
# Militarism, Developmentalism and Environmentalism

*An institutionalist tale of the greening of the Brazilian government and the emergence of the Amazon rainforest's monitoring system*

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# ABSTRACT

The dissertation analyses the evolution of the Brazilian government policy and the Amazon monitoring system from the perspective of institutional theory. More specifically, we argue that an evolving Amazonian institution, a social entity composed by ideals, discourses and techniques of control has influenced the governmental actions towards the Amazon, including the environmental policy and the creation of the Amazon's monitoring system. The Amazonian institution, at its turn, has been influenced by three different conceptions of control (managerial paradigms): the militaristic, which focus on national security; the developmental, which centre on wealthy creation; and the environmental, which is mainly concerned with the long term survival of humanity. In this sense, the evolution of the policy towards the Amazon and the monitoring system are the reflection of a constant warfare between those three conceptions of control. Between 1964 and 1988 the Amazonian institution has been dominated by the militaristic and developmental conceptions of control, which explains the destructive policy towards the rainforest. The reason for the prevalence of those conceptions can be found in the fact that Brazil was under the military rule and in the 20th century the intervention of foreign countries in the Amazon had brought heavy economic losses to Brazil. During the second phase of the Amazonian institution, between 1989 and 2000, international pressures introduced into the discursive facet of the Amazonian institution (e.g. the environmental laws) the environmental conception of control. However, the other facets, ideals and techniques of control, remained under the influence of the developmental and militaristic conceptions of control. This explains why the shape of the Amazon's monitoring system that aimed during that period at helping Brazil to defend itself from international criticism, not at protecting the environment. Consequently, despite the new environmental-friendly discourses, the situation in the Amazon did not improve. During the last phase of the Amazonian institution, from 2001 up to the present, the military conception lost its force and the environmental conception of control was finally able to influence the ideals and techniques of control of the Amazonian institution. The strengthening of environmentalism can be explained by the raise of the risk society, where parts of society start to be concerned about the future survival of the human species. The Amazon's monitoring system has been able for the first time to reduce deforestation in the rainforest, and the government has proposed the creation of a fund linking international money to the preservation of the rainforest. However, the analysis suggest that the militaristic values embedded in the Amazon's monitoring system, added to the still strong presence of the developmental conception of control pose a threat to the long-term preservation of the Amazon rainforest. The empirical data for this paper has been collected through a series of interviews held between June and August 2007, in three different states of Brazil. The informants were thirteen government officers, two members from NGOs and one entrepreneur active in the Amazon region. The government officers interviewed are individuals directly involved in the development and use of the Amazon monitoring system and the creation of the country's environmental policy, including two ex ministers of the Environment and directors of different environmental and research bodies.

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# 1. Introduction

The Amazon rainforest spans nine countries, but nearly 60% of the area is under Brazilian sovereignty. The rainforest is one of the most important ecosystems on the planet since it represents over a half of the remaining rainforests, hosts the highest number of vegetal and animal species and 20% of the planet's fresh water. However, many believe that its importance goes well beyond beauty and biodiversity as they hope that Amazon's biodiversity may provide remedy for modern plagues such as HIV/AIDS and cancer (Mans, da Rocha, & Schwartsmann, 2000). In addition to that, some studies point out that the Amazon rainforest is inexorably linked to global warming, since there is evidence that the deforestation of the Brazilian alone contributes to 4% of man-made greenhouse gasses emissions at planetary level (Fearnside, 1997; Schroeder & Winjum, 1995). Thus, the preservation of the Amazon forest plays a key role in reducing the speed of global climate change which may lead to catastrophic events in different parts of the globe, including famine and mass migration triggered by droughts (IPCC, 2001, 2007).

At present, the idea that the Amazon rainforest should be preserved is well established at the current Brazilian government. Furthermore, it is also broadly accepted that geographic information systems (GIS) and remote sensing technologies (that compose the Amazon's monitoring system) are "essential tools" to protect the rainforest. As a consequence, in the last years the situation of the Amazon rainforest has improved consistently: deforestation rates dropped sharply and the current government made a historical move and proposed a carbon credit scheme to channel international money to preserve the rainforest.

However, the governmental vision towards the Amazon was quite different in the past. As we will see bellow, in the previous decades the official policy towards the Amazon was highly predatory, which suggested that the preservation of the Amazon was not a concern for the government. Furthermore, it was only at the turn of the century that the Amazon's monitoring system started to present any influence on the reduction of the speed of environmental degradation of the rainforest.

The history of the Brazilian environmental policy and the world's biggest environmental monitoring system used to protect the world's last patch of virgin land may contain lessons that could contribute for the preservation of the remaining of the

rainforest and other ecosystems. However, despite the importance of this topic, little research has been done to investigate the reasons behind the evolution of the Brazilian environmental policy and the establishment of geographic GIS and remote sensing for environmental purposes.

This dissertation attempts to address this gap by developing an in-depth case study based on the analysis of the current literature and a series of interviews to senior officers and politicians in Brazil. The case study highlights the relation between the evolution of the Amazonian policy, the emergence of the Amazon's monitoring system and the broader socio-organisational context during the last four decades. The analysis bellow argues that the current shape of the Amazon's monitoring system is not purely "scientific" as their technical reports suggest, but has been susceptible to influences from the military worldview present when the system was born. Similarly, this study argues that events as distant as the rubber boom in the 20$^{th}$ century and the emergence of environmentalism are able to explain the false starts and contradictions present at the current and past Amazonian policy.

The dissertation is organised as follows. The second chapter states explicitly the research aims and questions that this dissertation attempts to answer. This dissertation has two research questions: the first looks at the evolution of the policy towards the Brazilian Amazon, while the second focus on the emergence of a set of GIS and satellite-based remote sensing systems that compose what this dissertation calls the "Amazon's monitoring system".

The third chapter reviews different bodies of literature related to the topic under study. The first section of the review illustrates how sociology, anthropology, management and international politics have seen the rise of environmentalism in the contemporary society. The second section reviews the literature on the social aspects of GIS in order to seek for links between the broader context and information systems. The last section addresses the literature from different areas that cite the Amazon's monitoring system. The chapter argues that the current literature on the topic do not address the link between the Amazon's monitoring system and other broader factors, such as the raise of environmentalism and the changes in political system that occurred in Brazil in the last decades.

The fourth chapter reviews the literature on institutionalism, a body of theories that could be useful to trace the relation between the evolution of the policy towards the Amazon, the monitoring system and the Brazilian context. It starts from the

origins of institutional theory in organisational studies, and discusses of the different traditions in the field. The last section proposes and justifies a specific take on institutional theory that draws on the work of different authors to build the theoretical framework for this dissertation.

The fifth chapter explains and justifies the research methodology applied to collect organise and analyse the empirical dimension of this dissertation. First, it states that subjective idealism and anti-positivism are respectively the ontology and epistemology adopted for this study in order to fit with the theoretical framework proposed in chapter four. Then it explains how the informants for this dissertation were selected, and how their interviews were analysed under the interpretivist tradition.

The sixth chapter finally presents the case study that provides the empirical basis for this dissertation. The case study shows during the last four decades the policy towards the Amazon rainforest has changed consistently, while the technology behind the Amazon's monitoring system remained relatively intact.

The seventh chapter rereads the case study under the theoretical lens proposed in chapter four. It provides an institutionalist account of the greening of Brazilian government and the emergence of the Amazon's satellite monitoring system for environmental protection and answers explicitly the two research questions.

The last chapter provides conclusion of the analysis proposed in chapter seven, and argues that the history of the Amazon's policy and monitoring system can be conceptualized as the contested ascent of environmentalist versus developmental ideas.

## 2. Research Aims

This study intends to understand the reasons behind the emergence and establishment of the Amazon monitoring system as the main tool to protect the Amazon rainforest, and the evolution of the country's policy towards the Amazon. However, the history of the monitoring system is inexorably linked to the evolution of Brazil's environmental policy. Therefore, before turning our focus to the monitoring system, this study attempts to understand the evolution of the government's policy that led to the decision to preserve the Amazon rainforest. More specifically, this study aims at answering two research questions in the following order:

1. How has the Brazilian policy concerning the Amazon rainforest evolved in the previous four decades, and what were the reasons for that evolution?
2. How did the Amazon monitoring system emerge and establish itself as the tool to protect the Amazon rainforest, and why it took its current shape?

The study intends to have outcomes to at both theoretical and practical levels. Being an interdisciplinary study, this research intends to make original contributions to the areas from which it draws its theoretical framework, namely: institutional theory and GIS research. This study will also attempt to influence the environmental and technological policy of Brazil and other countries with similar natural resources in two ways. First, while uncovering the deep assumptions behind the current use of ICT for environmental protection this study intends to improve current practices in the field and eventually lead to new ones. Second, the history of the world's biggest environmental monitoring system used to protect the world's last patch of virgin land may contain lessons that could contribute for the preservation of the remaining of the rainforest and other ecosystems.

# 3. Literature Review

In order to address the research questions posed in the previous chapter, this dissertation required the exploration of areas usually kept separated by faculty borders, such as biology, organisational studies and computer science. The next section, reviews the literature from different areas covering the emergence of environmentalism. The third section looks at the literature concerning the social aspects of GIS, while the last section presents the papers from international politics, biology and remote sensing literature that refer to the Amazon's monitoring system, a set of GIS and satellite-based remote sensing systems used to protect the Amazon rainforest.

## *3.1. Environmentalism*

The literature of different areas has studied the increasing awareness of environmental risks generated by human activities, usually referred as environmentalism. This section reviews environmentalism in four different disciplines – sociology, management, international politics and anthropology – in order to highlight findings relevant to this dissertation.

Different sociologist proposed theories to explain the raise of environmentalism in contemporary society (e.g. Douglas, 1993; Giddens, 1990). Beck (1992), for example, suggests that the emergence of environmentalism is a symptom of an ongoing paradigm shift in modern societies. In order to explain this change, he makes the distinction between the classical and a new emerging society. The old society, or industrial society, has a strong faith in modernity and scientific knowledge, and focuses on wealth creation through technological expansion. During the second half of the 20$^{th}$ century, the industrial society reached a high level of modernity that enabled the emergency of a new society. In this new context, agents have become more individualised and consequently, the social structures that shape their behaviour loose their power forcing individuals to think reflexively about their own decisions. Beck calls this new social form the *risk society*. Risk society recognises that the previous notion of modernity produces a series of unintended consequences that threats humanity's survival (e.g. pollution, unsustainable development, nuclear

disasters). Therefore, risk society focuses on preventing, minimising or channelling "the risks and hazards systematically produced as part of modernization" (*ibid*; 19).

After an initial lapse, environmentalism has also reached management and organisational studies (e.g. Bansal & Roth, 2000; Fineman, 2001; Gladwin, Kennelly, & Krause, 1995). Paul Shrivastava was probably pivotal for the introduction of environmentalist in this literature. In 1994 Shrivastava argued that organisational studies up to that date, "has failed to engage seriously in environmental discourse" and calls for the creation of a "green centred" organisational theories (1994; 705). One year later the same Shrivastava answered this call in a series of highly quoted articles (1995a, 1995b, 1995c). One of these papers, Shrivastava (1995a) draws generously on Beck (1992) to propose a new management paradigm. First, he points out that the traditional management paradigm aims only at economic growth in order to benefits the company's shareholders. Furthermore it looks at the environment merely as a source of natural resources, and "downplay[s] discontinuities and crises, especially in the ecological arena" (1995a; 199). The ecocentric management paradigm proposed by Shrivastava (1995a), in contrast, recognises the impact that human activities have on the environment and treats risks – hazards generated by modernization – as management's core problem. Therefore, ecocentric paradigm "seeks ecologically sustainable organisational designs and practices" (*ibid*; 127). Similarly, based on the ecocentric paradigm, Shivrastava affirms that companies play a key role in archiving ecological sustainability (1995b). The author in another paper goes even further. According to Shivrastava (1995c) sustainable technologies are not only necessary and economically feasible for companies, but could also be source of competitive advantage. In summary, the work of Shivrastava (1994, 1995a, 1995b, 1995c) suggests that organisations – including the Brazilian government – should ecocentric and take decision based environmentalist ideals.

