studies are industrialized countries, particularly European (see Figure 2 e **Erreur ! Source du renvoi introuvable.**). Institutions of countries like Brazil start to appear in the list of authors (14th) and of case studies. Among the most important institutions whose members publish on the subject are Wageningen University, Utrecht University (both in Netherlands) and University of Sussex (in the United Kingdom). Other institutions and think-tanks also stand out, as the Center of International Forestry Research (CIFOR), located in many countries, and encouraging a research agenda on the concept of policy mix (see Table 1).

FIGURE 2: AUTHORS' LOCATION (CONSIDERING THE THREE FIRST AUTHORS) - 1985-2017



Source: Prepared by the author

FIGURE 3: AUTHORS' LOCATION (CONSIDERING THE THREE FIRST AUTHORS) AND THE GEOGRAPHICAL FOCUS OF THEIR PUBLICATIONS - 1985-2017



Source: Prepared by the author

TABLE 1: TOP 10 UNIVERSITIES (1985-2017)

Wageningen University	18
Utrecht University	16
University of Sussex	13
KTH Royal Institute of Technology	12
CIFOR	11
Stockholm Environment Institute	11
Lund University	10
University of Leeds	10
Finnish Environment Institute	9
Helmholtz Centre for Environmental Research	9
University of East Anglia	9

Source: Prepared by the author

1.2. CONCEPTS AND SUBJECTS: MULTIPLE APPLICATIONS, BUT PREVALENCE OF ENVIRONMENTAL MATTERS

The first studies on **policy integration** highlighted the objective of making policy formulation more rational, by removing contradictions between their goals. Underdal (1980), one of the first authors to contribute to this literature, defined policy integration as the result of a strategy in which the policy constitutive elements are gathered and exposed to a sole conception. The author also identified three criteria to characterize this process: comprehensiveness, consistency and aggregation³. By following a similar path, but with less focus on policy formulation and on their results, Peters (1998) proposed an approach focused on the organizational context of policy integration. Collier (1996) pointed out the importance of trade-offs in the political process, however his approach was based on the economic concept of Pareto optimality as the criterion to solving dilemmas. The idea of trade-offs remains present in the literature, but its analysis merge currently the conflicts between opposed actors, interests and ideas, and the political resources asymmetry on the decision making, as it will be presented in the next section.

The term **environmental policy integration** has later emerged, drawn as the integration of environmental policy aspects and objectives to sectorial policy (Persson 2004). The diversity of

³ The first one is related to space, actors and questions inclusion. The second one means that all components of a policy agree on. The third one defends that a main criterion is used to access different elements of a policy.

terms and definitions is due to, according to Tosun e Lang (2017), the fact that the concept was originated in a world of public management and international organizations. The urge to consider environmental and economic aspects jointly was being emphasized by a series of international documents, the most important being the Brundtland Report (1987). However, this narrative emerges firstly as a rhetorical reference in the environmental area than as a policy strategy (Hertin & Berkhout 2003). According to Lafferty e Hovden (2003), the European Union would have been one of the most important promoters of the environmental policy integration idea, at least concerning the political commitment, dated from the 1970's The Organization for Economic Co-operation and Development (OECD) has also contributed for its consolidation; however, as noted by Persson (2004), its work was guided towards the processes, without mentioning the matter of national decision-makers preferences and environmental/sectorial trade-offs.

This literature was partially guided by a revision of political objectives' traditional hierarchy, in which the environmental concerns should be prioritized (Lafferty & Hovden 2003). Lafferty and Hovden has concluded that simply removing the contradictions between policies to highlight their complementarities are not feasible, once there are strong conflict of interests referring to environmental matters. The authors have assumed, thus, a normative point of view regarding the policy processes' expected results and have introduced the notion of "***principled priority***" of the environmental policies related to other sectorial policies. Such an approach was criticized for neglecting the fact that this conceptual priority rarely is translated in the effective formulation of policies and also not for considering the existence of different "environmentalisms" based on different sets of norms (Bastos Lima et al. 2017).

However, despite being normative, the studies in this field acknowledge the conflicts behind integration limits, which could not be simply associated to and efficiency deficit in policy implementation. Persson (2004) justifies this option by remembering that the trade-offs are so inherent to environmental policy that they should be reflected from a conceptual perspective. More recent studies, on the other hand, focused on climate policies, propose a less normative and rationalist approach of this process (Adelle & Russel 2013a), taking the conflict between the actors into account (Di Gregorio et al. 2016).

The integration between fragmentary sectors is key to this literature, recently developed beyond the perspective of mainstreaming one sector (environment) into other development sectors. The "**Nexus**"⁴ approach underlines the consequences of lack of integration between sectors which are considered key to human livelihoods: water, energy and food. It assumes the interdependency between these three systems, concluding that the interactions affect their availability. The first studies that directs to the Nexus approach have emerged in the late 1990's, but it was in the late 2000's that this literature was consolidated (Artioli et al. 2017). This approach has arisen in the context of the 2007-2008 food and finance global crisis (Allouche et al. 2014). And, as the aforementioned approaches, this one became popular in close dialogue with international organizations and global conferences, besides events promoted by the German government, as the Bonn Conference, in 2011 (Artioli et al. 2017)⁵.

⁴ The "Bonn 2011 Conference: The Water Energy and Food Security Nexus – Solutions for the Green Economy" has originated one of the first conceptualizing documents of the Nexus approach.

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For some authors, the water-energy-food nexus represents a new “buzzword”, as a result of the evolution of the integrated natural resources management literature (Biba 2016; Wichelns 2017). It is worth noting that this literature scarcely explains what provides the coherency between sectors and how it can be achieved (Weitz et al. 2017). Overall, its objective is to strengthen the cross-sectorial and cross-system analysis, management and planning (Weitz et al. 2017), and most of the work address questions related to the use of water and energy in agriculture or the competition for water and energy involving agriculture and other sectors (Wichelns 2017). The aforementioned Bonn Conference itself has previously positioned water resources as central point and has identified global tendencies with negative impact on the nexus: urbanization, population growth and climate changes.

In addition, the concept of policy integration had other developments beyond the incorporation of environment concerns or the articulation of sectorial agendas. Eggenberger and Partidario (2000) show the connection between this concept and the cross-sectorial coordination in the territorial planning process. This literature is very similar to that of the 2000's. It is worth noting that the concept was not included in the key-word list surveyed, but its occurrence in the text base was high. The integration or coordination of sectorial policies is considered one of the most important goals of the current territorial planning (Stead & Meijers 2009). At the same time, the territorial planning may develop an important role in directing sectorial actions, by promoting the integration when it defines a global action agenda for the land, long-run goals and communication channels between the sectors (Stead & Meijers 2009). This connection was widely investigated in studies on urban development (Momm-Schult et al. 2013; Wamsler et al. 2014), transport policies (Dirgahayani & Nakamura 2012), and marine and coastal management (Howlett et al. 2017).

The **territorial planning** perspective promotes a closer connection between the literature on environmental policy integration and the other local implementation processes that, according to van Stigt et al. (2013), are less studied. In spite of analyzing aspects related to the coordination between different levels, this literature is focused in national and supranational levels.

Multilevel governance was another concept developed in the attempt to articulate different levels of action. Used since the 1990's in studies on European integration, this studies showed how the authority and the competence of policy elaboration are shared by actors placed in different jurisdictional levels – subnational, national, and supranational (Marks 1991). The concept came to be renowned in the 2000's by proposing an analysis framework for the relations between state actors and non-state actors connected through networks, being spotted as a milestone in European environmental studies (Hooghe & Marks 2001; Bache & Flinders 2004). It was later restored in other areas, including, for example, studies on common resources governance (Armitage 2007).

The **multilevel governance** is associated to the concept of policy integration once the latter requires interactions not only between sectors (horizontal integration) but between administrative

levels (vertical interaction). It “captures” both the multiple levels of governance and the myriad of actors and institutions that act simultaneously in these levels and that might be contributing to promote or prevent the policy integration. This notion also allows to connect local policies to international institutional and political arrangements, for instance, the international governance towards the climate agenda (Betsill & Bulkeley 2006). Stevens (2018) went beyond the idea of coordination between different levels of the same jurisdiction, defending that the multilevel governance could be understood in different scopes, jurisdictions and epistemologies.

An additional literature body that dialogues with the subject of global and regional arenas is the one concerned about **policy coherence**. Despite presenting a very similar definition to that of policy integration (Nilsson et al. 2012), their origins and applications are different. The idea of objectives harmonization (and implementation) of public policies has become, long time ago, a key-principle of public management, however the “policy coherence” as an approach in itself was developed in the debates of international cooperation in the 1990’s. The term was particularly promoted by the OECD’s Development Assistance Committee as a means of coordination between international donors, aiming the articulation among all environmental relevant sectors in the financing receiving country (Forster & Stokke 2013). At that time, coordination between national policy and cooperation and coordination between donors were a prevailing topic of discussion (Hoebink 2013). The term was also matter of important debates in the European Community, but limited to external politics (Carbone 2008).

The term “**development policy coherence**” has emerged in this context, whose main contribution was the attention given to the need of building or using existing institutional structures to the cross-sectorial coordination (Larsen & Powell 2013). This literature was applied to other global agendas, specially in the Millennial Development Goals (MDGs) and later in the Sustainable Development Goals (SDG), both promoted by United Nations (Nilsson & Persson 2017). Following the same path as the SDG, a rising theme in debates on policy coherence was the one of health policy (Ruckert et al. 2017).

At last, a term of a distinct origin from the others is the concept of “**policy mix**”. Imported from the economic debates concerning fiscal and financial connection (Flanagan et al. 2011), it adds more complexity to an already disperse universe of study interested by interactions between instruments, systems, sectors and public policy scales. In the 1990’s, the term not only became known in economic literature, but it was also extended to other public policy areas. However its consolidation was carried out during the 2000’s, by studies on policy innovation, related to subjects as environmental economy, energy transition and macroeconomic policies (Flanagan et al. 2011). Part of literature was limited to analyze the interactions between public policy instruments (del Río González 2007), often focusing on the identification of “optimum” – more efficient – combinations of instruments (Bahn et al. 2015). However, as indicated by Flanagan et al. (2011), a mix is made of not only instruments combination, but also by processes by which the instruments emerge and interact. The objective, in this case, would be to compensate the weaknesses of individual instruments by adding complementary instruments (Ring & Barton 2015).

The concept was widely used for payments for environmental services and other political and economical mechanisms relevant to the biodiversity conservation. In this context, it was defined as a combination of policy instruments that evolve to influence the quantity and quality of biodiversity conservation and provision of ecosystemic services in the public and private sectors (Ring & Schröter-Schlaack 2011). Recently, the literature has developed in convergence to that of policy integration, aiming to analyze how different instrument combinations can deal with the multiple goals of policy strategies and benefit from potential synergies (Ring & Barton 2015).

Rogge e Reichardt (2016) proposed a comprehensive definition of the concept of mix, by including aspects as political strategy, political processes and mix features, that can also be used in the analysis of policy integration. This definition converges with studies that head towards the dynamic nature of the mix and its evolution through time, what can lead to changes also in their interactions (Ring & Schröter-Schlaack 2011).

Table 2 presents a summary of concepts, their main related subjects and references.

Figure 4 replicates graphically the information presented in this section, specially the relation between the different concepts mentioned, their interrelations and the main associated subjects. It was elaborated based on the analysis and textual extraction of the abstracts, titles and keywords of the aforementioned text base. By using the WordStat 7, it was possible to analyze the frequency of occurrence among the identified concepts and subjects as well as their interrelations. For instance, as it can be noticed, the highest occurrence is of “policy integration”, strictly associated with the term “environmental policy”, which is the second highest occurrence. The literature of policy integration is, thus, specially focused on the analysis of environmental policy integration. The second term on the list is “policy mix”, whose texts are mainly focused in identifying an “optimum” or more efficient policy arrangement, whether being energy, fiscal or innovational. The analysis can not comprehend the complexity of each literature group, but it presents graphically and in a simplified way the main orientations of the mobilized terms. In the Annex, another type of representation of this dendogram was included (Figure 18). Moreover, as policy integration and policy mix are the most frequent concepts, proximity graphs between them and the others identified in the database were also included in the Annex (Figure 19 e Figure 20).