The international politics literature has different studies highlighting the influence of environmentalism in the way governments define military threats (Funke, 1994; Levy, 1995; Mathews, 1989; Page & Redclift, 2002). According to these studies, the concept of national security, is not static but has been redefined in the last decades in order to accommodate the changes in the world's geopolitical landscape and the concerns of the different levels of society. The rise of Japan and the oil crisis in the 1970's made the U.S. realise that it was not economically independent anymore, but was exposed to other countries' policies. As a response to that, the

security domain incorporated economical and natural resources issues. In a similar fashion, during the last phase of the cold war, concerns about the long term survival of humanity and the borderless characteristic of ecological degradation, led scholars and the military to propose a new concept of national security which includes also the environment, the so called ecological security (Dalby, 1994).

Getting nearer the topic of this dissertation, different authors have explored the link g the Amazon rainforest and national security (e.g. da Costa, 2001; Keck, 2001; Kolk, 1998; Lopez, 1999; Tulchin & Golding, 2002). These studies focus on the ways the Brazilian government perceive the Amazon rainforest from a military perspective. They discuss, for example, the notion of ecological security in Brazil, the threat from drug trafficking and the impact of military operations in neighbour countries.

Anthropological research has also reflected the concern about the environment. Little (1999), in a literature review, separates anthropological studies concerning on this topic in major areas: ecological anthropology that studies the impact of human groups in their surrounding environment: and anthropology of environmentalism, which research environmentalist social movements.

Lima and Pozzobon (2005) provide a good example of ecological anthropology study focusing on the local populations of the Amazon rainforest. The researchers point out that the environmental attitude from different populations is bound to cultural and economical factors. On the one hand, the traditional populations of the Amazon (indigenous and white/mixed small peasants) have an ecological behaviour that contributes towards the conservation of the environment. On the other hand, newly arrived immigrants have a predatory behaviour. However, in the presence of factors, such as overpopulation, overexploitation of local resources by for-profit enterprises, the environmental-friendly populations may change their ecological behaviour towards destructive activities, such as logging and mineral extraction, in order to guarantee their survival.

Anthropology of environmentalism also offers articles about the Amazon rainforest (e.g. Barbosa, 2003; Fearnside, 2001). Domask (1998) for example, presents the history of environmental movements in the Amazon. He starts his analysis discussing the basis of the socio-environmental movement emerged during the 1970's and finished describing the maturation of the environmental movement in the 1990's and its relation to the PPG7 program (joint research project between Brazil and the G7 countries). Zhouri (2006, 2004), in contrast, focuses on the strategies of

environmental movements between the 1980's and 1990's. The author points out that those movements shifted their approach from public campaigns to boycott timber extraction from the rainforest, to an approach based on certification schemes to ensure timber's legal provenience. The author suggests both approaches contain a global market perspective that largely ignores the local populations, and as such may be insufficient to warrant the preservation of the area.

The literature on environmentalism presented above provides theories and insights useful for understanding the emergence of environmentalism and its reflections in different sectors of society. However, those studies focus mainly on non-governmental organisations or, in few cases, on private sector companies. Therefore, the literature largely ignores the raise of environmentalism in the public sector - the organisation that probably has the biggest impact on the environment – and those few studies that looks at the government focus mainly on the security aspects of environmental threats. More specifically, the researcher found no study in the literature describing the materialisation of environmentalism into specific technologies like the Amazon's monitoring system. In order to complement the environmentalist literature, the next section covers the social aspects of geographic information systems (GIS), in particular, how this technology is influenced and influences its surrounding context.

## 3.2. Social aspects of geographic information systems

Amazon's monitoring system represents in an information system some aspects of a physical space, more specifically, the land coverage of the Amazon rainforest. The literature on the social aspects of GIS can be a good resource for this research. The view commonly found in the computer science literature suggests the predominance of a deterministic point of view. In these studies, the impact of GIS in organisations is seen as a direct consequence of the software's characteristics, and the actual use of GIS in organisations is largely ignored (e.g. Goodchild, 2000; Morain, 1999; Tor, 2002). Different studies of the social aspects of GIS, in contrast, point out that this technology has a strong non-deterministic component, and propose that the outcome of the implementation depends more on the socio-organisational context than the technology *per se* (e.g. Campbell & Masser, 1995). Sahay and Robey (1996) argue that the context influences because the actors involved in the implementation and use

of GIS, construct their own interpretation of technology, which at its turn influences the outcome of GIS implementations.

The literature on GIS in developing countries points out that it is essential to consider carefully the local context and culture (e.g. Barrett, Sahay, & Walsham, 2001; Georgiadou, Puri, & Sahay, 2005; Puri, 2007; Sahay, 1998; Walsham & Sahay, 1999). Walsham and Sahay (1999), for example, explain that GIS developed by western countries contains a series of values embedded on it. The contrast between the western values embedded in the software, and the cultural context from developing countries, raises a number of obstacles to the success of GIS in those countries. Examples of this contrast include the assumptions embedded on the on GIS that different parts of the government work together, while in India the cultural-based strict division of tasks inhibit collaboration.

Other studies suggest that the context not only influences GIS implementations, but GIS itself is also able to influence the context. Zuboff (1988) after performing a longitudinal interpretive study in organisations from different industries concluded that information technology not only has the capacity to automate (computerize work activities) but also to informate (generate new information about the work itself), changing the perception of the work environment's reality. Similarly, Barrett et al. (2001) suggest that the introduction of GIS is behind the social transformation of India's forestry sector at both individual and institutional levels.

Having delineated the importance of the context for the development of GIS, the next section reviews the literature that refers to the different GIS and remote sensing technologies that constitute the Amazon's monitoring system.

## *3.3. The Amazon monitoring system*

It is possible to identify four different areas of the literature citing the Amazon's monitoring system: remote sensing, environmental modelling, environmental policy and international politics. The studies about remote sensing are the most numerous. The research in this area focuses on techniques to transform different kinds of satellite images into georeferenced data. This data is then used to estimate the vegetation coverage and hydrography of the Amazon region (e.g. Asner, Keller, Pereira, & Zweede, 2002; Câmara, Valeriano, & Soares, 2006; Jensen, 2002; Riebeek, 2003; Valeriano, Mello, Moreira, Shimabukuro, Duarte, e Souza, dos Santos, Barbosa, & de

Souza, 2004; Valeriano, Shimabukuro, Duarte, Anderson, Espírito-Santo, Arai, Maurano, de Souza, de Freitas, & Aulicino, 2005).

The monitoring system features also in many environmental modelling studies concerning the Amazon where it is perceived only as a source of secondary data. Popular examples include: models linking global warming and the deforestation in the Brazilian rainforest (Fearnside, 1997; Schroeder & Winjum, 1995) and the observation that the construction of roads is the main predictor of deforestation in adjacent areas (Laurance, Fearnside, Albernaz, Vasconcelos, & Ferreira, 2005; Pfaff, 1999; Stone, 1998).

The third type of study analyses the role of the Amazon's monitoring system in Brazilian environmental policy. Fearnside (2003), for example, points out that in the past the degradation process of the Amazon was more linked to macroeconomic factors than Brazil's environmental policy. In this context, the state-level monitoring system SLAPR represents a revolution for the environmental policy of the Amazon, since it enabled the creation in 2001 of the first mechanist able to reduce deforestation rates. Unfortunately, two years later the same Fearnside and the ONG Instutitio Socio-Ambiental observed that political influences were able to almost halt SLAPR (Fearnside, 2003, 2005; ISA, 2005). Despite the highs and lows, Fuller (2006) affirms that the Amazon monitoring system is essential for the environmental protection of the Amazon, since it explains why Brazil has been able to maintain relatively low deforestation rates when compared to Indonesia, which does not have a good monitoring system in place.

International politics scholars have also collaborated to the body of knowledge regarding the Amazon monitoring system. Thomaz Guedes da Costa (2001), for example, point out that SIVAM, a monitoring system designed by the military, will probably not be able to ensure environmental and human security because of the lack of transparency and involvement of other governmental bodies and civil society. One year later Tulchin and Golding (2002), published a report exclusively focused on international politics issues facing the Brazilian Amazon. This report discusses, for example, how SIVAM could change the face of the environmental and military security on the area, and criticises the project for focusing too much on security to the detriment of a sustainable development of the Amazon.

The studies on remote sensing and environmental monitoring involving the Amazon monitoring system provide useful insights about its technical aspects and its

capacity to slow deforestation rates. In some cases, these studies even mention the susceptibility of the monitoring system to political influence. However, in general this body of literature largely ignores the broader social, cultural and organisational contexts and relies mainly on the analysis of secondary quantitative data. In this sense, the current literature concerning the Amazon's monitoring system fails to respond to the call of the social aspects of GIS reviewed in the previous section. More specifically, the researcher has not found in the current literature any study linking the changes of the Brazilian policy towards the Amazon and its reflection in the government's practices and technologies – which is in this case the Amazon's monitoring system. In order to address this gap, the next chapter proposes a theoretical framework that aims at filling the gap identified in the literature review.

# 4. Theoretical framework

As argued in the previous chapter, most studies on the literature fails to address how the context influences the shape of information systems and policies, and they influence the context in their turn. Remarkable exceptions are some studies on the social aspects of geographic information systems (GIS) that explain the role of culture and context in the implementation and use of information systems. In order to reach this goal, this literature has borrowed different theories from sociology and science studies: Barrett et al. (2001), for example, draw on Gidden's structuration theory, while Walsham and Sahay (1999) applied Latour's Actor-Network Theory to analyse the use of GIS in India.

As stated in the research questions, this dissertation focuses on "soft" aspects of the Amazon reality, such as the cultural context, ideologies and worldviews of the protagonist of environmental protection in Brazil. From the different theories available today in the social sciences domain, institutional theory is probably one of the frameworks that best describe the link between enduring social entities present at specific social groups. For this reason, this dissertation adopted institutional theory in organisational studies as the basis for its theoretical framework.

Blackler and Regan (2006) propose, in one of the possible definitions, that institutions are socially constructed procedures or social patterns that become established and self-sustainable within a broader societal level. In this context, this dissertation conceptualises the past, present and future Brazilian environmental policy as a reflection of an evolving Amazonian institution present at the government. It also sees the emergence of environmental protectionist goals regarding the Amazon rainforest and establishment of the Amazon's monitoring systems as an institutionalisation process.

The remaining of this chapter is organised as follows. The next section reviews the literature on institutional theory in order to justify the choice of the particular stance of the theory adopted by this research. The review depatures from the traditional theory based on rationalist assumptions, to the more recent based on social construction of realty.

The third section uses the theoretical divisions proposed in two highly quoted papers, to analyse institutional theory according to two dimensions: (old) institutional

versus neo-institutional theory; and the Foucauldian versus the structurationist approaches. The last section illustrates the specific theoretical framework adopted in this research.