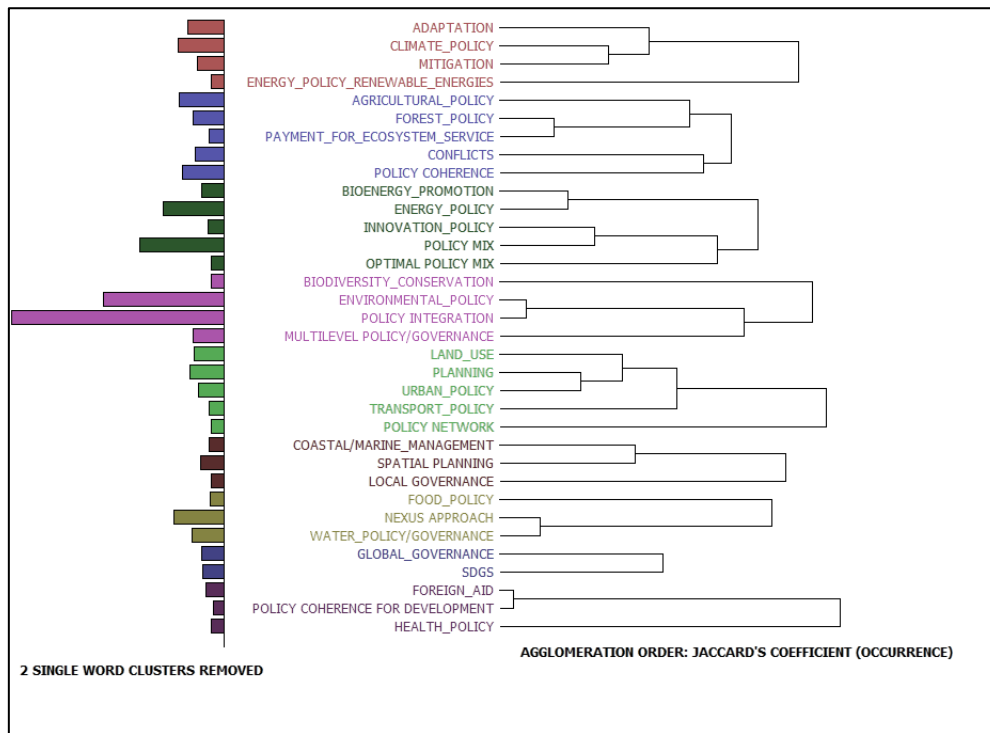
TABLE 2: SUMMARY TABLE OF THE MAIN CONCEPTS RELATED TO PUBLIC POLICY INTERACTION AND ASSOCIATED SUBJECTS

CONCEPT	DESCRIPTION	MAIN SUBJECTS	REFERENCES
Policy integration	It analyzes the the features of policies that systematically reduce conflicts and promote synergies between different areas to reach the goals associated with political objectives commonly agreed. Different types of integration are analyzed: vertical, horizontal, internal and external. Rationalist approaches focused on aspects such as policy consistency and efficiency and other approaches focused on power dynamics on instrument prioritization coexist.	Environmental, climate and agricultural policies and matters related to land use change and territorial planning	(Underdal 1980; Collier 1996; Barrass et al. 1997; Peters 1998; Persson 2004; Jordan & Lenschow 2010a; Nilsson et al. 2012; Candel & Biesbroek 2016; Tosun & Lang 2017)
1.a. Environmental/climate policy integration	Derivate from the concept of policy integration, it discusses the incorporation of environmental /climate concerns for other sectors (from an often normative environmental priority point of view). It also discusses problems of integration between mitigation and adaptation to climate change. It can be related to the concept of mainstreaming.	Environmental and climate policies	(Hertin & Berkhout 2003; Lafferty & Hovden 2003; Persson 2004; Jordan & Lenschow 2008; Mickwitz & Partnership for European Environmental Research 2009; Feindt 2010; Jordan & Lenschow 2010b; Nilsson et al. 2012; Adelle & Russel 2013b; Aall et al. 2015; Nilsson et al. 2016; Di Gregorio et al. 2017; Alons

			2017)
Policy Mix (<i>Policy Mix</i>)	The concept discusses the integration between public policies, by analyzing complementarities and conflicts. Most of the studies are based on rationalist approaches that seek to identify the efficient mixes. Many definitions highlight the dynamic feature of the mix that might evolve and transform the interactions. Associated to the concept of <i>policyscape</i> , it is related to instruments oriented to different parts of the landscape mosaic.	Energy and innovation policies, tax and economic mechanisms to conservation (payment to environmental services)	(del Río González 2007; Kern & Howlett 2009; Flanagan et al. 2011; Barton et al. 2013; Görlach 2014; Ring & Barton 2015; Rogge & Reichardt 2016)
Policy coherence	Strictly related to the concept of integration, this concept is mainly applied to international contexts, and to the relation between international systems / regional organizations and national policies. A derived concept is the policy coherence for the development.	European policies, external policy, MDGs and global health (specially on international cooperation for development area)	(Carbone 2008; Barry et al. 2010; Nilsson et al. 2012; Hoebink 2013; Adelle & Jordan 2014; Ruckert et al. 2017; Collste et al. 2017)
Multilevel governance	The concept deals with the articulation between different scopes, jurisdictions and epistemologies, going beyond the idea of cross-sectorial coordination or between different levels of the same institution. It connects intergovernmental organizations	European policy, policy transfer, global regimes, actors' network.	(Marks 1991; Hooghe & Marks 2001; Bache & Flinders 2004; Betsill & Bulkeley 2006; Lanahan & Feldman 2015; Yang et al. 2015)
Nexus Approach	The concept addresses the problem of fragmentation between water, energy and food resources. Recent studies are critical about the lack of connection between the first documents of this literature and the governance processes that it intends to impact.	Sustainability and management of risks related to the use of natural resources. Main focus is the water resources sector.	(Allouche et al. 2014; Biggs et al. 2014; Biba 2016; Bartram & Dodds 2016; Artioli et al. 2017; Weitz et al. 2017; Wichelns 2017)
Policy coordination	The concept is related to that of policy integration, being that the later is more demanding in terms of articulation, formal arrangements, compatibility and interdependency. The coordination provides mutual adjustment of policies and objectives, but remaining sectorially distinct and separated.		(Stead & Meijers 2009; Adelle et al. 2015; Cavallo et al. 2016; Christopoulos et al. 2016; Cejudo & Michel 2017)
Integrated/territorial management	It discusses the integration of policies and actors in a specific territorial space (jurisdiction, ecosystem, basin, etc.). It gathers information on the relation between physical conditions of a landscape and the scale of political decision.	Marine and coastal policies, water resources management/governance (hydrographical basins)	(Crawford & French 2008; Stead & Meijers 2009; Acheampong & Ibrahim 2016; Khan et al. 2017; van Oosten et al. 2017)

Source: Prepared by the author based on cited references.

FIGURE 4: DENDROGRAM OF CONCEPTS AND SUBJECTS



Source: Prepared by the author

This section showed that despite the different thematic origins, many of the concepts presented converge in the attempt to characterize the interactions between policy instruments and the fragmentation of public actions, mainly in relation to the merging of climate and environmental concerns. The objectives are old, and most of these studies emerge as an effort to operationalize the theoretical and practical forms of sustainable development. This is a permanent recycling of concepts that, from their disciplines and thematic areas, slowly converge and are often treated equivalently. As shown before, the concepts currently used are “policy integration” and “policy mix”. Both present a normative view regarding the need of integration, in a way that the first one discusses mainly the sectorial public instruments and the second one includes more consistently the economic instruments.

However, regarding the environmental focus, characteristic of most of the literature, it can be stated that this is an extremely ambitious goal either from theoretical or the practical point of view. Moreover, the structures of government (and governance) in the modern state operate in most cases according to logics of sectoral fragmentation and of very diverse and asymmetrical universes (territorial, thematic, and interests). In this context, the integration goal remains detached from the political reality and, thus, the idea we seek to transmit in this study is of concentration of different and divergent instruments – that is, the articulation between fragmented spheres and conflict ponderation. Nonetheless, independently of the adopted concept, what needs to be outlined are the analytical features and the factors that influence negatively or positively this concentration process. These aspects will be approached in the next section.

2. CONVERGENCES AND DIVERGENCES OF THE ANALYTICAL FRAMEWORKS

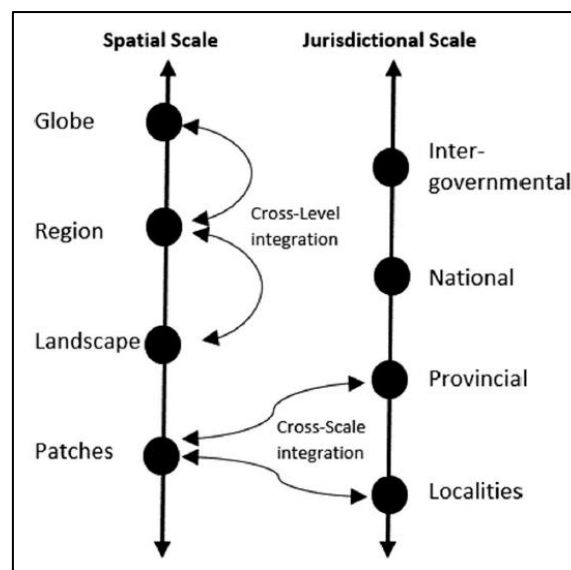
2.1. ANALYTICAL CATEGORIES: WHAT TO EVALUATE

The first decisive aspect in the analysis of policies in light of the concepts presented above is the identification of the object of analysis. The policy integration literature has advanced in this sense by proposing heuristic categories. Firstly, the relations between the policy goals can be differentiated between “horizontal” (among sectors) and “vertical” (among management levels) (Lafferty & Hovden 2003; Jordan & Lenschow 2010a; Di Gregorio et al. 2016). Secondly, other authors underline the importance of consistency not only between mitigation and adaptation initiatives towards climate changes and other development policies, but also between these two climate policy goals between them (Locatelli et al. 2015). In this sense, the coherence within a sole sector (e.g. between mitigation and adaptation to climate changes) is commonly called “internal” and the coherence between different sectors (e.g. between climate and agricultural policy) is called “external” (May *et al.* 2006, Nilsson *et al.* 2012).

AS PREVIOUSLY PRESENTED, THE LITERATURE ON MULTILEVEL GOVERNANCE ALSO CONTRIBUTES TO THIS POINT, BY PROBLEMATIZING THE CONCEPT OF VERTICAL INTEGRATION. STEVENS (2018) BASES HIS ARGUMENT ON THE DISTINCTION BETWEEN “SCALES” AND “LEVELS” TO DEFINE VERTICAL INTEGRATION. ACCORDING TO THE AUTHOR, SCALES REPRESENT COGNITIVE CONSTRUCTIONS USED TO ANALYZE SOCIAL AND BIOGEOGRAPHICAL PHENOMENA: SPATIAL, TEMPORAL, JURISDICTIONAL, INSTITUTIONAL, MANAGEMENT SCALE, AND SO ON. WHILE LEVELS ARE DEFINED AS ANALYTICAL UNITS PLACED IN DIFFERENT POSITIONS OF THE SCALE: THE JURISDICTIONAL SCALE WOULD BE, FOR EXAMPLE, DIVIDED INTO INTERGOVERNMENTAL, NATIONAL, REGIONAL AND LOCAL (SEE

Figure 5). Such distinctions are useful to specify what exactly is analyzed.

FIGURE 5: HEURISTIC ILLUSTRATION OF THE INTEGRATION BETWEEN LEVELS AND SCALES



SOURCE: STEVENS (2018)

In the case of Nexus approach, the horizontal integration is the main object of analysis. These studies focus on the interactions between same-level institutions and on the coherence between policy goals of the sectors considered key (water, energy, food) (Weitz et al. 2017). For most authors, the challenge is the governance of these three fragmented sectors – or systems – to promote sustainability and risk management (Artioli et al. 2017).

The literature on policy mix addresses these different types of integration and is often mobilized as a means of analyzing the combination of policy instruments (Ring & Barton 2015), although some authors argue that the concept goes beyond the interaction between instruments (Flanagan et al. 2011; Rogge & Reichardt 2016). In this sense, the literature not only addresses the **direction of interactions** (vertical, horizontal, etc.), already highlighted by the studies of policy integration and coherence (Lafferty & Hovden 2003; Carbone 2008), as it also brings important contributions in the definition of **types and dimensions of interactions**. For instance, Flanagan *et al.* (2011) indicate dimensions and forms of interaction between instruments, besides the possible sources of tension (Figure 6). Sorrell et al. (2003) identify different natures of interactions between instruments which may have implications for effectiveness, efficiency, social impacts or viability of the mix:

- Direct interaction involving target groups covered by more than one instrument;
- Indirect interaction between superposed instruments regarding the target groups;
- Operational integration, when two instruments operate jointly;
- Sequential integration, when an instrument is followed in time by another one, and they both affect directly the same target group;
- Commercial interaction, when two instruments are bound by the exchange of an environmental or commerce commodity.

Both analytical frameworks were revisited by Ring & Barton (2015), who proposed the framework summarized on Figure 7. The authors start from an analysis of the biodiversity conservation goals to highlight the importance of the combination of economic instruments (direct regulation, economic incentives, and market facilitation) to achieve these goals. The summary of such instruments is given in the annex (Figure 21). Another contribution of this literature refers to the idea of “policyscape”, that addresses the policy integration in the landscape scale. The concept is defined as the spatial distribution of a mix of instruments and it incorporates aspects as the biophysical features and the local actors perception, interacting in response to a combination with applied norms in the whole landscape (Ring & Barton 2015).

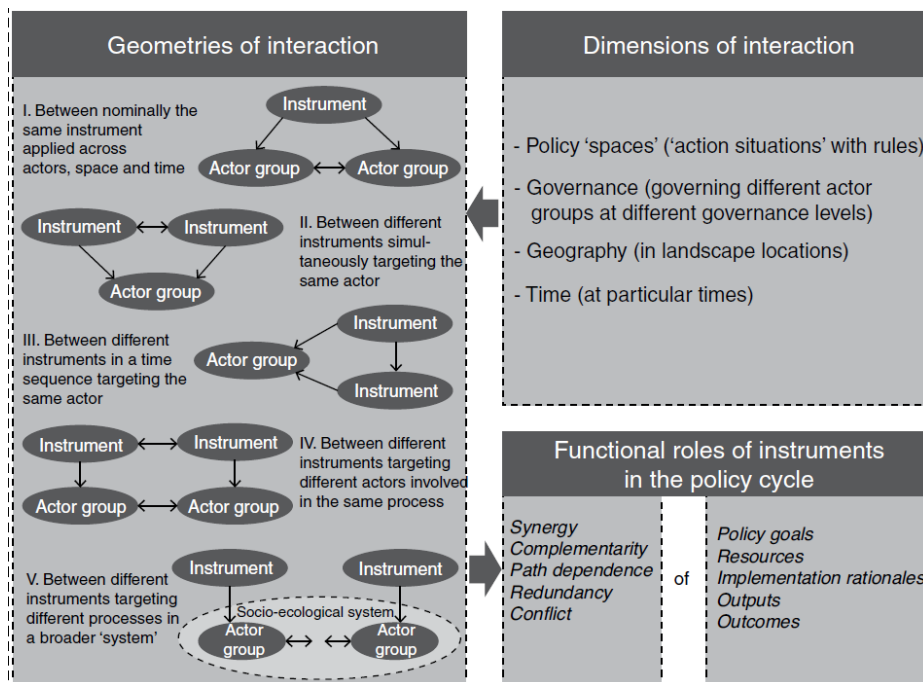
Finally, Rogge & Reichardt (2016) merge the framework proposed by Flanagan (2011) to a wider concept of policy mix (Figure 8). According to the authors, the policy elements (strategies and instruments) are the basis of the concept of mix, concerning its content. In addition, the political processes of elaboration and implementation correspond to the factors that determine the content of the mix, as we shall see in the next section. The features (elements consistency, process coherence, reliability and comprehensiveness) are identified to evaluate the mix performance.

FIGURE 6: INTEGRATION OF POLICY MIX: DIMENSIONS, TYPES AND SOURCE OF STRESS

Dimensions in which interactions can occur	Possible types of interaction
<p>Across:</p> <ul style="list-style-type: none"> Policy space Governance space Geographical space Time 	<p>Between:</p> <ul style="list-style-type: none"> 'different' instruments targeting the same actor/group (within/across dimensions) 'different' instruments targeting different actors/groups involved in the same process (within/across dimensions) 'different' instruments targeting different processes in a broader system (within/across dimensions) <hr/> <p>Between:</p> <ul style="list-style-type: none"> 'the same' instruments (across different dimensions)
<p>Possible sources of tension between instruments in the policy mix</p> <p>Conflicts between:</p> <ul style="list-style-type: none"> policy rationales policy goals implementation approaches 	

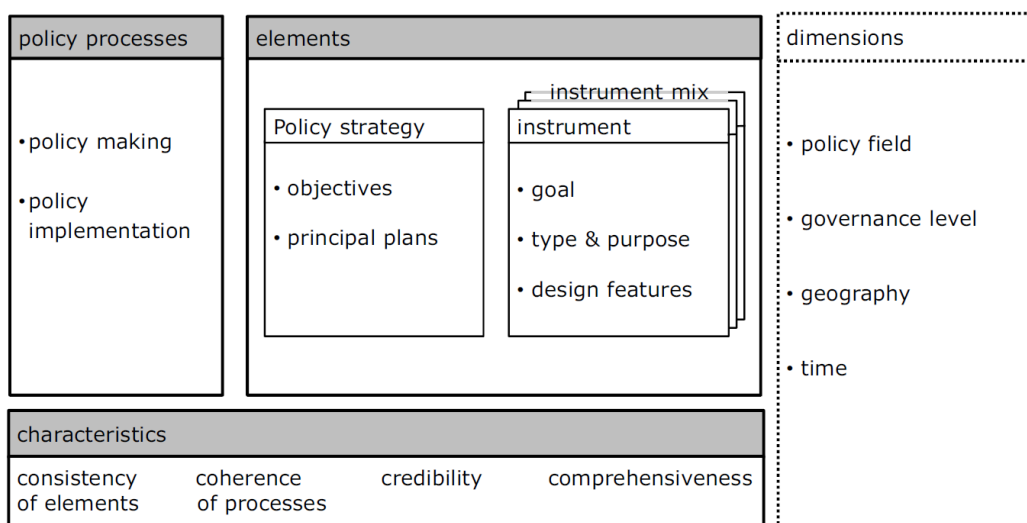
Source: Flanagan et al. (2011)

FIGURE 7: INTERACTION DIMENSIONS AND GEOMETRIES BETWEEN PUBLIC POLICY INSTRUMENTS



Source: Ring & Barton (2015)

FIGURE 8: COMPONENTS FOR A WIDER CONCEPT OF POLICY MIX



Source: ROGGE & REICHARDT (2016)

To sum up, the references presented in this subsection sought to identify the analytical categories – i.e. the elements to be analyzed; the types of interaction between instruments and goals and target groups; and their dimensions. In this sense, the literature on policy integration has made an important contribution to define the direction of interactions between instruments: horizontal, vertical, internal, external. This points are fundamental to the outline of the object of analysis, regardless of the context studied. The policy mix literature has gone a step further and sought to identify the types of interaction dimensions. The approach proposed by Flanagan (2011) (Figure 6) was afterwards improved by other authors. However, this approach is already a robust and flexible analytical framework for the identification of the dimensions and interaction forms between instruments. In the case of the Odysseia project, thus, this work could be used as a starting point for the description of the object of analysis. The inclusion of aspects as the political process, proposed by Rogge e Reichardt (Figure 8), strengthen the research study and add points that are not validated by different integration explanatory approaches, as it will be shown in the following subsection. Therefore, as strategy for analysis object definition, the categories proposed for Flanagan are sufficient. The second step will be to identify the explanatory factors of content and policy results in combination. These factors are distinct according to the approach adopted, as it will be shown below.

2.2. DETERMINANTS OF POLICY INTEGRATION: MAIN APPROACHES

The studies presented offer different explanations as to why policies are fragmented and what are the implications of this phenomenon. A first perspective addressed in the literatures is guided by the **economic and administrative rationality**. Here conciliation between policies/instruments is

understood as a way to improve the cost-effectiveness of policies and the efficiency in the use of resources, besides optimizing the allocation of resources between sectors and scales. In the case of the nexus approach, it is argued that such an approach promotes the coherence by the identification of more efficient arrangements between water, energy and food (Weitz et al. 2017). In this context, Rogge and Richardt (2016) point out that the criteria commonly used to evaluate individual policy instruments – as efficacy, efficiency, equity, feasibility – are not fully applied to the evaluation of policy combinations. The latter should consider criteria as consistency, coherence, credibility and comprehensiveness. The authors follow a line similar to the one proposed in the first studies on policy integration and several others that followed it (Underdal 1980; Lundqvist 2004).

As summarized by Weitz *et al.* (2017), in this perspective the coherence would be doomed by differences between institutional apparatus of different sectors, by different goals, lack of communication and lack of clarity on sectors competences. Governance issues, in this case, mainly refer to technical and management problems, in the way that a better coordination of information between sectors is considered capable of improving– or optimizing – the performance of systems. The proposed responses are mainly organizational – such as strengthening cross-sectional cooperation, increase of communication, establishment of dialog platforms or other interagency mechanisms – or processual – such as establishing strategies and action plans and systematic impact assessments (Persson 2004; Howlett et al. 2017). In the case of the literature focused on environmental policy integration, many studies identify normative factors as explanatory variables for integration (or the lack of it): for instance, the absence of political leadership, the general political scenario, or the change on political culture.

These factors can be analyzed through both rationalist or policy process approaches. Therefore, a key point would be precisely the permanence of a certain political culture, typical of many contexts where environment challenges are manifested, as in the case of the Amazon frontier region. In these cases, it is exactly the crystallization of patrimonialist management models that prevents the policy change. Rationalist perspectives were, thus, criticized for reducing the analyzes to economic rationalities and administrative processes that are not necessarily objectives and for disconnecting themselves from decision-making and policy-making processes that these literatures seek to influence (Weitz et al. 2017). Bastos Lima (2017) brings another empirical critic to the rationalist approach, showing that despite mechanisms as the payments for environmental services have shown to be quite coherent from a rational point of view, integrating aspects of environmental conservation and rural development, their impact is often limited by the lack of involvement of the dominant actors in the Brazilian agricultural sector. Therefore, the authors identified here argue that the trade-offs are inherent part of the cross-scalar/cross-sectorial public action – and not simply the result of fragility in the managing process – and therefore should be integrated into governance analysis (Stevens 2018).

In this context, an approach that considers the challenges imposed by integration issues as a political process that requires negotiation between different actors with different perceptions, interests, and practices emerges (Adelle & Russel 2013a; Allouche et al. 2014; Rogge & Reichardt 2016). This proposes a contrasting approach to the rationalist perspective – which views variations in policy design as deviations from an optimal outcome – to show that variations in policy formulation and implementation usually mean responses to institutional and political factors in a given context. (Jordan & Lenschow 2008). As summarized by Weitz et al (2017), the main barriers to integration include conflicts of interest – both in domestic or international scales – and asymmetrical distribution of power, information, and resources as well as the capabilities of actors and institutions. In fact, approaching policy integration as a political and multifaceted

process (with many dimensions) allows, according to its proponents, a more refined analysis of its complexity and policy change – and not just as a panacea (Rogge & Reichardt 2016; Artioli et al. 2017; Candel 2017).

The concepts previously presented can be associated to different theoretical lines of the policy process framework. For example, in nexus literature, an aspect brought by Artioli et al. (2017) is its need of politicization, by bringing it closer to approaches to political economy and ecology which deals with questions related to the reproduction of power structures and inequities. Studies that are identified with such an approach are largely oriented to issues such as equity and social progress, highlighting that technical solutions used in natural resource management can often generate unforeseen and negative impacts in other policy areas such as poverty reduction (Stringer et al. 2014). Another example is the mobilization of Elinor Ostrom's institutional analysis framework to understand the processes and results related to the implementation of payment for environmental services in many countries. (Barton et al. 2017). Another possibility is to apply the advocacy coalition framework proposed by Sabatier e Jenkins-Smith to the identification of intra and cross sectional conflicts. (Sabatier & Jenkins-Smith 1993; Jenkins-Smith et al. 2014).

At last, a perspective that is more specific to nexus literature focuses on the precepts of risk and safety related to the natural resources required for human livelihoods. This perspective is based, according to Weitz et al. (2017), on the idea of that the absence (or poor quality) of connections between the water-energy-food sectors can aggravate scarcity of resources and induce conflicts. Thus, the limited emphasis on the interfaces between resources relevant to increasing social and environmental resilience in policy formulation would sometimes lead to contradictory interventions and inefficient use of natural resources (Howells et al. 2013). This perspective mobilizes notions such as “sustainable livelihoods”, stating that development sectorial strategies can lead to the increase of vulnerabilities by restricting capacities or enlarging risks in other location or sector (Biggs et al. 2014; Rasul & Sharma 2016). In this case, the strategies proposed to reduce the risks and insecurities of nexus refer to the inclusion of risk management strategies in the political agenda, to the promotion of cross-sectorial articulation or the isolation of certain sectors from the impact of others.

TABLE 3 SUMMARIZES THESE ASPECTS, NOTING THAT THERE ARE GAPS AND SOME OVERLAP BETWEEN SUCH CLASSIFICATION SYSTEMS, WHICH SEEK ONLY TO SIMPLIFY THE PRESENTATION OF ANALYTICAL TABLES.