## 4.1. Institutional Theory in Organisational Studies

The traditional economic and rational administration theories underling many articles on institutional theory in organisational studies, believe that organisations adopt certain social patterns (e.g. departmental structure, reliance on information systems, human resource policies), only as a rational response to changes in their environment and to achieve greater efficiency. Blau (1970), for example, explains in his theory of differentiation, that organizations creates structural differentiation – new departments, roles and shared response – as a efficient response to increases in size.

However, in the last decades, different scholars have noticed that cultural factors have deep influence in organisational change, and rational decision making alone is not able to explain the spread of certain organisational patterns. This disenchantment with traditional economic theories led these scholars to introduce in the organisational studies endeavour new theories, including institutional theory (Barley & Tolbert, 1997).

DiMaggio and Powell (1983) wrote one of the founding articles of institutional theory in organisational studies. In the paper the authors explain that organisations tend to be similar to each other due to a phenomena called isomorphism. This theory proposes, for instance, that the force that led to the spread of multidivisional form in large organisations was institutional isomorphism, not a rational response to increases in size as proposed by Blau (1970).

Following the call of pioneering studies like the above, the literature on institutional theory today includes studies that span from longitudinal studies in specific organisations (e.g. Barley, 1986; Zilber, 2002) to cross-sectoral studies (Fligstein, 1996). Avgerou (2000), for example, offers an example of study focusing on the use of information technology (IT) in a oil company. After analysing the way IT has been applied in the company over the years she concludes that the diffusion of IT has been followed by an institutionalisation process whereby the value, function and presence of IT is widely accepted by our society. In her words, “IT has captured the hopes and fears of people in their professional roles as well as in their personal lives […] IT applications are taken-for-granted as fixtures of contemporary

organizations" (*ibid*; 237). For this reason, it has become increasingly accepted that by investing resources in IT organisations automatically become more modern, where "modern" always means "better".

Fligstein (1990), offers broader analysis and in his book "The transformation of corporate control", which provides an institutional account of the economical and organisational history of America's largest firms over one hundred years. His analysis, like DiMaggio and Powell (1983), challenges the mainstream economic theory. Fligstein denies the idea that the U.S. naturally created technological efficient firms, in contrast, he shows that today's firms are result of a series of intended and unintended consequences of actions outside the realm of pure rationality. Fligstein proposed in the place of evolutionary model, the idea of *conceptions of control* - managerial paradigms that directs the actions of large firms. Conceptions of control are at the same time a worldview (shapes perceptions of how the company works) and a reflection of how companies are structured. Conceptions of control tend to remain stable, however strong external stimulus such as changes in government policy or economic conditions that undermine the perceived profitability of the current conception, may trigger the emergence of new conceptions. So far, American firms have passed through four different conceptions of control: direct control (until 1900), manufacturing control (1900-1925), sales and marketing control (1925-1955), and, the current financial control. Appling a similar theoretical framework Fligstein and his colleagues have also analysed, for instance, the formation of markets (see Fligstein, 1996) and the European Union (see Fligstein & Stone Sweet, 2002).

## *4.2. Competing Theories*

Despite the growing literature on institutional theory in organisational studies, there is today no consensus on what constitutes an institution or how the institutions emerge and establish themselves in a given social field. In order to illustrate the competing theories, this section draws on the divisions proposed by Powell and DiMaggio (1991) and Blackler and Regan (2006). These authors suggest the existence of two important dichotomies in institutional theory, namely, the distinction between the old institutional and the new institutional theory, and the difference between the Foucauldian and the structuralist approach.

During the last three decades, the institutional literature witnessed the emergence of a new line of research that focus on structure, in detriment to the focus

on action present on most studies at the time. Powell and DiMaggio (1991) coined the term neo-institutionalism to distinguish this new line of research from the previous one. The old institutionalism, or action perspective, focuses on dynamics, change, values and social construction of reality. The research in this tradition considers politics and vested interested as key elements of institutions, and tend to obtain its empirical data from case studies of specific organisations. In contrast, the new institutionalism, or structuralist perspective, focuses on cognition, outcomes and the environment's dominance and continuity. This position is nearer to the traditional economic theory that the old institutionalism. It attributes organisational failure more to inefficiency then politics. The level of analysis of its empirical research tends to be broader – field, sector or even society – and conflict of interests is usually seen as peripheral.

Blackler and Regan (2006) propose another dichotomy in the institutional theory in organisational studies: the Foulcaudian versus the structuration traditions. They argue that even though both approaches draw heavily upon social construction of realty (see Berger & Luckmann, 1967), the theoretical basis of each approach are significantly different. Barley and Tolbert (1997), is an exemplar of the structuration tradition. The authors define institutions as "shared rules and typifications that identify categories of social actors and their appropriate activities or relationships" (*ibid*; 96). In this context, institutions set bounds on our rationality and perceptions, and as a consequence increase the probability of certain behaviours. They propose that, given the similarities between the Gidden's notion of structures and modalities, his structuration theory can be applied to neoinstitutional field to explain how institutions constraint actions and how actions, at its turn, mould institutions. They propose that Giddens' notion of *structure* can be used as a synonym for *institution*, and his mechanism of *modalities* can be reinterpreted into a more concrete way using the concept of *scripts* (observable patterns of social actions typical of a specific setting). Barley and Tolbert also extend the original theory into the temporal axis by affirming that institutionalisation (or structuration) is a continuous process that can be divided in four moments: (1) *encoding*, when individuals internalise rules and the interpretation of behaviours through socialisation; (2) *enacting*, when individuals perform scripts in an unconscious way that shows the underling presence of institutions; (3) *replication/revision*, happens when institutions are changed in order to adapt to new contexts; (4) *externalization/objectification*, indicates when social

patterns based on institutions are disassociated from a specific context and acquire a factual or taken-for-granted status. In this model, during the two first phases (encoding and enacting) institutions constrain actions, while in the last two phases individuals are able to maintain or modify institutions through their own actions.

Hasselbladh and Kallinikos (2000), in contrast, are representatives from the Foulcauldian tradition. The authors criticise Barley and Tolbert (1997), and argue their and other approaches in the literature are not able to explain why certain institutions (and their social patterns) diffuse rapidly and relatively unchanged, while others are completely transformed or simply fade away unnoticed. In other words, they state that structuralist approach is not able to offer a satisfactory connection between the diffusion of certain forms of organising and wider societal beliefs. In order to fill this gap Hasselbladh and Kallinikos (2000) suggest a parallel between institutions and Foucault's *knowledge regimes* (classifications and criteria of truth), and redefine institutions as "basic ideals that are developed into specific […] discourses, supported by elaborate systems of measurement and documentation for controlling actions" (*ibid*; 704). Therefore, the argument goes, the process of institutionalization should be viewed as a process whereby abstract ideals (which are deeply connected to wider societal beliefs) become discourses and then techniques of control. In this process, institutions become increasingly precise in the way they prescribe social patterns, but at the same time lose in semantic richness and interpretive flexibility.

After recognising the strengths and weakness of each tradition, Blackler and Regan (2006) propose that both traditions need to recognise the conflicts inherent to the institutionalisation process. The case study presented in their paper illustrates an attempt to change of the child and family support service in city in North England. The authors observed that even though the actors involved in the change process were able to internalise the ideals from the new institution, they failed to externalise it into their every day practices. Blackler and Regan (2006) explained that this happened because the reform challenged entrenched practices, which are reflections of well established institutions. Therefore, the authors conclude that institutionalisation "should be analysed as a *contested ascent* from the abstract to the concrete" (*ibid*; 1858). In this contest, old institutions, cultural infrastructures and cognitive framings may help or hinder the emergence of new institutions and its actual reflection in the realm of action.

Similarly, Zilber (2002) also observed the existence a competition between different institutions and practices during an in-depth longitudinal case study regarding a rape crisis center in Israel. She notices that while for most staff the meaning regarding their work has changed from a feminist to therapeutic focus, many feminist practices created during the centre's foundation were kept intact. This suggests a competition between the old feminist and the new therapeutic institution with unbalanced reflections on the cognitive and practice realms. From this observation she concludes that "institutionalization should be analysed as a nonautomatic interplay between three interrelated yet separate components – actors, actions (practices and structures), and meanings" (*ibid*; 234).

## 4.3. My Specific Theoretical Lens

The current institutional theory literature contains a rich debate on the best definition for "institution" and "institutionalisation process". It well beyond the aims of this research to provide a new theory or settle down the academic disputes illustrated in the previous section. Nevertheless, the researcher hopes that combination of different institutional theories proposed above, could provide a good framework to address this specific case study.

Given the research aims and kind of data available for this dissertation, the researcher concluded that Hasselbladh and Kallinikos (2000) version of neoinstitutional theory allied to Blackler and Regan's (2006) concept of contested ascent could suit well this research. This conclusion was based on two observations. First, the research questions ask not only "how" the preservation of the Amazon and the use of IT in this context become institutionalised, but also "why" the institution took exactly this shape. I believe the answer for the "why" question can be found in the link between wider believes and specific institutions, as highlighted by Hasselbladh and Kallinikos' (2000) approach. Second, the research methods used in this research allows me to have access to a certain kind of qualitative data (e.g. interviews and textual secondary data) which fits well with the Foucauldian approach (see section 5.2, page 23). At the same time, other approaches (e.g. Barley, 1986; Barley & Tolbert, 1997; Zilber, 2002), requires the use of ethnographical methods not available for this research given time constraints.

In addition to the theories cited above, during a later stage of this study the researcher noticed that the case study required a theoretical instrument able to

conceptualise broader worldviews present at the Brazilian government, which influences the evolution of the institution connected to the Amazon's environmental policy and monitoring system. The observation of this phenomenon led to the inclusion of Fligstein's (1990) *conceptions of control* (broader managerial paradigms that directs the actions) to the theoretical framework of this study.

At this point, it is important to consider how the different (and sometimes contrasting) theories cited above can sit together in a single theoretical framework. Starting from the similarities, Blackler and Regan themselves uses Hasselbladh and Kallinikos (2000) theory to illustrate the case. By doing so, they suggest that, when complemented with the concept of contested ascent, Hasselbladh and Kallinikos' (2000) version of institutional theory is compatible with the own view. The integration of their theories from Fligstein (1990) and Hasselbladh and Kallinikos (2000), in contrast, requires some compromises. First, the two articles have different units of analysis. Fligstein work departures from the point of view of large corporations embedded in a social field under the influence and rule of the state. Hasselbladh and Kallinikos, in contrast, do not constraint their analysis to any type organisation. Thus, in the later case even a very big organisation, the Brazilian government – which is the unity of analysis of this dissertation – can be seen through their theoretical lens. Second, the two theories see the law in very different ways. On the one hand, Hasselbladh and Kallinikos consider laws to be the discursive dimension of certain institutions. On the other hand, Fligstein proposes that laws are able to triggers the change of conceptions of control. The theoretical framework of this dissertation takes the former interpretation of laws, and considers them as part of institutions, while the triggers of changes of conceptions of control are broader societal phenomena, such as changes in political systems or social movements. Third, Fligstein defines organisational fields as set of companies that interact. Since this case deals with the Brazilian government, the definition of organisational field should also include the interaction between nations. In summary, the theoretical framework adopted in this study proposes that:

> Institutions are basic ideals that may evolve - through a contested ascent - into specific discourses (e.g. written norms, laws, systems of knowledge) and techniques of control (e.g. systems of measurement, information systems). The evolution of institution

depends on conceptions of control present at the organisational fields.

After defining the theoretical framework of this dissertation, it is now important to describe how this research collected, analysed and integrated the data that forms the empirical basis of this study. The next section presents and justifies the choice of the philosophical stance, research methods and data sources used of this dissertation.