TABLE 3: FACILITATING AND INHIBITING FACTORS OF INTERACTION ACCORDING TO EACH APPROACH

Approach	Facilitating factors (examples)	Inhibiting factors (examples)	Source:
Economic/administrative rationality	<p>Organizational:</p> <ul style="list-style-type: none"> - Standardized processes, allowing better supervision; - Similarity of structures and competences of the organizations involved; - Coordination capacity and positive record of organizational collaboration; - Shared understanding of the benefits of coordination to the organization; <p>Processual:</p> <ul style="list-style-type: none"> - Geographical proximity, facilitating interaction and communication 	<p>Organizational:</p> <ul style="list-style-type: none"> - Levels of bureaucratization, leading to problems of communication; - Large institutional and organizational differences, increasing operating costs; - Fragmentation of governance spheres, leading to contradictory mandates and regulations; - Technical staff inadequately trained and high turnover; - Lack of macro vision on sectorial matters; - Institutional fragility and inability to 	<p>(Underdal 1980; Lafferty & Hovden 2003; Lundqvist 2004; Stead & Meijers 2009; Pittock et al. 2013; Candel & Biesbroek 2016)</p>

	<p>between decision-makers and staff;</p> <ul style="list-style-type: none"> - Complementarity in the functions of staff and institution mandates ; - Mechanisms to anticipate, detect and solve conflicts at the beginning of the process; - Existence of a political strategy so that the sectorial policies are consistent to objectives and global priorities; - Harmonization between political priorities and fiscal imperatives; - Proceedings of flexible implementation and monitoring mechanisms capable of adjusting policies; - Systematic intersectoral dialogue;- Ability to involve key-actors, without creating large and less operational forums; <p>Normative:</p> <ul style="list-style-type: none"> - Change on organizational culture; - Prioritize resource allocation in cross-cutting rather than sectoral issues; 	<p>resolveconflicts;</p> <ul style="list-style-type: none"> - Weak historical and negative evaluation of coordination processes; - Difficulty of common understandings resulting from non-convergent approaches (techniques) and languages; - Poor interpersonal relation between key-actors and different work styles; <p>Processual:</p> <ul style="list-style-type: none"> - Infrequent, inadequate communication or lack of systematic dialogue between sectors; - Bureaucratization in the accountability or differences of procedures between institutions; <p>Fragility or absence of management mechanisms;</p> <ul style="list-style-type: none"> - Different planning cycles of budgets and resources between sectors; - Direct and opportunity costs involved in personnel management dedicated to establishing and sustaining transversal work mechanisms; - Competition between departments by jurisdictions or resources; <p>Normative:</p> <ul style="list-style-type: none"> - Absence of political leadership; - Incorporation of specific (environmental) concerns into the policy and administrative decision-making processes of sectoral agencies; 	
<p>Political process</p>	<p>Political/economic/institutional:</p> <ul style="list-style-type: none"> - Definition of problems, professional ideologies and convergent interests; - Relatively equivalent status among organizations involved in coordination; - Influence gain over other sectors; - Commitments of integration by political leaders and / or key actors; - Ability to identify a global vision and cross-cutting issues; - Perception of gains in resources (time, financial resources, information, raw material, legitimacy, etc.); - Sharing the costs and risks associated with the implementation of certain policies; - Change in political culture; - Social learning: interactions through which actors within and between subsystems learn about the 	<p>Political/economic/institutional:</p> <ul style="list-style-type: none"> - Insufficient recognition of the diversity of actors and issues present in the network; - Coalition-dominated political system against change / integration and lack of political priority, support or leadership; - Diverging priorities, interests, ideologies and objectives among actors, leading to a lack of consensus on the nature of the problem and its solutions; - Perception of loss of organizational power, strategic position, prestige, authority; - Differences in status and asymmetries of scale between sectors and sectorial objectives above transversal ones; - Contrast between short-term political 	<p>(Jordan & Lenschow 2008; Stead & Meijers 2009; Adelle & Russel 2013b; Rogge & Reichardt 2016; Artioli et al. 2017; Weitz et al. 2017)</p>

	(crosscutting) nature of the problem and its governance. - Formation of coalitions, aligning powers within and between subsystems;	aspirations and time needed for integration; - Loss of autonomy over the results of policies and services;	
Risk and Security	- Correspondence between real needs, common benefits and scarce resources; - Communication among stakeholders on risk minimization strategies; - Agreement on acceptable levels of risk; - Establishment of strategies and means of monitoring ecological performance in terms of resources used and results achieved in relation to the objectives of the sector;	- Asymmetry of power and resource utilization across sectors;	(Lundqvist 2004; Biggs et al. 2014; Candel & Biesbroek 2016; Weitz et al. 2017)

In view of the above, it can be said that addressing integration as merely technical or procedural issues would mean neglecting fundamental aspects related to the governance of natural resources or sectorial agendas that this literature ultimately intends to influence. Although communication (or lack of it) and other organizational aspects are fundamental to integration efforts, it is not enough to assess policy coherence in programmatic and procedural terms, since it is in the ownership of the political agenda or in the implementation processes that the inconsistencies become visible. For example, in the Brazilian case, it can be seen that fragile institutions tend to be less effective in border (Amazon) or oligarchic (Northeast) contexts. In practice, it is possible to identify a board that is programmatically committed to environmental policy that is ultimately at the service of actors that degrade the environment, either because of political appointment of its leaders or because of the preeminence of economic and political interests antagonistic to its mission. Therefore, an analytical framework guided by the policy process, without giving up organizational and procedural aspects as facilitators or inhibitors of integration, is recommended.

2.3. RESEARCH METHODS

Although a large number of studies have been identified, they still lack more robust and flexible methodologies for analyzing policy interactions, whether in rationalistic or policy process approaches. Regarding the first, the evaluation of the degree of integration, raised by Lafferty and Hovden (2003), is still problematic. In the second, although the mobilized literatures (e.g. advocacy coalitions, political economy, etc.) bring specific methodologies, there are not always mechanisms of dialogue between policy process and the policy integration studies. Since the operationalization and measurement of these degrees have not been agreed in the academic

literature (Nilsson et al. 2012), these remain largely as a result of the interpretation of the analyst (Candel 2017).

Among the studies identified, the large majority is based on documentary analyzes and qualitative and often descriptive case studies. A methodology used in some of these cases refers to process-tracing, based on the systematic examination of a temporal sequence of events, and can be used to reconstruct the process of policy change (Candel 2017). Another approach used was the definition of coherence measures through network analysis (Ingold & Balsiger 2015; Adelle et al. 2015; Ahlström & Cornell 2018). For example, Ahlström and Cornell (2018) analyzed governance structures associated with activity regulation with effects on global nitrogen and phosphorus flows, seeking to assess levels of connectivity and interactions between scales. Adelle *et al.* (2015) sought to show that the coordination capacity of the networks depends, in part, on the type of network present in each political field. Many of these studies are based on the interactions between actors and institutions in political arenas, as it is the case of studies mobilizing the advocacy coalition framework (Feindt 2010; Sarvašová et al. 2013) or of the development arenas (Jørgensen et al. 2017).

Rationalist studies have produced scenarios and econometric analyzes (Suardi & Kurian 2015; Costantini et al. 2017; Dumont 2017; Purkus et al. 2017), environment analysis (SWOT) (Fertel et al. 2013) and economic and environmental modeling (AbdelHady et al. 2017; Kaddoura & El Khatib 2017; Khan et al. 2017; Dhaubanjari et al. 2017; Collste et al. 2017) to define the optimal combinations of political and economic instruments. They were complemented by budget allocation models in order to quantitatively analyze the consequences of the use of multi-objective policy instruments in agri-environmental policy mix (Schader et al., 2014). Spatial computing tools have also been used to support scientists – based on spatial life cycle analyzes – in visualizing the interconnections and interdependencies of nexus resources at different levels (Eftelioglu et al. 2017). Danaeefard *et al.* (2017) based on a consensus-building tool between experts (Delphi) to identify factors inhibiting political coherence in Iran.

Finally, Nilsson et al. (2012) proposed, based on theories of institutional interaction, a three-step analytical approach, consisting of an inventory of policy objectives, a screening matrix, and a more in-depth analysis of key interactions. Then, these authors developed a simplified framework to classify (between -3 and +3) the relationships between the different SDGs (Figure 22 annexed) (Nilsson et al. 2016). They presented a typology of interactions, organized into seven points, providing a non-exhaustive range of relationships classification. Such interactions have been quantified both in relation to policy objectives and in relation to specific interventions and instruments. The definition depends on the purpose of the analysis. According to the authors, positive interactions allow the construction of cross-sectorial strategies and negative interactions are the object of trade-offs. Collste *et al.* (2017) consider this useful framework only as a first step in analyzing the links between SDGs, arguing, however, that it should be complemented with more quantitative and integrative simulation tools. In addition, its application is subjective because the score system is defined broadly, without specific criteria or punctuation procedures.

Therefore, despite the diverse range of methodologies applied to integration studies, there is still a large gap in methods that are both robust and accessible. The formulation of methodologies that answer the questions of a mixed approach and that are applicable to the political contexts and the availability of data in a field of study such as the Brazilian Amazon could be a consequent contribution of Odysseia project.

CONSIDERATIONS

This section sought to review the main concepts related to the analysis of interactions among policy instruments, with the objective of deepening their understanding, identifying their points of convergence and potential uses. This material could serve as a basis for information for the academic debate and for the definition of an analytical and methodological framework that is flexible and shared by members of the Odysseia project. No attempt was made to build a new framework, but to systematize relevant points from the existing literature, which could inform future debates. The points covered in the different sections are summarized here:

- Although this is a diverse literature with multiple origins, the research agenda has been developed mainly in European countries and oriented to case studies in these same countries. Research networks involving Brazilian institutions have become increasingly interested in the theme⁶. However, **there is still scope as well as academic and political interest to deepen this agenda in Brazil.**
- With regard to the topics addressed, each body of literature emerged and consolidated in dialogue with different themes. Despite this, there is an **urgency for the environmental issue, and more recently the climate issue.** This is understandable given the inspiring objective of most of these studies: to propose tools for theoretical and practical operationalization of sustainable development.
- From the conceptual point of view, the most used terms in the current debate are "policy integration" and "policy mix". They dialogue with older studies that were interested in the question of the interaction of policy instruments. The choice of the concept to be used depends on the case study and the results expected. However, in a pragmatic way, the most relevant aspects to be defined in an analytical framework are the **categories of analysis and the approach adopted.** Complementary aspects of each literature can be combined.
- An analytical framework should identify **categories of analysis** that are adaptable to different contexts. The literature on policy integration has made an important contribution in defining the **direction of interactions** between instruments (horizontal, vertical, internal, external) and the

⁶See, e.g., the PolicyMix project (<http://policymix.nina.no/Case-studies>)

literature on policy mix has identified the types of **interaction dimensions**. The approach proposed by Flanagan (2011) proposes a robust and flexible analytical framework for identifying the dimensions and forms of interaction between instruments.

- Addressing merely technical or procedural issues in the interaction between instruments would mean neglecting fundamental aspects related to the governance of natural resources or sectorial agendas that this literature ultimately seeks to influence. Therefore, it is recommended to build a **mixed analytical framework, but guided by policy processes**. Conflicts between opposing actors, interests and ideas, and the asymmetry of political resources in decision making are therefore considered fundamental ingredients for the definition of the analysis framework of the context that one seeks to understand.
- The methodologies for this type of analysis are still not very robust or little accessible / adaptable. The formulation of methodologies that answer the questions of a mixed approach could be a consequent contribution of Odysseia project. The next section provides elements that aim to contribute to the design of this methodology.
- Finally, a less explicit aspect of the literature is the fact that the objectives of cross-sectorial, multilevel integration and of operationalization of sustainable development are ambitious and often detached from the political reality, not only in Brazil. Therefore, the idea that is sought to be transmitted is less normative: it seeks to analyze the **conciliation** between different and divergent instruments - that is, articulation between fragmented spheres and consideration of conflicts.

PART II - CONTRIBUTIONS TO THE DESIGN OF AN ANALYTICAL FRAMEWORK

As mentioned in Part I, the policy integration literature has brought important contributions in defining the direction of interactions (horizontal, vertical, internal, external); and the policy mix literature has identified the dimensions of these interactions. However, the methodologies currently available are considered to be little robust or little accessible / adaptable.

This section aims to contribute to the formulation of a methodological framework that is adaptable to different contexts of the natural resource or sectorial agendas governance. In addition, the section is intended to analyze the **conciliation** between distinct and divergent instruments in a less normative way. The case used for the formulation of the framework was the region of Mato Grosso, but it is expected that this will be applicable to other contexts.

Prior to addressing the methodological proposals, the theoretical bases of the framework will be briefly presented.

1. THEORETICAL ASPECTS: NEXUS, VULNERABILITY, SUSTAINABLE LIVELIHOODS

The proposed framework dialogues with Biggs et al. (2014) proposal to combine, in a more explicit way, the concepts of "sustainable livelihoods" and "environmental security" with the "nexus" approach. As indicated earlier, such an approach is based on the argument that the limited emphasis on interfaces between essential resources for increasing social and environmental resilience would commonly lead to contradictory interventions and inefficient use of natural resources (Howells et al. 2013). It is argued that sectorial strategies can result in increased vulnerabilities by restricting capabilities, or increasing risks in another location or sector (Biggs et al. 2014; Rasul & Sharma 2016). The nexus approach has emphasized in many studies the centrality of water resources, moving on to a more resource-centered approach.

The analysis of the nexus by an environmental lens allows associating it with the idea of "security", which can be achieved, according to Biggs et al. (2014), when the unit of analysis (from country to individual) has the capabilities and assets to use environmental resources in a sustainable manner to promote their well-being. The term "environmental security" addresses the problem of vulnerability of particular human groups to environmental stresses - which may be related to natural processes and phenomena or unsustainable social activities. In this way, environmental insecurity is often felt most adversely by the poor and vulnerable populations of developing countries (Upreti 2013). The term has been associated with social, economic, and political factors that determine access to and ability of these populations to use resources, rather than merely focusing on the issue of environmental scarcity (Pritchard 2014). In fact, definitions of food, energy, or water security may vary, but issues such as access, availability, and quality of livelihood resources are often present.

As discussed in Part I, the water-energy-food nexus seeks to optimize efficiency in the management of these resources, recognizing interdependencies between systems. However, a significant part of this literature does not explain what ensures consistency across sectors and how this can be achieved (Weitz et al. 2017). As Stein et al (2018) remind us, this literature did

not sufficiently consider the relationship between the actors involved in the governance of the sectors and their social practices. In this sense, the present document is based on the idea that inconsistencies are an inherent part of cross-sectorial / cross-scale public action – and not simply the result of weaknesses in the management process – and should therefore be integrated into the governance analysis (Stevens 2018). The need to "politicize nexus" (Artioli et al. 2017), taking into account the existence of conflicts of interest and the asymmetric distribution of power, access to information, resources and capacities among actors and institutions, is therefore key in this document. In addition, the section analyzes how the actors are inserted in the structures of specific coalitions.