# 5. Research Methodology

This chapter discusses and justifies the research design of the Master's dissertation. "A research design is the logic that links the data to be collected (and the conclusions to be drawn) to the initial questions of study" (Yin, 2003; 19). In other words, the research design is the architecture that holds together the different pieces of the research project, from the ontological stance up to conclusions drawn from the data analysis. The research design of this study was organised in five parts: philosophical stance, research methods and theoretical framework. The design can be summarised as follows: it starts at the ontological level, where the researcher adopts a certain philosophical stance to decide "what is reality" (and thus where she should look at). This "reality" is then passed to the next level, or epistemology, where it is decided what is decided conceptually what valid data and the best way to capture it. The third level, research methods, put into practice the philosophical concepts encapsulated into the epistemological and ontological instances, in order to materialize the fuzzy and bondless outside reality into something that the researcher can call "my data". Then, in the next level a certain theoretical lens are applied to the data collected by the researcher (and from other sources) in order to move the research to the last level, the conclusion, where the researcher draws conclusions from the study and attempts to generalise those insights to a broader context (Easterby-Smith, Thorpe, & Lowe, 2002).

However establishing harmony amongst the different components of the research design is much harder than it may look at a first glance. The decisions regarding each part do not take place in a vacuum but are bound to a series of factors, such as: personal preferences of the researcher, gaps in literature, tendencies and ideological wars in academia, time available and level of access granted to the field. Most importantly, the decisions regarding, say, the ontology, have a cascade effect in the whole research design since specific ontological stances request specific kinds of data that at its turn can be obtained only with a certain set of methods and so on.

But if the component of the research design depends on each other, from where should we start the crafting of the research design? First of all, the researcher should look at the research questions at hand to see which approach can lead to their answer. In this case, the research questions focus on "soft" aspects of the Amazon's

reality, such as the cultural context, ideologies and worldviews of the protagonist of environmental protection in Brazil. Following an advice from the supervisor, the researcher studied the institutional theory literature that for his delight, presents many papers with aims similar to this research. Therefore, the researcher decided to apply theories from institutional literature to analyse the in-depth case study of the Amazon's monitoring system and environmental policy. From this initial decision regarding the theoretical framework followed the entire research design. In other words, I adopted a top down approach, where a decision made at the highest levels of the research design set the direction for the remaining components.

The next section of this chapter justifies and illustrates the epistemology and ontology adopted in this study. The third section presents the research methods used to collect data and relate it the theoretical framework illustrated in the section 4.3 (see page 17). Furthermore, the research methods section also present the primary and secondary data sources used to build the case study presented in Chapter 6 (page 30). The last section of this chapter discusses some limitations of this specific research methodology.

## 5.1. Philosophical Stance

As seen above in the literature review, the positivistic perspective has been successfully applied in many studies about the technical and environmental aspects of the Amazon's monitoring systems and policy. Roughly speaking, positivism believes that reality is external and can be objectively measured, and the best way to produce scientific knowledge is find cause-effect relationships (Johnson & Duberley, 2000). Common objectives of those studies are the development of more accurate methods to derive forest coverage data from satellite images or find cause-effect relationship between macroeconomic data and deforestation (see section 3.3, page 9).The objective of this research, however, is not to find deterministic relations between factors or to propose better monitoring systems. In contrast, this study aims at *understanding* the process of emergence and establishment of the Amazon monitoring system. Therefore, soft aspects of information systems (IS) and organisations such as user's perspectives, politics and other broader phenomena at societal level, assume prime importance in this context. By taking into account the scope of this study, it is worthwhile to follow the subjectivist approach to social science, in particular, the interpretive tradition of IS research.

The interpretive on IS was inspired on ethnographic research methods, with the difference that it allows studies with shorter durations and the use of interviews as the main research method (see next section). This tradition is able to provide much richer and more contextualized insights from the in-deep cased study than conventional positivist approaches since it is 'explicitly designed to capture dynamic, social phenomena that are both context and time dependent' (Orlikowski & Baroudi, 1991; 18). In other words, this tradition aims to understand the *context* where the IS is being developed and used and the *process* whereby the IS influences and is influenced by its context (Walsham, 1993, 2006).

Within the interpretive stance chosen for this study lies a series of assumptions about "reality" and "knowledge". The set of assumptions about the nature of reality or the ontology adopted by this research is *subjective idealism.* This ontology denies the existence of an external universal reality. Reality is subjective and facts cannot be asserted without considering the observer. Thus, truth depends on who establishes it and facts are creations of our perceptions (Archer, 1988).

This ontological position has epistemological implications, in other words, it influences the assumptions about the nature of knowledge and the best way to enquire the world. Since reality is subjective, in order to study a phenomenon the researcher should abstain from any assumptions about a pre-existing external reality. Thus, the creation of knowledge should focus on the way the subjects perceive and make sense of their contexts (Burrell & Morgan, 2001). Therefore, this study adopts the *anti-positivistic* epistemological position since it encapsulates the concepts above.

The adoption of subjective idealism and anti-positivism goes hand in hand with the status of data in anthropology, which is the same adopted in this study. Empirical data cannot be collected directly but is "our own constructions of other people's constructions" (Geertz, 1973; 9). In other words, the informants use language to communicate to the researcher their interpretation of the world. The researcher then applies his own cognitive lens to make sense of those accounts and construct his own interpretation. In this process the researcher undertakes a hermeneutic effort to interpret the informant's account of their subjective reality. Hermeneutics is the study of the interpretation and understanding of text. It has it roots in the interpretation and translation of Biblical texts during the middle ages, however more recently it became a broader approach that consider as text all forms of communication mediated by language (Walsham, 1993).

As said above, it is important to assess the compatibility between the philosophical assumptions stated above and the theoretical framework built in chapter 4.3 (page 17). The theoretical framework (as the articles that from where it draws upon) is profoundly influenced by the work of Berger and Luckmann which argue that institutions are socially constructed procedures or social patterns (Blackler & Regan, 2006). Therefore, it is essential for this research to adopt an ontology (set of assumptions about the nature of reality) and epistemology, which takes into consideration the role of society in defining reality. Since subjective idealism and anti-positivism believes that reality is socially constructed, they are aligned with the theoretical framework chosen for this study.

## 5.2. Research Methods

This research applied qualitative methods to collect and analyse empirical data. The justification for this choice lies in the importance of language in hermeneutics and the ontological and epistemological positions adopted. However, the choice of the specific qualitative methods to collect data has been influenced by the theoretical framework. Hasselbladh and Kallinikos (2000) – the providers of the basis of the theoretical framework of this study – suggest which kind of data they believe is necessary for studies on institutionalisation. They state that research on the area must look at "the social and cognitive means and procedures underlying rationalized beliefs and schemes of action" (Hasselbladh & Kallinikos, 2000; 700). This implies that the researcher should focus both at people's minds (interpretations, worldviews and opinions) and bodies (everyday practices and actions) of the actors involved in the protection of the Amazon, and their everyday work practices and actual behaviour. More specifically, the research should look at the (1) ideals – vague background ideas that delineate social expectations expressed in oral language, (2) discourses – written norms, systems of measurement and social roles, (3) techniques of control – specific procedures or information systems aiming to put into practice the institution's discourse. Therefore, in order to find evidence for the presence of the institutions behind the Amazon's environmental policy and monitoring system, this study looks at the environmental-friendly speeches from politicians (ideals), the environmental law (discourses), and the monitoring system which helps the Brazilian government to enforce the environmental law (techniques of control). The next section shows in detail the sources of the primary and secondary data of this study, and argues that

those sources are a good way to obtain the ideals, discourses and techniques of control from the institution under study. However, as discussed in the last section, the research design has also some limitations.

### 5.2.1. Secondary Data

Part of the content of discourses and techniques of control can be extracted from secondary data available in the form of documents from the Ministry of the Environment, system specifications and academic papers, both in Portuguese (PT) and English (EN). It is possible to see throughout the case study (chapter 6, page 30) and analysis (chapter 7, page 41) references to those sources. Outside the academic endeavour, the secondary data for this research was obtained in the form of news, reports and documents from different sources:

- News from newspapers and magazines:
    - Folha de São Paulo (PT)
    - Correio Braziliense (PT)
    - Avionics Magazine (EN)
- Reports from governmental research institutes:
    - INPE (National Institute for Space Research) (PT)
    - EMBRAPA (Brazilian Agricultural Research Corporation) (PT)
    - PPG7 (PT, EN)
- Brazilian laws
    - Brazilian Constitution (PT)
    - Environmental code (PT)
- Reports from International Research Institutes
    - Intergovernmental Panel on Climate Change (EN)
    - Woodrow Wilson International Center for Scholar (EN)
- News and reports from non-governmental organisations
    - Instituto Socio-Ambiental (PT)
    - WWF Brazil (PT)

It was also possible to find useful secondary data regarding the Amazon in peer-reviewed academic journals and proceedings. These studies were particularly useful to

reconstruct the historical background of the case. The papers were published in academic journals from different areas:

- Remote Sensing
    - Remote Sensing for Environment (EN)
    - Spectrum IEEE (EN)
    - International Society for Photogrammetry and Remote Sensing (EN)
- Environmental Modeling and Management
    - Climate Change (EN)
    - Revista Árvore (PT)
    - Singapore Journal of Tropical Geography (EN)
    - Journal of Environmental Economics and Management
    - Ecological Economics
    - AMBIO: A Journal of the Human Environment
    - Forestry Ecology and Management
    - Conservation Biology (PT)
- History, Sociology and International Politics
    - Estudos Avançados
    - World Development (EN)
    - Political Studies (EN)
    - The Business History Review (EN)
    - Procedings from the VIII Congresso Luso-Afro-Brasileiro de Ciências Sociais (PT)
    - São Paulo em Perspectiva (PT)

However, not all governmental reports are public available and in some cases do not even exist in written form. Most importantly, the ideals behind the formation of the environmental policy and design of the Amazon's monitoring system cannot be found in such documents. Thus, it was necessary to interview the main actors involved in the development and enforcement of Brazil's environmental policy regarding the Amazon, in order to get access to their social and cognitive means. The next subsection presents the research methods used to extract the primary data for this study.

### 5.2.2. Primary Data

The primary data required for this master's dissertation has been collected through sixteen semi-structured interviews. The main aim of these interviews was to get access to the ideals behind the more apparent discourses and techniques of control found in secondary data sources. Semi-structured interviewing is a qualitative research method whereby the researcher asks a series of questions to the interviewee following a loose structure. In contrast to the structured interview, the researcher should be ready to decide "on-the-spot" which question to make and how to make it, in order to make the interview a "purposeful conversation" where the interviewee feels comfortable to talk and express his opinions (Mason, 2002). Most interviews followed loosely the following general structure:

- Career path of the interviewee and current role;
- Personal view about the environmental and economical history of the Amazon;
- Past and current role of the Amazon monitoring systems in protecting the rainforest;
- Personal explanation of the reasons behind the creation and evolution of the Amazon monitoring system.

All interviewing was done in Brazilian Portuguese, since the researcher and all interviewees shared the same mother language. Fourteen interviews were individual while in the remaining two took the form of small meetings with two interviewees, thus this research involved eighteen different individuals. The interviews were held between 18th of June and the 16th of August of 2007. It was not possible to do any interview during July because it is the vacation's period in Brazil and most senior officers were out of office.