The very option to emphasize the concepts of security and vulnerability leads to the need for a politicized analysis of cross-sectorial integration. This is because there are many connections between socioeconomic conditions that make people more vulnerable to environmental threats as well as environmental conditions and natural disasters that can impact development, creating transient or chronic insecurity situations and further increasing vulnerability (Biggs et al. 2014). Aspects such as capacity, equity, and sustainability present since the early studies on "sustainable livelihoods" in the 1990s (Chambers & Conway 1992) also imply a more focused approach to governance processes, as they emphasize issues such as the availability of options and choices, knowledge, access to resources; distribution of assets, capabilities and opportunities; and sustainability in a context of vulnerability to stress and shocks.

In this context, policies and institutions represent a set of external factors that influence livelihoods, determining access to assets and reducing vulnerability to shocks (Biggs et al. 2014). More recently, the concepts of "resilience" and "adaptation" have complemented the analytical framework of vulnerabilities. In early studies, which gained great visibility on the international agenda of the 1990's, vulnerability reduction meant a shift in emergency management strategies to management based on shock prevention, emphasizing the role of inequality in the occurrence of disasters. "Resilience" and "adaptation", on the contrary, are mobilized in dynamic and changing situations, characterizing both the state of a system and the intrinsic processes or qualities that characterize it (Reghezza-Zitt & Rufat 2015).

These were appropriated by the field of global climate change, which gradually converged in the 2000's to the reduction of natural disasters. According to Adger (2006), "vulnerability" is the state of susceptibility to damage caused by exposure to stresses associated with environmental and social changes and lack of adaptive capacity. The author associates vulnerability to "socio-ecological systems," arguing that resilience in this case refers to the magnitude of the disturbance that can be absorbed before a system changes to a different state, as well as the ability to self-organize and the ability to adapt to emerging circumstances. Adaptive capacity, in this sense, refers to the ability to manage, accommodate and recover from environmental disturbances (Smit & Wandel 2006).

Therefore, the framework developed in this document dialogues with the theoretical model proposed by Biggs et al. (2014) and analyzes the interactions between food, energy, water and socio-environmental security through an analysis of the interactions between public policy instruments. The last category was added to those proposals by the nexus approach with the aim of more explicitly integrating the discussion on "sustainable livelihoods" and the combination of "vulnerability" and "socio-ecological systems". In this way, social, political, institutional, and infrastructure issues related to access, availability and quality of essential livelihood resources are integrated into the analysis. Such a framework will be examined from a perspective based on political processes, including institutional bottlenecks and actor's games.

2. METHODOLOGICAL STEPS AND OPTIONS

1.1. SURVEY OF INITIATIVES

a. Delimitation of sectors, jurisdictional unit and categories to be analyzed

The first step of this study is a survey of the main federal and state government programs and projects in Mato Grosso, as well as of the institutional actors involved in their coordination and implementation. The survey was limited to four major thematic axes: food, energy, water and socio-environmental security, as indicated in the previous section. In this case, the analysis focuses mainly on rural landscapes; therefore, the policies identified are limited to those that influence the dynamics of land use and change.

In addition to the thematic aspect, the interactions between policy instruments take different forms and directions depending on the territory in which these instruments are implemented and the political coordination among the actors involved in this process. Therefore, the survey should be based on a territorial unit, more specifically a jurisdictional unit. It is worth noting that the environmental component of human security reflects the fact that threats to human security do not always respect jurisdictional boundaries and the same is true for the dynamics of environmental change. However, an approximation in this case would be important to ensure a more direct dialogue with public policies.

In the Brazilian case, the recommended unit is the federative unit, whose scale allows satisfactory data collection and comparison with other units. Such a definition does not imply examination of only the instruments of state jurisdiction. It also includes federal instruments that focus on the state and that articulate with the state instruments, depending on the territory in question, the actors present and the priorities defined for public action.

As regards the time frame, the survey was limited to programs implemented over the last five years (2013 and 2017). This period may be altered depending on the objectives of the analysis and the data availability, but a minimum period of four or five years is recommended to ensure the identification of some trends and avoid generalizations from "atypical" years in public management.

The information collected for each program / project is summarized in the table below:

TABLE 4: INFORMATION COLLECTED ON EACH IDENTIFIED PROGRAM

	Program name
Characterization of the instrument	<ul style="list-style-type: none"> • Acronym • Reference government plan • Level (National, Regional, State, Local) • Sector (agriculture / livestock, agro-extractivism, energy, management / forestry, environment, land use and land tenure, social protection / assistance, water management) • Theme • Objectives
Programmatic features	<ul style="list-style-type: none"> • Type of instrument (direct intervention, institutional, regulatory, information system & technology) • Characterization of the instrument (rural credit, rural insurance, environmental inspection, environmental / land regularization, etc. ...) • Target public
Governance	<ul style="list-style-type: none"> • Governance space (articulation arena, co-implementation) • Actors - Main institutional bond (responsible body) • Actors - Co-implementation (partners) • Actors - Funding • Lines of action
Implementation	<ul style="list-style-type: none"> • Municipalities • Priority areas / Biome • Starting year • Period
Financing	<ul style="list-style-type: none"> • Volume of funds invested in Mato Grosso (2013-2017) • Volume of funds invested in actions without territorial definition (2013-2017) • Budget line (program n., action n., cooperation project, etc.)
Additional	<ul style="list-style-type: none"> • Source • Legal Instrument

The information was obtained from the official documents of the programs, decrees and management documents available on federal, state websites as well as in Portal da Transparência and Portal Siga Brasil websites. Some information was requested through the Electronic System of the Citizen Information Service.

A total of 138 structuring programs / projects were identified with a focus on the state of Mato Grosso in the period in question. Some plans, such as the "National Plan for Agroecology and Organic Production" (Planapo), the "Plan of Action for Prevention and Control of Deforestation in the Legal Amazon" (PPCDam) and the "Plan of Action for Prevention and Control of Deforestation and Burning in the Cerrado" (PPCerrado) were separated into their components, which often represent specific programs. An additional number of programs were surveyed, but those that were not active in the period, did not fit in the defined sectors or did not directly relate to any municipality of

the state were suppressed. Programs with very low incidence were not considered either. For example, the Bolsa Verde Program, which has only five beneficiary families across the state.

1.2. IDENTIFICATION OF INTERACTIONS BETWEEN INSTRUMENTS

Many of the information regarding the interactions between the instruments are already known and are available both in the literature and in the program management and evaluation documents themselves. Therefore, an initial and exploratory analysis can be done by the researcher himself when the data are collected. The process can be deepened in a second step from interviews.

The definition of the categories of analysis was based on the existing literature proposals (Flanagan et al. 2011; Rogge & Reichardt 2016; Barton et al. 2017; Stevens 2018). However, in order to provide a sufficiently objective analysis, very precise categories have been defined (**Erreur ! Source du renvoi introuvable.**). Such an analysis should be based on information available in the literature and in the program implementation documents and allows the visualization not only of the political environment in a jurisdiction, but also of the comparison between different jurisdictions.

TABLE 5: POSSIBLE INTERACTIONS BETWEEN INSTRUMENTS THAT AFFECT DIFFERENT TARGET GROUPS, IN A SINGLE JURISDICTIONAL UNIT (MATO GROSSO)

Sign	Type	Description
++	Complementarity	Complementarity in programmatic and / or procedural aspects Especially when one instrument contributes to the implementation / financing of another. For example, Ecoforte Program whose objective is the strengthening of Planapo's production axis.
+	Coherence	Programmatic coherence, however without direct connection (institutional or financial) For example, lines of credit that have the same objectives and the same financeable items.
+	Prerequisite	One instrument as a prerequisite for another For example, CAR is a prerequisite for a range of environmental and credit programs.
-	Articulation deficit	Deficit of procedural articulation Institutional / implementation issues between instruments, observed by managers / analysts (available in the literature / documents). Most inconsistencies between instruments are observed in this category. This does not include implementation deficits.
--	Conflict	Programmatic incoherence. For example, credit instruments that finance traditional inputs to agricultural production in a given territory and instruments that promote the use of bio-inputs. Caution is required in the definition of this type of interaction, since conceptually the policies would not be designed in a conflicting way.

3. ANALYSIS OF INTERACTIONS BETWEEN POLICY INSTRUMENTS

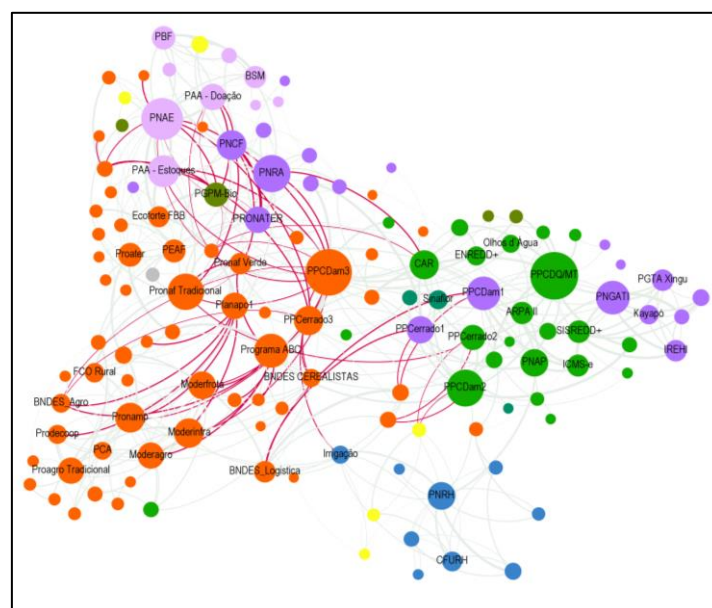
Different forms of data analysis and visualization are possible:

- isolating specific sectors;
- isolating specific themes;
- isolating specific objects;
- isolating targeted public of the policy;
- isolating levels (federative units, macro and micro regions);

The analyses of the interactions are carried out with support of Gephi 9.2 software. In addition to the type of interaction (complementarity, coherence, prerequisite, institutional deficit, programmatic inconsistency) and its intensity (-2 to +2) (**Erreur! Source du renvoi introuvable.**), the amount of financial resources invested (executed) are also used to define the weight of the interactions. The programs / projects were divided into groups according to the type of instrument, in order to avoid asymmetric comparisons such as, for example, building energy infrastructures and transferring income to families. In each group of instruments, the programs were separated into four classes according to their position in the distribution of the amount of resources in that series (descriptive statistics). Therefore, the weight of the interactions takes into account the type of interaction and the approximate amount of resources compared to the rest of the resources invested in other programs of the same group of instruments.

Figure 9 shows the positive (light gray connections) and negative interactions (red connections) between programs / projects by sector. (*Agriculture in orange; Environment in green; Protection / Social Assistance in pink; Territorial and land tenure in purple; Water resources in blue; Energy in yellow*). The objective of the image is to present a cartography of the main instruments implemented in Mato Grosso in the defined sectors and to show among which sectors / groups of policies the main inconsistencies / conflicts occur.

FIGURE 9: POSITIVE AND NEGATIVE INTERACTIONS BETWEEN PROGRAMS IN DIFFERENT SECTORS



Source: Prepared by the author

Most negative interactions registered refer to **articulation deficits, mainly due to procedural / organizational issues**. Some examples are the difficulties of institutional articulation between the programs of public purchases of agricultural products (Food Acquisition Program - PAA, National School Feeding Program - PNAE) and programs to strengthen the marketing of agro-extractivist products (Minimum Price Guarantee for Socio-biodiversity Policy - PGPM-Bio). The challenge of identifying and accessing extractive populations to the Declaration of Aptitude to Pronaf (DAP), associated with their dispersion in the national territory, contributes to this type of deficit. The regulation of DAP in order to make it more appropriate to the agro-extractive context is considered as a way to promote greater articulation, as well as the access of this public to the "National Program for Strengthening Family Agriculture" (Pronaf).

The non-inclusion of extractive products in the menus of school meals benefited by the PNAE or the frequently observed asymmetry between the amount of resources made available by the program and the price of these products are other factors. The base document of PPCDam III and PPCerrado II also mentions the need to expand the scope of technical assistance (ATER) to attend agro-extractivism practices, as well as forest management and agroforestry systems (MMA 2016).

In addition, the deficit can also be observed from the territorial point of view. For example, as indicated by the same document, much of the supply for the production of pig iron in the national territory is of illegal origin, causing unauthorized deforestation. The Sustainable Steel Project, promoted under one of the sectorial plans of the national climate change policy, does not yet cover the state of Mato Grosso, maintaining in this state the disarticulation between policies to combat deforestation and credit to industrial production.

The cases of **programmatic conflict** are rarer, including, for example, rural credit lines that target the same target public, but which finance different items such as inputs and agrochemicals x investment in organic and agro-ecological production. With regard to the articulation between rural credit and environmental conservation, a resolution of the federal reserve bank from 2014 required financial institutions to establish an internal socio-environmental responsibility policy. The incorporation of socio-environmental risk in the analysis of credit operations and the establishment of a governance structure that ensures compliance with these objectives could in fact contribute to the procedural articulation between credit instruments and those to combat deforestation.

However, negative conditionalities are not the only strategies to combat deforestation associated with productive activities. These, as well as the inspection, are fundamental, but do not alter the structural land use patterns. Positive incentives that stimulate more sustainable production systems also contribute to this goal. However, Pronaf's "green" credit lines (Eco, Forest, Agro-ecology) represent, according to the Central Bank, less than 1% of the total rural credit granted. The Low Carbon Agriculture Program (ABC Program) has not shown very different results either, representing less than 2% of the total since the beginning of its implementation. In addition, according to reports from the Ministry of the Environment, the volume of this type of credit available to priority municipalities to combat deforestation in the Amazon is still inexpressive (MMA 2016).

It should also be noted that the progressive growth of the ABC Program interest rates⁷, coupled

⁷ At its launch, the ABC Program presented the low interest rates as a competitive and attractive differential, at 5.5% p.a., in order to stimulate producers' access. This interest rate gradually

with a low investment economic environment, negatively impacted the volume of disbursements, which was already insufficient, making the credit line uncompetitive in relation to traditional rural credit lines. In addition, the technical requirements demanded by the programs are much higher than those demanded by traditional lines. In the case of Mato Grosso, the tendency is the greater inclination of producers and technical assistance professionals for the credit lines of the Center-West Fundamental Constitutional Fund (FCO), to the detriment of the ABC Program (Observatório ABC 2017a). The areas defined as priorities by the ABC Program, mainly for the recovery of degraded areas, should, according to analysts, be supported by a state subsidized rural insurance program. Most of the degraded lands are those that face greater climatic risk (due to problems of high variability in rains, sandy soils, slopes, etc.) (Observatório ABC 2017b).

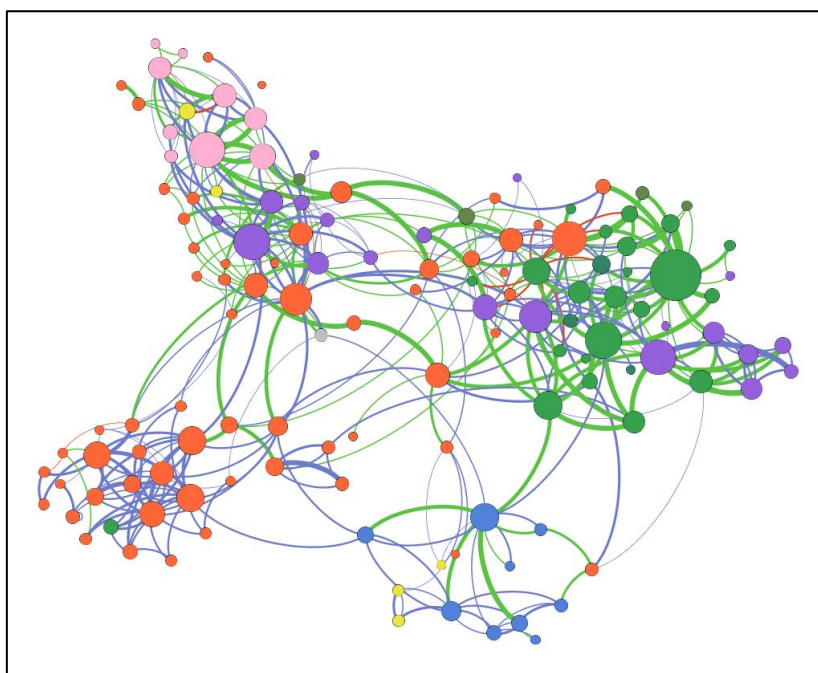
Finally, some initiatives aimed at increasing policy integration are being planned. These initiatives deserve more in-depth case studies to assess their integrative potential. We can cite the axis IV of PPCDam and PPCerrado, which focuses on economic and normative instruments, including mechanisms of articulation with private sector. In addition, the direct support of these national plans to the state plans for prevention and control of deforestation point to the complementarity of these actions and the establishment of a multilevel articulation. In the case of Mato Grosso, the discussions on the updating of the Plan of Action on Prevention and Control of Deforestation and Burning (PPCDQ / MT) point in the direction of focusing on actions related to environmental monitoring and control. Thus, it would be interesting to assess to what extent the other components of national plans translate into support for other state strategies.

As far as positive interactions are concerned, from a broad repertoire of these interactions one can identify the different combinations of instruments (*policy mixes*) that affect each region and involve different groups of actors.

Figure 10 considers only the positive interactions. In this image it is possible to observe more accurately intra and cross-sectorial interactions. Four main policy groups (or mixes) are identified: (i) a rather dense (orange) group of agricultural programs with little integration with other sectors; ii) a less dense group (in blue and yellow) where water resources management programs (mostly institutional instruments) interact with energy investment projects; iii) two relatively dense groups with a greater number of cross-sectorial interactions (in pink, purple and orange on the left side, and green, purple and orange on the right side). The first presents programs of productive inclusion, food and nutritional security, social assistance and land regularization. And the second presents programs to promote sustainable production systems, environmental conservation and regularization and management of indigenous lands. They can be summarized according to the thematic axes proposed in this document: energy, water, food and socio-environmental security.

evolved to the level of 8% to 8.5% p.a., currently practiced (Safra 2016/17), in line with the country's economic situation. Pronaf still presents interest rates from 2.5% pa. to 5.5% a.a. for costing and investment, depending on the value of the (Observatório ABC 2017a)

FIGURE 11: POSITIVE INTERACTIONS BY TYPE OF INTERACTION



Source: Prepared by the author

The same type of analysis / filter can be applied to the main themes of each program, target group, etc. Another option includes comparing different states. For example, it was observed that in the state of Pará, a series of programs that do not effectively affect Mato Grosso, such as Bolsa Verde, Assentamentos Verdes, Florestas de Valor and other projects of the Amazon Fund with great potential to integrate different sectors, could modify the structure of the network of interactions. An additional possibility would be to use this type of methodology for planning exercises. For example, the Produce, Preserve and Include Strategy, institutionalized in 2017 by the government of Mato Grosso, would have the potential to connect the agricultural and socio-environmental spheres, which can be represented by this type of chart.

4. ANALYSIS OF THE TERRITORIAL IMPACT OF PROGRAMS

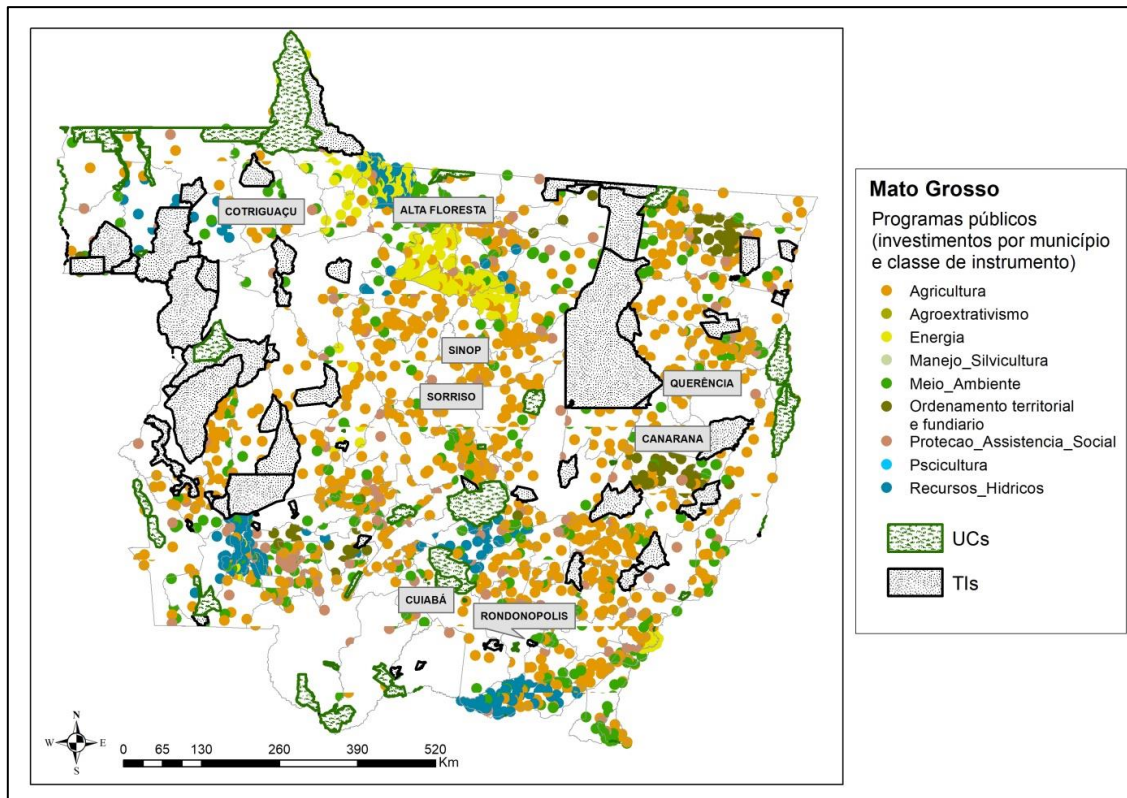
In addition to the direct interactions between the identified programs, another useful tool is the geo-referencing of direct support investments (credit, development, insurance, compensation, infrastructure investment, income transfer, public procurement and food distribution, etc.). This tool, however, does not include regulatory or institutional instruments, which do not necessarily have a specific territory.

The figures below represent the allocation, in the municipalities of Mato Grosso, of the volume of resources of each program divided by the total volume in each group of instruments and by the population of each municipality. The selected view was the density of points as a reference to the volume of resources.

Figure 12 shows the incidence of colored programs by sector. It is possible to verify the importance of actions of support to the agricultural sector all over the territory and, in some regions, concentration in the energy and water resources sectors. To this image were added the

Protected Areas and the Indigenous Lands existing in the state. Moreover, the data can also be layered with other information such as logistics infrastructure, dams etc. **This type of exercise provides an image of the territoriality of public policies, indicating a kind of mapping of priorities and, therefore, of recognized / induced vocations.**

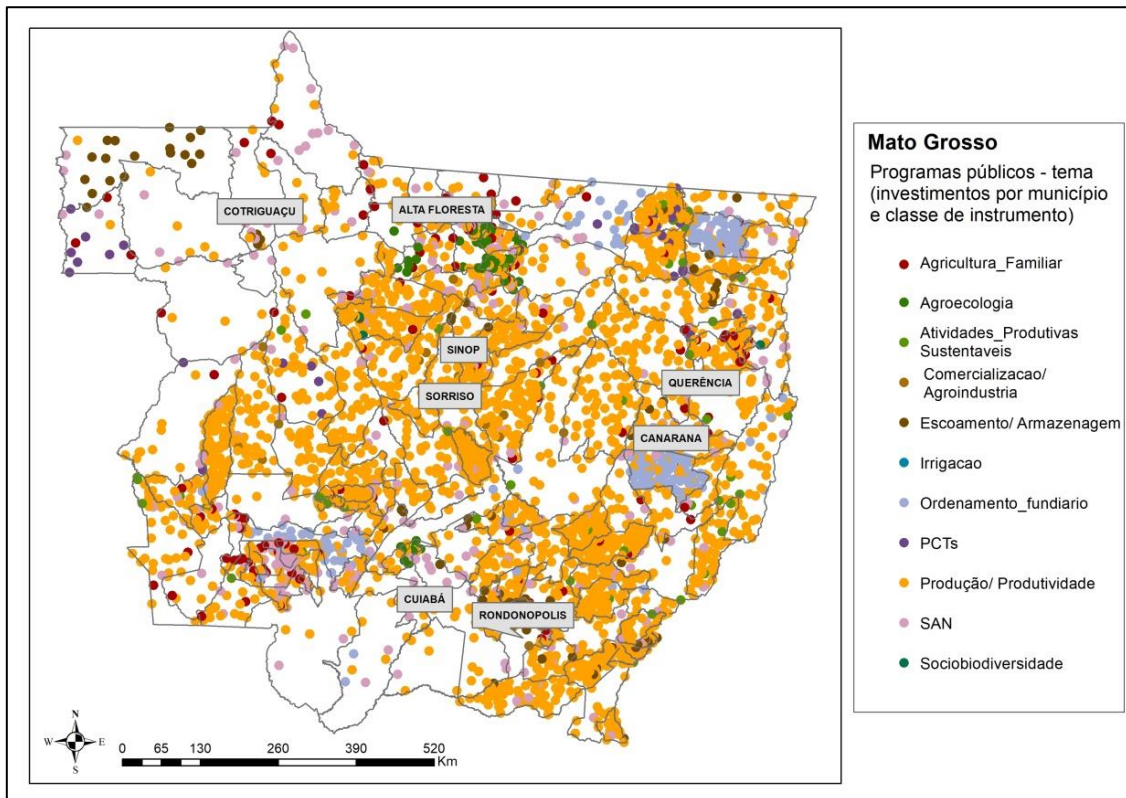
FIGURE 12: INCIDENCE OF PUBLIC INVESTMENTS IN MATO GROSSO BY SECTOR (2013-2017)



Source: Prepared by the author

Figure 13 mainly shows the programs with some relation to the agricultural sector (including production, commercialization, outflow and productive inclusion). It is possible to observe the urgency and great spatial distribution of actions focused on increasing agricultural production and productivity. The relative importance of instruments to support family farming is small and actions to support land regularization of settlements are rather concentrated.