As stated in the research aims (see chapter 2, page 4), this research attempts to understand the evolution of the Brazilian environmental policy concerning the Amazon rainforest. Following this aims, the research design selected individuals that have had a prominent role in shaping the ideology behind the Amazon policy, including one ex president and two ex ministries of the Environment. In addition to that, in order to have a clearer picture of how the strategy set by top officials were put into practice I interviewed also senior officers and the directors of IBAMA and

CENSIPAM, the main organs responsible for the environmental protection of the Amazon. These interviews were complemented by the accounts of five researchers from INPE, responsible for developing the Amazon monitoring system and doing research about the relation between global warming and the rainforest. The selection of the informants were based on their position in the organs involved in the environmental protection of the Amazon (as shown in the official web site of the government), but in two instances the same interviews provided me the name of other possible informants, that according to them could be useful for this research.

Furthermore, even though this research focuses on the vision held by the Brazilian government, in order to have a glimpse of the perceptions of the civil society the researcher also interviewed two representatives from non-governmental organisations and an entrepreneur who works in the Amazon (see Table 1).

Most interviews were arranged by an email where the researcher explained that he a master student from Lancaster University and needed the interviewee collaboration for a master's dissertation. However, politicians did not initially reply the requests sent via email. In these instances, the author's personal social network allowed him to contact these high profile people, who otherwise would not have allowed an interview outside the mainstream media.

The interviews were realised at three different states in Brazil: Distrito Federal, Minas Gerais and São Paulo. It is noteworthy that all interviews here held hundred of kilometres from the Amazon rainforest. The reason for that is because the headquarters of the institutions that develop the monitoring system and set the Amazon's environmental policy are not in the Amazon (see Figure 2, page 31).

| Role | Number of Interviews |
|---|---|
| Ex President | 1 |
| Ex Minister of the Environment | 2 |
| Deputy from the National Congress | 2 |
| Researcher | 3 |
| Director of governmental bodies or senior officer | 5 |
| Representative of NGO | 2 |
| Private sector entrepreneur | 1 |
| | **16** |

**Table 1 List of interviews**

It was possible to record with a voice recorder most interviews since all interviewees, on request, provided the authorisation to record the conversation. The exception was the interviewees with top politicians, where the researcher preferred not to request the recording on tape in order to more honest accounts. In these instances, the researcher took extensive hand notes in Portuguese and fully transcribed and translated them to English just after the interview.

In order to facilitate the transcription and analysis of the recorded interviews, during the interviews the researcher wrote down in a block note a "topic index", namely, the list of different issues covered during the interview and the exact time when the interviewee started to address that point. Later on, the content of the interviews were processed in two stages. In the first stage, the recording was heard and interpreted by the researcher. It was not possible to transcribe and translate all interviews for time constraints – the audio files summed up more than fourteen hours of speech -, thus the researcher selected and transcribed only the parts that are more relevant to this research. Second, the researcher analysed the transcribed interviews, hand notes, personal impressions and secondary data according to the interpretive stance state above, and slowly integrated the whole into a single in-depth case study.

## 5.3. Limitations

In order to allow the reader to height the findings of this study, it is important to inform him or her about the limitations of this research. First, what people "say" they do may differ from what they actually do. Even though the researcher attempted to make sure that the interviewees are comfortable and that they have the right to cut off or make anonymous any part of the interview, it would be naïve to believe that they have bee always completely sincere.

Second, the institution the researcher is trying to uncover influences the interviewees and the researcher himself. One of the main characteristics of institutions is that they are so deeply embedded in certain social groups that they become taken-for-granted facts, and as such, institutions and their reflections into the realm of action become invisible. Therefore, it is difficult to uncover those institutions and link them with the realm of practice if the interviewees are not able to recognise them in the first place. Furthermore, present institutions may interfere in the interpretation of events that happened in the past, since actors may reframe their past experiences according to new institutions.

The use “deforestation rates” as a way to indicate the state of health of the rainforest is one example of the difficult to separate the influence from the institution while describing the institution itself. The study argues in section 7.2.1 (page 49) that the usage of deforestation rates, a number obtained from the Amazon’s monitoring system, is evidence of the institutionalisation process of the monitoring system itself. However, since the interviews kept referring to those figures the researcher felt constrained to adopt the term to refer to the environmental impact of the Amazonian institution on the rainforest.

Barley and Tolbert (1997) suggest a solutions for the issues identified above. They propose that institutional studies using longitudinal ethnographic research methods may be able to order to get access to the practices of specific groups. In those studies, the researcher should take detailed notes scripts (established practices) in order to seek for changes over time. However, the time available for this master’s dissertation is not enough to follow the guidelines proposed by the authors. The consequence of these limitations for this study is the impossibility of knowing to which extent the accounts from different senior officers and politicians correspond to the reality in the Amazon. It is difficult, for example, to know for sure if the raise in efficiency of the monitoring system in the previous years was due to the change of ideals and practices at governmental level (as proposed in the analysis) or exclusively to external factors like the exchange rate of the Brazilian currency or the fall on the soy price. Therefore, the current study has to recognise its limitation concerning the observation of the actual reflection of institutions in the realm of action.

# 6. Amazon: from green hell to lost paradise

Mankind, there, still an impertinent intruder.
Arrived without being neither expected nor wanted –
when nature was still arranging
its widest and most luxurious venue.

Euclides da Cunha (1907), At the margins of history

This chapter presents the case study that is the empirical basis for this dissertation. The case study focus on how and why the environmental protectionist goals regarding the Amazon rainforest and IT-based practices associated to it became established within the Brazilian government. In order to facilitate the exposition, the case divided into three phases, one at each section of this chapter. Different interviewees pointed to a major shift in the policy towards the Amazon after the end of the military rule in Brazil. For this reason, the end of the military rule roughly marks the transition between the first and second phases of the history of the Amazon. In contrast, the threshold between the second and third phase is much blurrier. Even though most informants noticed an ongoing change in the last ten years, they were not able to specify a period. For this purpose, the case study used a paper from Fearnside (2003), where he point out to that in 2000 the state-level administration of Mato Grosso was able to create the first environmental policy able to effectively reduce deforestation rates in the Amazon.

The remaining of this chapter is organised as follows. The next section briefly illustrates the history of the Amazon from the beginning of the colonisation until the end of the 1980s. This phase was marked by a concern with national security and the lack of regard for the environment. The second section will describe a major change in the policy towards the Amazon and the establishment of the Amazon's monitoring system. The case will argue that despite the changes in the law, in practice the situation remained the same. The third phase, starts at the turn of the century, will suggest that there were some improvements in the environmental protection of the area, and highlight the role of the Amazon's monitoring system in this process.

### 6.1.1. 1964-1988: Development at any costs

From its discovery by the Europeans in the 16th century, the Amazon rainforest has assumed different and contrasting images to the imaginary of its rulers. The first rumours about the existence of an immense area covered by a dense jungle were provided to the Spanish by the indigenous populations from Peru. Propelled by the medieval legend of El Dorado, the golden city, in 1541 the Spanish organised the first expedition to the Amazon. Following the Spanish lead, England, France, Holland and Portugal tried to establish outposts in the Amazon region. After fighting a long war, in 1701 the five nations finally settled down the dispute by signing the Treat of Lisbon, which divided the Amazon in two parts: English, Netherlanders and French to the north, at the Guineas, and Portuguese to the south, at the Amapá (Schilling, 2002).

**Figure 1 Satellite image of the Amazon rainforest. The yellow line shows the Amazon rainforest as delineated by the World Wide Fund for Nature (Source: NASA, 2007).**

Fortunately for the rainforest, El Dorado was never found in the Amazon. Thanks to the lack of any considerable source of wealthy in the region, the rainforest was left almost untouched by its colonisers for almost four centuries (Silveira, 2004). Historical accounts suggest that the Portuguese decided to keep outposts in the region only because of the size and strategic position of the region, not its natural resources. This scenario changed with the industrial revolution in Europe. The rubber, a material extracted from the heave, a tree initially only fond in the Amazon, rapidly became a

key raw material to a myriad of industrial products. As the world only producer of rubber, the Brazilian Amazon rapidly became one of the richest areas in the world. Due to the rubber boom, Manaus, the main city of the region, grew from 5 thousand to 70 thousand citizens between 1850 and 1920. It is not surprising that local and foreign commentators of the time unanimously predicted a golden future to the region, putting the Amazon at the same level of the U.S., as the land of opportunity and prosperity (Weinstein, 1983).

The rubber era witnessed two events concerning international superpowers that left profound scares in the Brazilian memory. At the end of the 19th century, the U.S. did a secret agreement with Bolivia to obtain a contested part of the Amazon rainforest near Brazil, in order to get into the lucrative rubber business. If the U.S. were successful in their intents, the current Brazilian state of Acre would probably have been under American economical and military control (*ibid*). The second event involved U.S. founding fathers. During the last decades of the 19th century, the British Foreign Office tried in different occasions to smuggle the seeds of the hevea, the rubber tree, to its own colonies in Asia. After a series of failed attempts, in 1875 Henry A. Wickman, a British amateur botanist, was able to send 70'000 seeds to London and then Ceylon, receiving a prize from the British government. As planed, the smuggled seeds became the nucleolus of the entire East Asian plantation industry, which given their lower production costs had a devastating impact on the Amazonian economy. The crisis of the rubber production in the Amazon was only relived when the Japanese invaded East Asia during the Second World War. But after the end of the war, the Asian rubber production and the development of synthetic rubber pushed Brazil out of the market up to our days (Resor, 1977). It is possible to argue that those two events were the seeds of the persistent idea that Brazil risk losing the sovereignty over the Amazon to other countries.

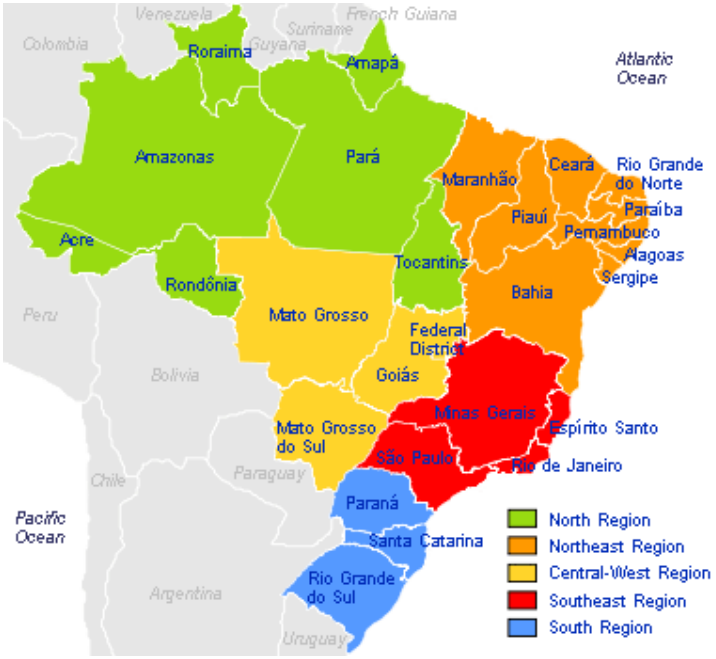


**Figure 2 The 26 states that form the Federative Republic of Brazil. In different colours the five regions of the country, where the Brazilian "Legal Amazon" covers the entire North region, the state of Mato Grosso and part of the state of Maranhão (Source: Felipe C.S, 2007).**

After the end of the first rubber cycle, the Amazon, went back again into oblivion. During this period the image of the Amazon was again transformed from "land of opportunity" to "green hell", as it was sometimes called (Silveira, 2004). The Amazon only came back to the governmental agenda when a *coup d'etat* in 1964 replaced democracy for a military dictatorship. The interviewees reported that one of the main concerns of the military dictatorship in Brazil was the defence of the Brazilian territory. The Amazon in this context, with its huge inhabited space, was seen as the most vulnerable part of the country. The interviewees reported that this perception led the government to take two actions concerning the Amazon.