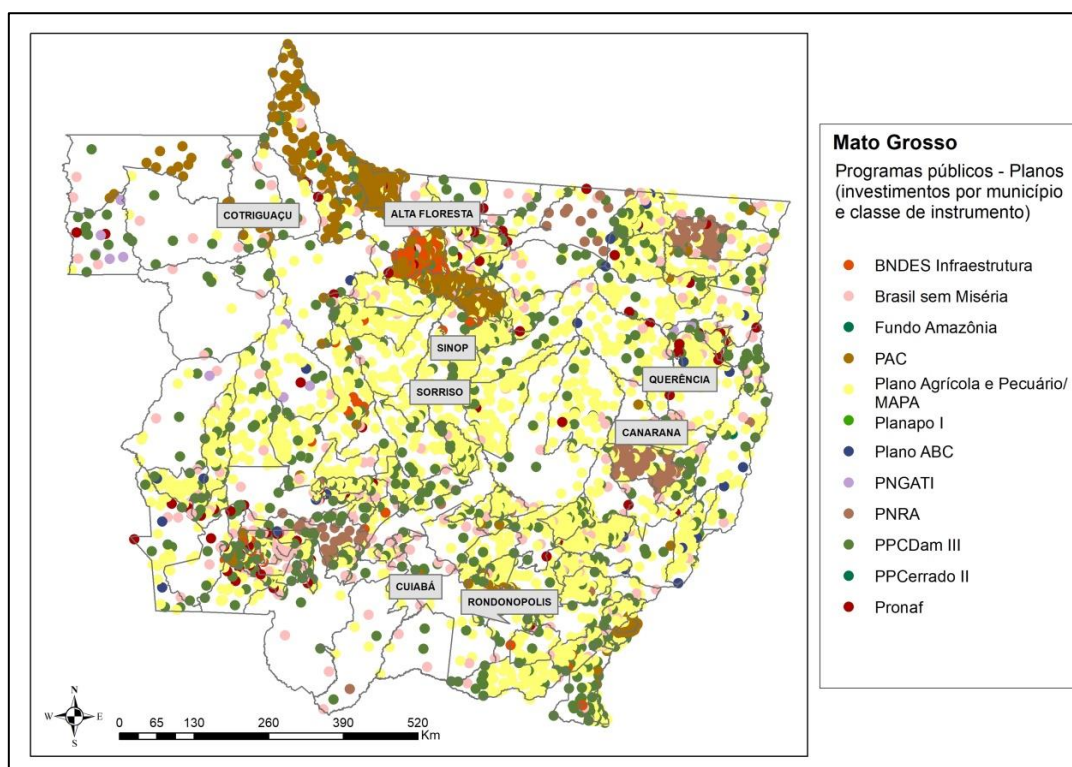
FIGURE 13: INCIDENCE OF PUBLIC INVESTMENTS IN MATO GROSSO BY RURAL THEME (2013-2017)



Source: Prepared by the author

Figure 14 shows the federal plans that structure most of the programs that focus on the state, with emphasis on the Agricultural and Livestock Plan of the Ministry of Agriculture and the investments of the BNDES and the Growth Acceleration Program (PAC) in logistical and energy infrastructures in northern state.

FIGURE 14: INCIDENCE OF PUBLIC INVESTMENTS IN MATO GROSSO BY FEDERAL PLAN (2013-2017)



Source: Prepared by the author

5. ANALYSIS OF THE POLICY PROCESS

As previously defined, the framework proposed in this document is based on an analysis of the policy process. The explanatory factors of (non) integration situations include organizational factors, but are mainly based on political issues and concertation and conflict between actors and ideas. Addressing the integration of instruments as a multifaceted political process allows for a finer analysis of complexity as well as policy change.

This analysis combines literatures geared to policy change from the cognitive point of view, especially the approach of the advocacy coalitions (Sabatier & Jenkins-Smith 1993; Jenkins-Smith et al. 2014)⁸, and the institutional analysis of policy mixes (Stead & Meijers 2009; Rogge &

⁸ The framework of the defense coalitions seeks to explain the systems of normative and causal ideas (*belief system*) that guide the articulation between actors who seek to influence political decision. Actors from different public and private institutions, at different jurisdictional levels, are grouped into one or more coalitions, whose members share a set of normative beliefs and perceptions of the world, and act together to translate their ideas into public policies (Jenkins-Smith et al. 2014). 2014).

Reichardt 2016) with the networks analysis of the interactions between the institutional actors involved in the implementation of the programs, e a The combination of these frameworks is useful for the analysis of concertation among actors in a multilevel subsystem.

As mentioned earlier, the policy mixes are the result of a social and political construction at different levels, and their implementation refers to the translation / adaptation of the instruments to the socio-political and ecological contexts of each territory (Davenport et al 2017). It is sought, in agreement with the guiding question of the Artmix project⁹, **to identify the promoters and inhibitors of a successful and innovative articulation of adaptation instruments between sectors and scales**. These include the **structure of actor networks** (sectoral regulation, centralized cross-sectorial network, polycentric network) and the **role of intermediate actors** (Piketty & Massardier), in addition to **institutional** factors (clarity of mandates, cross-sectorial coordination), **socio-political and cognitive** factors (agendas, interests, view of the implementing actors, involvement of local actors), **economic factors** (availability of resources, evolution of prices of agricultural products, etc.).

Some examples of actors networks involved in the implementation of the programs identified for the Mato Grosso case are presented below. Figure 15 presents a network of actors in which the degree centrality measure was applied. This reflects the number of interactions of each node (the larger the node, the greater the number of interactions).

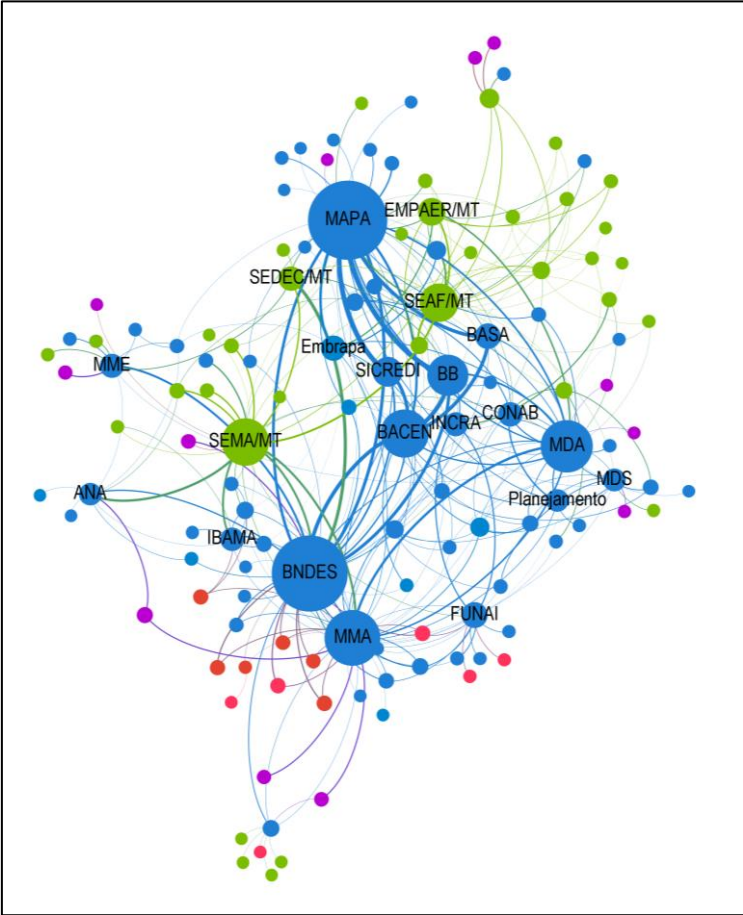
The nodes represent mainly governmental institutions and were colored according to the level of action (purple - international, blue - federal, green - state, red - municipal / territorial). It can be observed a network centralized in some actors, being that the federal and state institutions of the rural sector are shown to be quite interconnected. With regard to the institutions involved in environmental policies, there is a greater connection between national, municipal and international actors. It is worth highlighting the importance of the BNDES as a financing institution for many actions in the state of Mato Grosso.

In this figure, we sought to evaluate mainly the centrality of the nodes and the cohesion of the network. The network has a poorly interconnected structure (many institutions have only one inter-institutional connection), conveying the idea that the organizations involved do little to implement the identified initiatives. In addition, the network density is 0.2 (the density being between 0 and 1). According to Kurin et al. According to (2018), in a strongly connected network it would be expected higher levels of density in addition to a greater number of interactions between organizations of each group (sector).

⁹ "Articulations of adaptation policies to climate change in Latin America and the Caribbean". Funded by the French National Research Agency (ANR) and coordinated by CIRAD, it brings together cases in three countries: French overseas regions (Guadeloupe and Martinique with INRA, University of the West Indies and IT2), Brazil (Northeast with the Center for Sustainable University of Brasilia) and Colombia (with CIAT in Cali)

In general, centralized and hierarchical structures tend not to be able to deal with complex governance problems that characterize the challenges of nexus and adaptation, taking the local context into account (Stein et al. 2018). 2018).

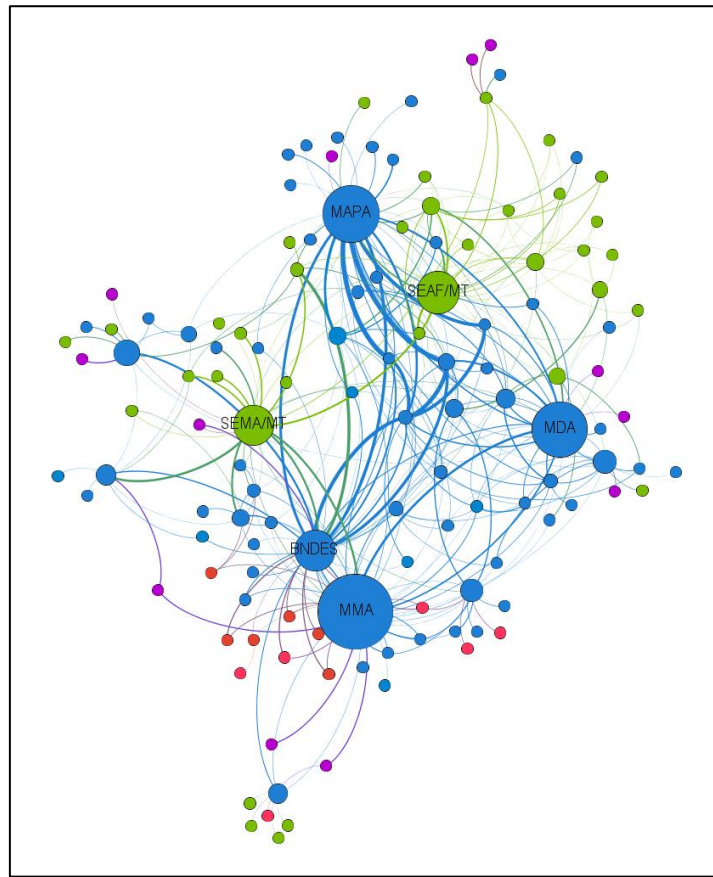
FIGURE 15: ACTORS NETWORK, MATO GROSSO - BY LEVEL OF ACTION (DEGREE CENTRALITY)



Source: Prepared by the author

In the network analysis, the notion of centrality is related to the different forms of influence and to the processes of intermediation. Because of their position, central actors can exert influence over other actors or have access to resources and information that provide them opportunities not accessible to others. Central actors may also be subject to specific restrictions due to the pressure associated with their location in the general network (Stein et al. 2018) . In Figure 16, we used the measure of betweenness centrality that informs how far an actor stands between two other actors who are disconnected. High intermediation is often associated with a broker position and, thus, to the ability of facilitating or restricting the flow of information and resources across a network. Governance processes can be shaped by multiple network structures, and at different network levels, to create the conditions in which co-ordination and cooperation are more likely (Stein et al. 2018). 2018).

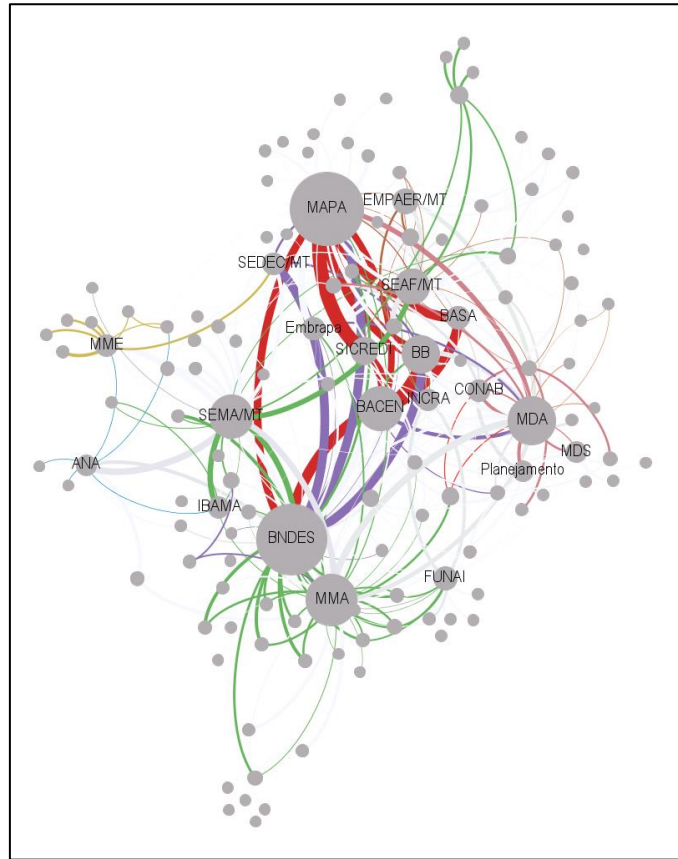
FIGURE 16: ACTORS NETWORK, MATO GROSSO - BY LEVEL OF ACTION (*BETWEENNESS CENTRALITY*)



Source: Prepared by the author

An additional analytical option is to identify, from the policy survey, the main arenas of interaction between the actors. Figure 17 presents the same network as Figure 15, and the connections were colored according to the main coordination arenas of the institutions in the programs implementation (green - Amazon Fund; pink – National Council for Food and Nutrition Security; purple – Executive Group on Climate Change; red – rural credit; brown – Technical Chamber for Destination of Federal Lands and State Council for Sustainable Rural Development, blue – National Council of Water Resources).