First, since the government perceived the Amazon as an unknown place it decided to invest in satellite-based remote sensing. In 1973 Brazil was one of the first countries to sign a contract with NASA to get access to its civil satellites (Biache, 1983). As we will see bellow, the decision to invest in satellite images and remote sensing research was the first step towards the creation of the Amazon's monitoring system.

Second, the government did large scales investments to develop the Amazonian economy. Some interviewees suggested that the governmental slogan that best summarises the ideology of the time is: *integrar para não entregar* (integrate the

Amazon to the rest of the country to avoid losing it). The interviewees explained that this ideology implied that the development of the Amazon should happen at all cost, since it was a response to a permanent foreign threat to the Brazilian sovereignty over the area[1]. As a left-wing deputy from the state of Acre, explained during her interview:

> During the 1970's the idea was to occupy and develop the region at any cost because of the imminent threat of the U.S to get the area from Brazil. It was the period of the "Mata por Pata" [replacement of trees by the cattle's paw].

In order to achieve this economical integration with military purposes, the government subsidised agricultural activities in the Amazon (Ferreira & Salati, 2005), created an industrial tax-free zone in Manaus (at the heart of the rainforest) (Serfico & Serfico, 2005) and built the Transamazon Highway (Fearnside, 2005). Statistics suggest that the plan of the military was successful from a demographical and economical point of view. The population of the Legal Amazon increased threefold between 1970 and 1980, reaching 12 million (Ferreira & Salati, 2005). Furthermore, today the region contributes to a significant share of the agricultural and industrial output of the country (Braga, 2007; CONAB, 2005; EMBRAPA, 2004).

However, the environmental consequences of the military rule were far from positive. While the rubber boom between 1876 and 1945 was certainly an example of sustainable development since the extraction of latex does not kill the trees, the kind development instigated by the military had severe environmental consequences. Thanks to the actions put forward by the government, the Brazilian Amazon has lost between 1978 and 1986 an area as big as what has been destroyed since the discovery of the Americas almost five centuries ago (Fearnside, 2005).

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[1] Even though most politicians have shown in their interviews a clear concern about the military security of the Amazon, the researcher was not able to find any neutral data source supporting the claim that the sovereignty over the Amazon is under threat. Since the research methodology adopted for the development of the case study states that realty in socially constructed by certain groups, this study does not challenge the opinion of an important group of actors involved in the elaboration of the Amazon's past and present policy, and accepts the this threat as an important factor.

### 6.1.2. 1989–2000: Change in theory but not in practice

In 1985 the political movement *Diretas Já* (direct democratic elections now) forced the military junta to step down. The change in the political regime did not mean initially any change to the environmental policy regarding the Amazon, and the Brazilian government, the World Bank and Inter-American Development Bank maintained the financing of the destructive development of the Amazon. Some government officers reported that during this period some parts of the civil sector in Brazil and in the developed countries woke up to the destruction of the Amazon. In the case of developed countries this social movement took form of environmental NGOs fighting against the environmental destruction of the "world's lungs", as the rainforest was usually called by the international media. In contrast, the social movements in Brazil took the form of trade unions fighting to ensure their own survival, since the big ranchers in the region started to deforest large parts of the rainforest and to expel Indigenous populations, rubber tapper and other traditional populations from their original lands.

The voices from social and environmental movements were only heard when they were able to have an impact on Brazilian budget. In the end of the 1980's under pressure from the NGOs (legitimised by Brazilian grass root social movements), the World Bank and the Inter-American Development Bank suspended the payment of loans to the Brazilian government for "colonisation" projects in the Amazon rainforest (Kolk, 1998; McCleary, 1991). In addition to that, different officers highlighted that the coverage of big fires in the Amazon and the release of an study from the world bank affirming that the Amazon would finish by 2050 put the Brazilian government in a difficult position.

At this point, the Brazilian government was constrained to realize a u-turn in its environmental policy. In 1988 the Brazilian government wrote what is one of the most environmental friendly constitutions in the world. The environmental law went even further and today all properties within the "Legal Amazon" have the obligation to keep 80% of their lands as "legal preservation areas" (e.g. original vegetation) (Fidalgo, Crepani, Duarte, Shimabukuro, Pinto, & Lopes, 2003).

During the same period, the government has also decided to create the PRODES, a monitoring system aiming at calculating the yearly deforestation rates of the Amazon rainforest. Different interviewees suggested that the international

pressures were also behind this decision. Furthermore, their account suggests that the aim of the project was not to protect the rainforest, but to defend the country from international criticism, or as explains the director of the Amazon project at INPE, PRODES was created "because there are some people from outside Brazil already doing it [the monitoring of the Amazon rainforest]".

During the interviews some politicians provided further evidence that international pressure was behind the u-turn in the Brazilian environmental policy and the creation of the Amazon's monitoring system. As said an ex president and current senator during an informal conversation:

> During the 1980's the international community was concerned with the Amazon. I created the IBAMA […] As a way to prove that we have the competence to manage the Amazon. […] During my government, I have also insisted to bring the 1992 UN's Conference on Environment and Development to Brazil, the ECO92. The idea with this move was again to demonstrate to the international community our preoccupation with the environment.

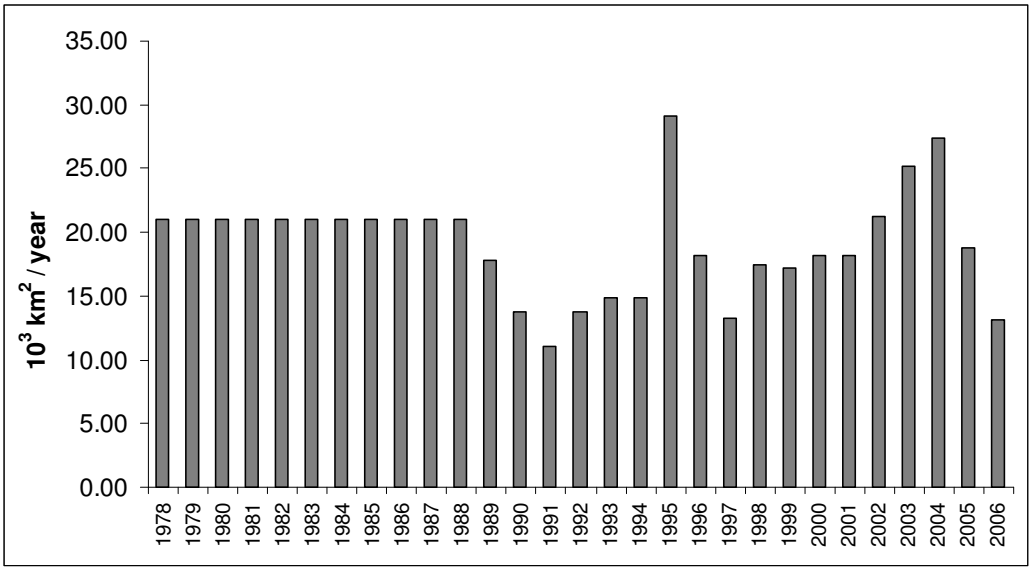


**Figure 3 Deforestation rates of the Brazilian Amazon rainforest between 1978 and 2006 calculated using the methodology PRODES. The data for the years 1978-1987 and 1993 are an estimative (Sources: Fearnside, 2005; Sources: INPE, 2006).**

The technological infrastructure to monitor the Amazon did not stop with the development of PRODES by INPE. In the beginning of the 1990's, the Secretary of Strategic Affairs, a body linked to the military, proposed the creation of SIVAM , a high-tech monitoring infrastructure. However, different interviewees suggest that the

connection between SIVAM and the preservation of the Amazon is not clear. Even though the project was financed by "green money" aiming at the development of an environmental system, different senior officers and politicians suggested that the project aim is predominantly military. A green party deputy and the researchers from INPE affirmed during their interviews that the environmental character of SIVAM were dubious. Furthermore, even one of the directors of CENSIPAM (headquarters of SIPAM) indirectly highlighted the military character of the project by saying during an interview that one of the reasons for the project was "the need to occupy the territory, specially the borders, in order to ensure the national security in military terms".

Despite the change in the environmental law and the creation of the Amazon's monitoring system after the end of the military era, the situation in the Amazon has changed little. Even though the government has stopped providing new subsides to destructive activities in the Amazon after 1991, the old benefits were kept. In addition to that, a study found that the environmental law forcing landowners to keep 80% the original vegetation of their lands has not been respected in many parts of the Amazon (Fidalgo et al., 2003). As a result, the 1990's and the beginning of the 21st century had years with higher deforestation rates than the period under the military rule (see Figure 3).

### 6.1.3. 2001–Present: Signs of hope for the rainforest

However, there are signs of hope. Consistent drops in deforestation rates between 2004 and 2006 and the recent decision from the current president to create an international carbon-credit fund linked to the Amazon rainforest, suggest that the situation in the area has improved consistently in the previous years.

According to the literature and some interviewees, the drop in deforestation was directly related to changes in the use of the information generated by the Amazon's monitoring system. While in the past, the information generated by the monitoring system did not have an immediate use in the field, today the environmental protection bodies use real-time data to tackle illegal deforestation in the rainforest.

Fearnside (2003) reported that SLAPR, a environmental licensing system from the state of Mato Grosso, was the first system able to have an impact on the field. The system aims at the enforcement of Brazilian forestry code which obliges land owners

in the Amazon to keep 80% of the original rainforest. SLAPR maintains a georeferenced database with all licences provided by the government, and monitors the rainforest via satellite images provided by INPE to detect any legal or illegal deforestation. If the area deforested does not have an licence or the area is bigger than the original licence, the system alerts the IBAMA and FEMA - the state-level environmental protection body - that apply fines to the land owner (PPG7, 2002). Thanks to SLAPR, in 2001, for the first time in Brazilian history, an environmental policy has been able to reduce significatively deforestation rates in the Amazonian state of Mato Grosso (Fearnside, 2003).

Subsequently, other monitoring systems launched between 2002 and 2006 – PRODES Digital, DETER, SLAPR and SISCOM – also have had a positive effect. Senior officers point out that those systems are the main responsible for the drop of 50% in deforestation rates in the Amazon between 2004 and 2006 (see Figure 3). As said by the general coordinator the monitoring and zoning of IBAMA:

> I believe that both the fall of the dollar and our monitoring endeavour has leaded to this good result [drop in deforestation rates]. Maybe a sign of the efficiency of monitoring is the fact that preliminary deforestation data from 2007 shows a further reduction in the rate despite the raise in production of agricultural goods.

Some informants, including a member of IPCC, suggested that the drops in deforestation rates, the political commitment of the current ministry of the Environment, Marina Silva, and the gradual *concientização ecologica* (the process of becoming aware of the importance preservation of the environment) recently enabled major changes in the policy towards the Amazon. The Brazilian government always avoided any kind of international mechanism obliging the country to preserve the Amazon rainforest, since it would mean interference to the country's sovereignty. According to some interviewees, this mentality even led Brazil to lobby against the inclusion of deforestation in the calculation of carbon emissions in the Kyoto protocol. But recently, the government proposed the creation of an international fund benefiting Brazil if the country is able to avoid deforestation on the basis that this mean lower emissions of greenhouse gasses at global levels. Even though this fund initially remains outside the Kyoto protocol, it is the first important step in linking international money (and political power) to the Brazilian environmental policy, and

as such, it represents a considerable change in the previous militaristic position. Following the same line, the governor of the state of Amazonas, created a special subside to incentive the preservation of the rainforest, the bolsa floresta (forest bursary, an allusion to family bursary, the government's main social program). The program aims at helping local poor families in exchange for assistance in the environmental protection of the region (Braga, 2007).