FIGURE 17: ACTORS NETWORK, MATO GROSSO - BY COORDINATION ARENA



Source: Prepared by the author

Network analyses can be combined with the identification of promoter and inhibitor factors of policy integration in case studies, as performed in the review of the Produce, Preserve and Include strategy. The strategy was launched during the Conference of the Parties to the UN Framework Convention on Climate Change (COP 15 Paris) as a means to promote a model of low-carbon rural development and innovative governance, involving both public and private actors. The governance structure sought to promote the integration between actions geared to these objectives, going beyond voluntary agreements between the agents of the main value chains with environmental impact and the councils of civil society. The design process and the evolution of this strategy were detailed in article (Milhorance & Bursztyn 2018). Here we summarize only the factors that led to the creation of this governance structure and its potential contribution to facilitate the integration of policies, as presented in the table below. The objective is to present different methods of analysis of these factors.

TABLE 6: MAIN FACTORS LEADING TO THE CREATION OF PCI AND POTENTIAL CONTRIBUTION TO POLICY INTEGRATION IN MATO GROSSO

Political factors:

- Window of opportunity to launch the PCI and international visibility.
- Strategic planning as a negotiation process, crucial in a context of divergent priorities, interest, ideologies and power asymmetries.
- Perceived gains in market access by some agribusiness' stakeholders and proposal of economic incentives by public agencies to promote more sustainable supply chains.
- Shared costs and risks of implementing the PCI.

Institutional/organisational factors:

- Proposal of allocating budgets to cross-cutting issues rather than to conflicting sectors.
- The PCI Facility as a means of promoting long-term objectives rather than initiatives dependent on election cycles.
- Potential to establishing standardised procedures, allowing for greater supervision and maintenance of an orderly and reliable pattern of resource flow.

Process/management/instrumental factors:

- Establishment of a strategic policy framework (the strategic plan) to ensure that sectoral policies are consistent with the PCI objectives and priorities.
 - Establishment of the PCI facility, making the implementation procedures more flexible and less bureaucratic.
 - Promotion of a systematic inter-sectoral dialogue, involving all indispensable actors.
 - Increase of transparency and trust in an environment of poor historical relations between stakeholders.
-

Source: Milhorange & Bursztyn (2018)

CONSIDERATIONS

This section sought to contribute to the design of a framework for analyzing the interactions among policy instruments that is adaptable to different contexts related to the governance of natural resources and sectorial agendas in Brazil. The material does not correspond to a finalized model, and should be submitted to evaluations and debates in order to make it applicable. It is an exercise that can be performed through documentary research, resulting in a mapping of the main combinations of instruments incident to a territory and of their most evident interactions. However, a more thorough and fine analysis would need to be accompanied by interviews in the identified territories.

The framework dialogues with the proposal of Biggs et al. (2014) to more explicitly combine the concepts of "sustainable livelihoods" and "environmental security" with the "nexus" approach. It analyzes the interactions between the food, energy, water and socio-environmental securities through an analysis of the interactions between the policy instruments. This framework is based on the concepts of "vulnerability", "resilience" and "adaptation", which since the 1990s have emphasized the role of social inequalities and of political and institutional factors in the impacts of environmental change.

In this context, the inhibiting and promoting factors of integration between policy instruments are

examined from the analysis of the policy process, including governance, institutional bottlenecks, and power and influence relationships. These factors include the structure of actors' networks, the role of intermediate actors, institutional, socio-political, cognitive and economic factors. The framework also discusses the proposal to "politicize the nexus", taking into account the existence of conflicts of interest and the asymmetric distribution of power, access to information, resources and capacities among actors and institutions.

The water, energy, food and socio-environmental security remit to the challenges of multilevel and cross-sectorial governance. Therefore, understanding the governance of these interconnected resources and policy systems requires scaling up the scope of analysis to include not only horizontal but also vertical interactions as well as other policy areas, and how they shape the potential for cross-sectorial collaboration and coordination. Social network analysis has proved to be a useful tool for examining the complexities of interactions between sectorial instruments and between actors. Data visualization tools can, for example, map the densities and hierarchical level of networks.

The survey of public programs and projects took into account the actually active initiatives in the territory (in this case a jurisdictional unit), as well as the weight of each initiative as an approximation of the volume of resources invested (by type of instrument) in the given period. In addition to being limited to the four thematic axes described above, the policies identified were limited to those that influence the dynamics of land use and change. The interactions between the instruments were defined on the basis of the literature, but they sought to formulate an objective framework that could be applied from the program documents.

It is worth noting that most negative repertoire interactions refer to articulation deficits, mainly due to procedural / organizational issues. The cases of program conflicts are rarer. From the repertoire of positive interactions, the different policy mixes that affect each region and involve different groups of actors were identified. These sets of policies are the result of a social and political construction at different levels, and their implementation refers to the translation of the instruments to the socio-political and ecological contexts of each territory.

In addition to examining the direct interactions between the identified programs, another tool was the geo-referencing of investments on direct support, capable of presenting an image of the territoriality of public policies, indicating a kind of mapping of priorities and, therefore, of recognized / induced vocations.

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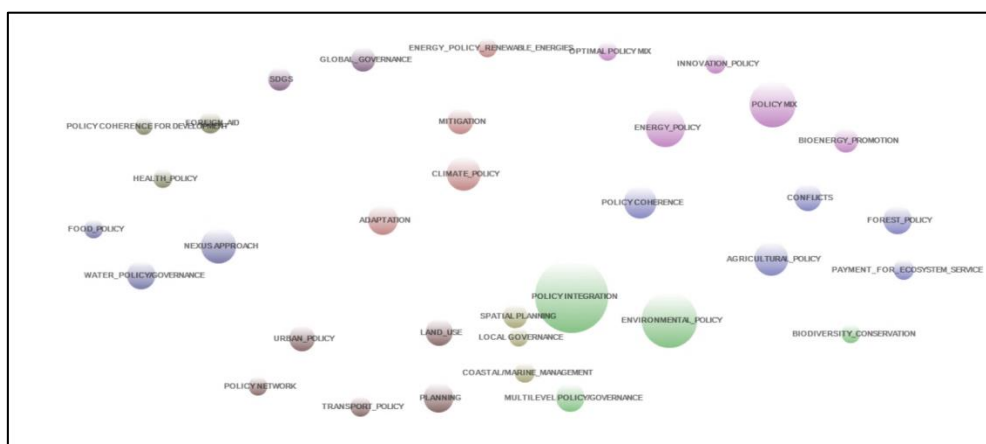
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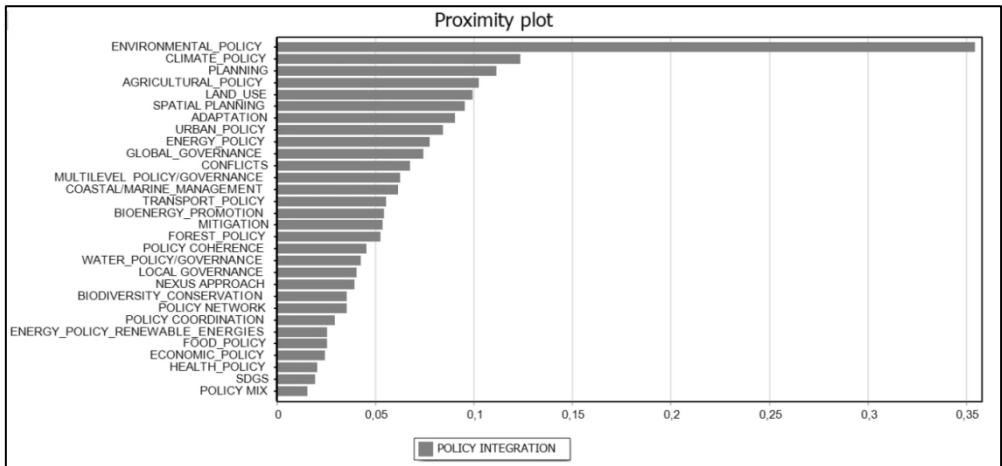
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FIGURE 18: INTERACTIONS BETWEEN CONCEPTS AND THEMES



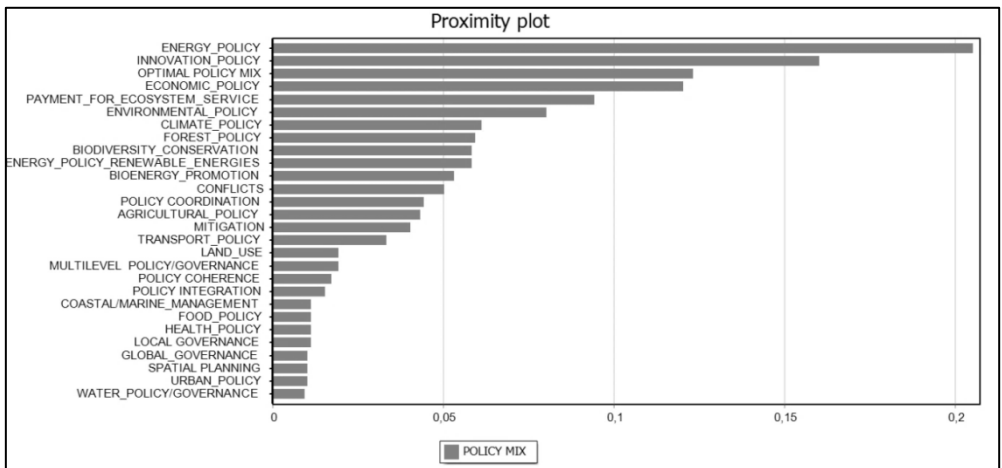
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FIGURE 19: INTERACTIONS BETWEEN CONCEPTS AND THEMES



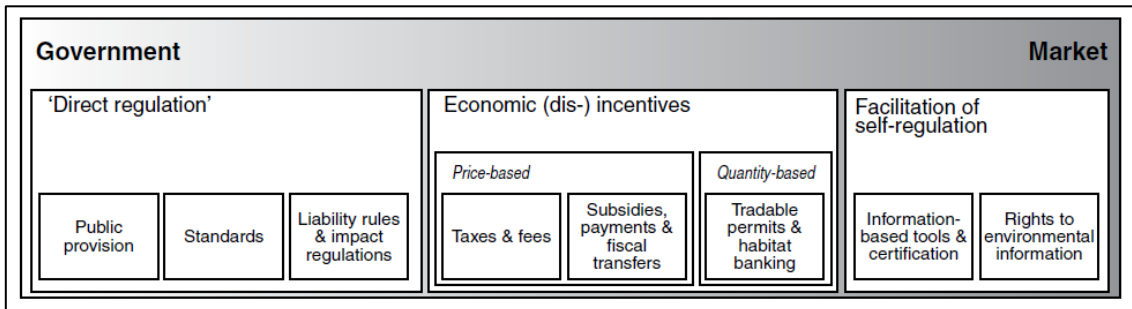
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FIGURE 20: INTERACTIONS BETWEEN CONCEPTS AND THEMES



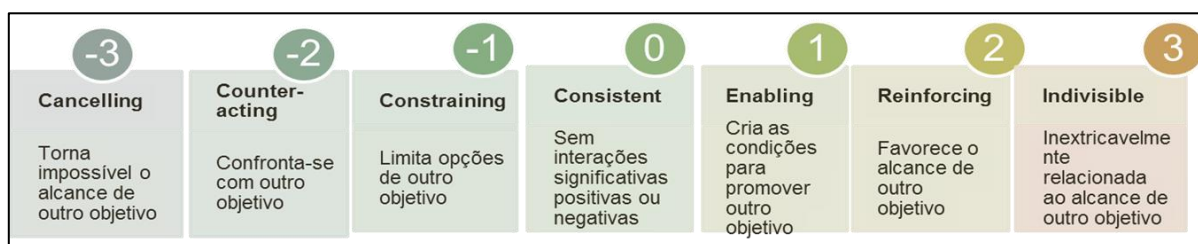
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FIGURE 21: SUMMARY OF ECONOMIC INSTRUMENTS (FOR BIODIVERSITY CONSERVATION)



SOURCE: RING & BARTON (2015)

FIGURE 22: SCORE OF INTERACTIONS BETWEEN SDGs.



SOURCE: NILSSON ET AL. (2016)