While looking at the future, some government officers suggested the current "command and control" model applied by the monitoring system will not be able to ensure the long term preservation of the Amazon. They suggest that the help of rich countries through international funds, like the carbon credit scheme, will play a key role in assuring the preservation of the Amazon. According to them, the local populations of the Amazon should be able to have a good life standard without destroying their own environment, and today, the only way to accomplish this objective is by providing subsides to sustainable activities. According to a senior representative of the Ministry of the Environment:

> The problem is that in order to adopt an environmental model the country will suffer an economical loss. Today half of the wealthy produced by the country comes from primary products which has an environmental impact. The rich countries on the other hand do not want to answer if they want to pay the bill.

In summary, the history of the policy towards the Amazon and the emergence and establishment of the Amazon's monitoring system is complex and many times even paradoxical. Brazil has a shameful elementary public education and high quality public university accessible almost exclusively by the rich who had access to private elementary education. The country also boosts the title of one of the most unequal in the world (The Economist, 2004). In the 1970's, an economist coined a term that summarises these contrasts. According to Bacha (1974), Brazil should be called Belíndia because while a small part of its population have a life quality compared to Belgium, while the majority lives like the untouchables in India (1974).

Therefore, it should not be surprising that the country can be at the same time an environmental hero and villain. On the one hand, Brazil has one of the world's cleanest energy matrixes thanks to the production and consumption of biofuels and hydroelectric power plants. On the other hand, the country is responsible for one of the biggest on going environmental massacres – the destruction of the Amazon

rainforest – and consequently contributes for a good share of the planet's greenhouse emissions.

The next chapter proposes an institutional analysis aiming to contribute for the understanding of the paradoxes within the Brazilian environmental policy. More specifically, the analysis bellow attempts to highlight the evolution process of the ideals and discourses behind Amazonian institution during the three phases of the recent history of the region.

# 7. Analysis and Discussion

The Amazon basin is one of these immensities
that are so immense that surpasses man's perceptions.

Mário de Andrade (1927)

The chapter revisits the case study with the assistance of the theoretical framework presented in chapter 4.3 (see page 17). The analysis focuses on a specific organisation, the Brazilian government, and a specific information system, the Amazon's monitoring system. It contends that there is an institution, the *Amazonian institution,* behind the creation and application of policies regarding the Amazon rainforest and related technologies. The theoretical framework proposes that institutions usually have three facets: ideals, discourses and techniques of control. More specifically to this case, the long term goals and visions proposed by Brazilian political leaders are interpreted as *ideals*, while the environmental law and other specific forms of defining reality are the *discourses* of the Amazonian institution. The Amazon's monitoring systems – GIS, remote sensing systems etc – and other mechanisms aiming at putting into practice the ideals and discourses are interpreted as *techniques of control.*

While performing the data analysis the researcher felt the need for a forth facet to complement theoretical framework. This forth component arises from the finding that the Amazonian institution (and the related ideals, discourses and techniques of control) does not live in a vacuum, but influences and is influenced by broader paradigms found at societal level. The observation of this phenomenon led to the inclusion of a sort of institutional called *conceptions of control* (managerial paradigms that directs actions) to the theoretical framework of this study (for more details, see chapter 4, page 12).

This chapter proposes that since 1964 the Brazilian government has had three different conceptions of control that influenced the Amazonian institutions, namely, the military, the developmental and the environmental conception pf control. The military conception represents the worldview usually held by the armed forces. The

nation is seen as a territory that must be defended from all kinds of threats to its economical, political and territorial independence. According to this paradigm, governance should aim at ensuring national security as defined in its traditional terms (see Page & Redclift, 2002).

The developmental conception coincides with the notion of pure capitalism found in many modern societies. According to this conception, the government should aim at the economic development, often defined as the achievement of certain quantifiable socio-economic statistics (e.g. GDP, per capita income and budged surplus). The notion of developmental conception adopted in this study dwells with the traditional management parading, as defined by Shrivastava (1995a). According to Shrivastava, the main goal of traditional management is economic growth to benefit the company's shareholders, in our case, the country's citizens. In addition to that, traditional management paradigm "downplay[s] discontinuities and crises, especially in the ecological arena" (ibid; 119).

The environmental conception, in contrast, is concerned primarily with the long term survival of humanity. Therefore, the government should aim at the sustainable development of the country, and consequently, the preservation of the environment. The environmental conception of control coincides with the definition of ecocentric management paradigm proposed by Shrivastava (1995a). Ecocentric management recognises the impact that human activities have on the environment and sees risks – hazards generated by modernization – as management's core problem and, as a consequence, "seeks ecologically sustainable organisational designs and practices" (*ibid*; 127).

The discussion bellow adopts the separation of the history of the Amazon into three phases, and characterises for each phase the most prominent Amazonian institution. For analytical clarity, the analysis bellow presents the evolution of the Amazonian institution through the three phases as a discrete phenomenon (see Figure 4, page 54). However, the reader should be aware that this is a simplification and reality is more complex. Data suggests that the transition of conceptions of control is gradual, fuzzy and sometimes even deceiving.

The remaining of this chapter addresses the research questions posed at the beginning of this dissertation. The next section revisits the evolution of the governmental policy towards the Amazon from the lens of the theoretical framework, focusing on the ideals and discourses of the Amazonian institution. The second

section focus on the Amazon's monitoring system, which is interpreted as being one techniques of control of the Amazonian institution.

## 7.1. RQ1: How has the Brazilian policy concerning the Amazon rainforest evolved in the previous four decades, and what were the reasons for that evolution?

### 7.1.1. Amazon's military conception of control

The case study suggests that the Amazonian institution, between 1964 and 1985, was marked by a strong influence from the military and developmental conceptions of control. During this period the country was ruled by a military junta, thus it should not be surprising that the military conception of control permeated all levels of the government including the Amazonian institution. Different government officers stated that the "slogan" (or ideal, when read through the theoretical lens) that dominated the military policy towards the Amazon was: *integrar para não entregar* (integrate the Amazon into Brazil to save it from falling into foreign hands).

From this slogan it is possible to uncover the presence of two conceptions of control: the military and the developmental one. First, by saying that the Amazon risks being *lost*, the slogan suggests that the Brazilian sovereignty over the Amazon is under threat. During the dictatorship there was no clear or identifiable menace to the Brazilian borders. However, it is possible to suppose that the historical events that happened in the 19$^{th}$ century - biopiracy of the rubber tree seeds by the UK, and the attempt by the U.S. to control the western part of the rainforest - have left profound scares in the memory of different parts of Brazilian society. The perspective that the country is constantly under threat and as such must be defended suggests the presence of the military conception.

Second, if the Amazon needs to be physically *integrated*, it is perceived as being isolated from the rest of Brazil. The case suggests that before the military era the Amazon was not actually isolated from the rest of the country. From the beginning of its colonisation, the rivers were always the rainforest's pathways. However transport by water is slow and the increasing speed of world economy required faster ways to integrate the Amazon. From this it is possible to suppose that the real kind of integration that the military was seeking was economical not physical, since after the end of the rubber boom the region did not contribute significantly for the country's

income. This perspective suggests the presence of the developmental conception of control.

In summary, the Amazonian institutional ideal during this period foresaw that the only way to "save the Amazon" from foreign hands is by developing and colonising the region at all costs, with no regard for the environmental impact.

The vision delineated Amazonian institution ideal, has been developed in "distinctive ways of defining and acting upon reality", the so called *discourses* (Hasselbladh & Kallinikos, 2000; 704). The institutional discourse during this period – as explained by different interviewees – defined the Amazon as unproductive empty areas that must be colonised for national security purposes, and converted into productive lands for economical purposes. The forest in this case is seen, as a hindrance to the economic activities subsidised by the government, namely, industrial manufacturing, extensive cattle rising and agriculture.

The case shows that the impact on reality of the Amazonian institution has been clear. The vision of the military become truth: the area has developed but also suffered severe environmental consequences.

### 7.1.2. Emergence of the Environmental discourse

The year of 1985 marked the end of the military era and the election of the first civil president since 1964. However, the change in regime did not translate in the Amazonian institution. This situation only changed at the end of the 1980's, when national and international pressures led Brazil to review its policy regarding the Amazon. As a consequence, in 1988 INPE (Brazilian Space Research Institute) started PRODES, the first Amazon's monitoring system. One year later the Brazilian government has created IBAMA (the body responsible for environmental protection in Brazil), launched the program *Nossa Natureza* (Our Nature, the first program aiming at protecting the Amazon rainforest) and wrote one of the most environmental friendly national constitutions in the world.

It is possible to argue that the sudden greening in the policy concerning the Amazon is evidence of the imposition of the environmental conception of control over the Amazonian institution. It is possible to argue that the mechanism that imposed the environmental conception of control was a sort of coercive isomorphism. DiMaggio and Powell (1983), in a highly cited paper on institutional theory, define isomorphism as a "constraining process that forces one unit in a population to resemble other units

that face the same set of environmental conditions" (149). More specifically, coercive isomorphism is a type of institutional isomorphism that stems from political pressures and the search for legitimacy. The main difference between the case and the theory proposed by DiMaggio and Powell (1983) is that the environmental model the deveped countries have imposed to Brazil is not the one they have used themselves but an ideal that they regard to be the "right one", since no developed country have preserved a substantial percentage of its original vegetation like Brazil. Meyers (as cited by DiMaggio & Powell, 1983) explained this phenomena by pointing out that developing countries, like Brazil, are "are far more isomorphic – in administrative form and economic pattern – than any theory of the world system of economy division of labour would lead one to expect" (*ibid*; 152).

The creation of IBAMA, the launch of the program *Nossa Natureza* and the new constitution represent a major swift at the discursive facet of Amazonian institution. According to the new discourse the Amazon rainforest is not "unproductive land", but a "national patrimony" that must be protected (see e.g. Assembléia Nacional Constituinte, 1988).

The analysis suggests that the change in discourse during the end of the 1980's did not represent any significant change in the militaristic/developmentalist ideal behind the Amazonian institution. The case provides two evidences that support this observation. First, the name of the environmental program, Nossa Natureza (Our Nature), implies the vision that the Amazon rainforest is *only* Brazilian, and not "from all of us", as affirmed Al Gore, then vice-president of the U.S. (Chagas, 1997). Second, the effects of the Amazonian institution on the environment did not improve, on the contrary. The deforestation rates during the 1990's in some years were even higher than during the 1980's and 1970's (see Figure 3, page 36).

Anthropological studies suggest that the difficulty for the environmental conception of control to reach the Amazonian institution's idealist layer, may lie on deep cultural factors. In *Raizes do Brasil* (Roots of Brazil) – one of the founding works of Brazilian modern sociology – Sérgio Buarque de Holanda (1995/1936) proposes that cultural and environmental factors collaborated for the persistence of predatory development models in the country. Holanda illustrate two opposing archetypes of coloniser: the adventure and the worker. The *adventure* is audacious, improvident, and irresponsible. The ideal of the adventurer is "to harvest the fruit without planting the tree", thus, after destroying a certain patch of land he simply

moves to the next one. The *worker* in contrast is persistent, pessimist and narrow-minded. He focuses mainly means and difficulties to reach a certain goal, not on its rewards. The aims of the worker are "stability, peace, personal security and efforts without perspective of fast material gains", thus he tend to have a low impact on the environment and remain stable in the same place for generations (*ibid*; 44).

According to Holanda (1936/1995), while the northern European are near to the worker's archetype, the Iberians are mainly adventures. It was thanks to its adventurous character that Portugal, a small country, has only been able to colonise and dominate almost half of South America. However, the Portuguese work ethic was also the kernel of a predatory development model that persists up to the present time. Frei Vincente de Salvador, Brazil's first historic, centuries ago offered evidence to Holanda's theory. Vicente wrote in 1627 that the colonisers (and the first generations of Brazilians with Iberian ancestors) did not have any regard to their hosting land. They wanted to use the land Brazil not like landlords but as explorers, "only to exploit it and left it destroyed" (1982/1627; 16). Therefore, the change from the developmental to the environmental conception of control implies challenging long-established cultural patterns.

### 7.1.3. Establishment of the environmental conception of control

In the previous phase of the discursive facet of the Amazonian institution has felt the influence of the environmental conception of control, but environmentalism has neither been able to change the other levels of the institutions nor have reflections in the realm of action. However, during the last decade the Amazonian institutions passed through a slow but stead transformation. First, the environmental conception of control has finally infiltrated into the institution's ideals and techniques of control. Second, the military conception lost most of its influence on all levels of the Amazonian institution.

Some events highlight the straightening of the environmental conception at the idealistic level of the Amazonian institution. Today terms like sustainable development, ecology and global warming are part of the speeches of most politicians, even those not directly related to the environmental cause. The president Lula, from the Worker's Party (from a left-wing trade unionist party), for instance, very often cite the use biofuels in Brazil as proof that the country is one of the

greenest in the world (Reuters, 2007). More importantly, all interviewees suggested the establishment of the vision that the Amazon rainforest should be protected and the area must be developed in a sustainable way.

The environmental conception seem also to have further entrenched into the discursive facet of the Amazonian institution, since recent laws have given to the preservation of the rainforest a moral and financial values. At the same time, this new discourse also suggest the weakening of the military conception of control. Recently, the government has proposed the creation of a new international fund to exchange avoided greenhouse emissions from deforestation for financial help. This last event also suggests the weakening of the military conception of control, since Brazil always refused any mechanism linking international money to the preservation of the Amazon on the basis that this represents a threat to the country's sovereignty over the area. Second, the governor of the state of Amazonas recently created *Bolsa Floresta*, a financial incentive to poor families living within natural reserves to protect the area.

While the reasons for the change in discourse during the last phase of the Amazonian institution were clearly a reflection of international pressures, thus, external factors, the reasons behind the more recent transformation is not as obvious. This analysis proposes that the emergence and establishment of the environmental conception of control within the Amazonian institution can be explained by an internal factor, namely, the raise of the risk society in the Brazil, as defined by Beck (1992). The *risk society*, in contrast to the old industrial society, recognises that the previous notion of modernity produces a series of unintended consequences (e.g. pollution, unsustainable development, nuclear disasters) which threats our survival. Therefore, the risk society is concerned with the impact of human activities on the environment (for more details see section 3.1, page 5). Different politicians and researchers provided in their interviews evidence to support the applicability of Beck's (1992) theory to the Brazilian case. They suggested the presence of a process of *concientização ecologica* in Brazil, namely society is increasingly aware of the importance preservation of the environment.

Despite the strengthening of the ecological conception of control within the Amazonian institution and the weakening of the military conception, the developmental conception of control still present at full force in the government's policies concerning the region. The case provides two evidences that highlight this observation. First, the president Lula recently decided to invest in the construction of

paved crosscutting the rainforest, despite the high environmental cost of such infrastructure. Second, a top officer of the government confessed during an off tape conversation that the government's real priority "is the model that generates most income, and unfortunately this model is not environmental sustainable". In addition to that, the international community seems to take decisions concerning Brazil (e.g. provision of loans and free-trade agreements) based mainly on the developmental conception of control, which at its turn reinforces this conception within the government. Despite the apparent preoccupation of the international community with the preservation of the rainforest, they seems more worried about Brazil's budget surplus than the deforestation rates in the Amazon.

Concluding, the case study suggest a clear trend towards the greening of the policy towards the Amazon in the last twenty years. There were both internal and external reasons for this phenomena. Externally, the pressure from the international community has been pivotal for the introduction of environmental discourse into the Amazonian institution, even though it initially did not have reflections upon reality. Internally, the greening of Brazilian society led to the expansion of the environmental conception of control into the other layers of the Amazonian institution and, finally, a impact of this conception on reality. However, the developmental conception still present at the government. Therefore, even though the speed of the rainforest's destruction has decreased in the previous years, the preservation of the area will depend on the outcome of the war between the developmental and the environmental conceptions of control, in Brazil and in the rest the world.

## *7.2. RQ2: How did the Amazon monitoring system emerge and establish itself as the tool to protect the Amazon rainforest, and why it took its current shape?*

The answer for the first research question finally leaves us in a position where is possible to understand the emergence of the monitoring system, and why it became the main tool to ensure the preservation of the Amazon. While the previous section illustrates the evolution of the ideals and discourses, this section focus on a specific technique of control, the Amazon's monitoring system.

The case study suggests that the same conceptions of control that have influenced the policy concerning the Amazon, have also shaped the Amazon's

monitoring system. This section proposes that that between 1964 and 2000 the military conception of control dominated the developmental agenda of the monitoring system. However, after the turn of the century, the monitoring system presented symptoms of the weakening of the military conception and establishment of the environmental conception, even though the shape of the Amazon's monitoring system still reflect its past.

The remaining of this chapter is organised as follows. The next section revisits the history of the Amazon's monitoring system from its conception in 1977 until 2000, while the second section takes the case to the present.

### 7.2.1. Monitoring for military purposes

The theoretical framework sees the Amazon's monitoring system as a technique of control of the Amazonian institution emerged under the influence of the military conception of control. Techniques of control are "elaborate systems of measurement and documentation", including software packages, that usually apply numerical or other forms of codification (Hasselbladh & Kallinikos, 2000; 704). The Amazon's monitoring system fits with this definition because it is at the same time a software, and a measure system that represent the health status of the Amazon rainforest through the calculation of the "deforestation rates".

The influence of the military conception of control can be found in different places. First, Brazil was a pioneer in satellite-based remote sensing technologies. In 1973 the country was one of the first to acquire the images from Landsat, the first civil satellite aiming at earth resources research (Biache, 1983). Using the images form Landsat, in 1988 the government created PRODES, the first Amazon's monitoring system. Different interviewees suggested that the reasons behind the creation of the monitoring system were very similar to the ideal facet of the Amazon institution: both saw the Amazon as an area under threat and that should be colonised (see section 7.1.1, page 43). The researchers at INPE, for example, suggested that the perception from the military that the Amazon was a "vast and mostly unknown area" and the fear of the "international greed" concerning the Amazon, were the two main reasons for the decision to invest in satellite imagery. In this sense, the emergence of the Amazon's monitoring system reflects the military conception of control present at the 1970's and 1980's.

Second, the creation of SIVAM during the 1990's (one of the parts of the Amazon's monitoring systems) provides further evidence for the military conception of control behind the system. As highlighted by different representatives, even though the government proposed SIVAM as environmental monitoring system and its development has been financed by "green" money, the Brazilian Air Force that has designed and operates part of the system. As a result, different informants affirmed that the system is used mainly for military purposes such as air space control.

The history of the Amazon's monitoring system also indicates an ongoing institutionalisation in thee ways. First, the model proposed by Hasselbladh and Kallinikos (2000) theorises that the institutionalisation process is usually followed by a process of objectification of the same phenomena. The evaluation of the degree of ecological integrity of a certain area is highly subjective. The environment is composed by millions types of organic and non-organic components, such as the air, fauna, flora and human beings. Thus, evaluations vary according to the factors that the researcher takes into consideration in his or her analysis. While developing PRODES in contrast, the government decided that the process of environmental degradation of the Amazon should be expressed in a single numerical figure: the annual deforestation rate. Thus, the status of the Amazon's environmental integrity has been objectified into a number indicating the area which still covered by the rainforest. Second, the government is not able to think about the environmental protection of the Amazon without referring to the monitoring system. The governmental representatives interviewed for this research unanimously refer to the system as an "essential tool" for the protection of the Amazon rainforest. Third, the developers of the monitoring system seem resistant to changes on the current shape of the system. For instance, the current director of INPE, Gilberto Câmara, said in an interview to a magazine that INPE wants to have researchers from social science disciplines to work on the development of the monitoring system, "as long as they accept the quantitative perspective" (Macedo, 2007).

As a technique of control, the Amazon's monitoring system should be able to control action outcomes. In theory, the system should help the government to defend the territory from different kinds of threats. However, since information about military activities is not public available, it is not possible be certain about the impact of the monitoring system on the military dimension of the Amazon. What it is possible to be certain of, is the lack of impact of the monitoring system on the environmental

dimension of the Amazon. Evidence for that can be found in the fact that despite the new laws protecting the Amazon rainforest and the creation of the Amazon's monitoring system, the 1990's had some years with even higher deforestation rates than during the 1980's (see Figure 3, page 36).

### 7.2.2. Organisational change: new uses for old data

The previous section argued that despite its environmental façade, the Amazon's monitoring system emerged under the influence of the military conception of control. This trend seem to have reverted in 2001, when SLAPR (a monitoring system developed by a state-level environmental body) finally start having a real impact on the speed of deforestation on the state of Mato Grosso. Furthermore, during the same period the government decided to make the system available over the internet, in order to allow NGOs and other parts of civil society to help the government to protect the rainforest.

In synchrony to the changes in ideals and discourses during the same period, the change of the Amazon monitoring systems' role suggests the decline of the military and the raise of the environmental in the Amazonian institution. During the previous phase of the Amazonian institution there was a strict control over the data generated by the system. The release of deforestation rates and other information had to be authorised by SAE (Secretary for Strategic Affairs), which is controlled by the military. After a failed attempt in 1992 to open up the Amazon monitoring system to the broader public, in 2002 INPE was finally able to make PRODES available over the Internet.

The raise in efficiency of the Amazon's monitoring system, and the actual use of the data generated by it suggest the establishment of the environmental conception of control, namely, it shows in practice the willingness to protect the Amazon rainforest. It is unanimous amongst all interviewees that Brazil has today one of the most advanced monitoring systems in the world, and that this system is an essential tool for the protection of the Amazon rainforest. Furthermore, In spite of a corruption scandal involving the SLAPR at Mato Grosso, one of the monitoring systems, today most states in the Legal Amazon have a state-level monitoring systems. Furthermore, most government representatives pointed out that the government was able to reduce deforestation rates by 50% between 2004 and 2006 thanks to the Amazon's monitoring system (see Figure 3, page 36).

It is important to not that the difference between the Amazon's monitoring system before and after the turn of the century is mainly organisational. The case suggests that while previously the government used the data generated by the monitoring system only to create (inefficient) environmental protection policies and to respond to international criticism, from Mato Grosso's SLAPR onwards, different environmental bodies started to use the data to tackle illegal deforestation in the field.

In contrast to the evolution of the organisational aspects of the monitoring system, its technological aspects remained almost untouched over the last twenty years. As previously, the system today still converting satellite images into georeferenced data indicating areas undergoing deforestation (even though, the time lag for the conversion dropped from one year to some weeks). From this it is possible to conclude that the military conception of control assumptions still embedded at the technological side of the current monitoring system - a reflection of the institutionalisation of the system highlighted in the previous section.

Unfortunately, the militaristic conception of control embedded at the monitoring system may have negative consequences for the future of the Amazon. As previously explained, the Amazon monitoring system is able to see only the top of the trees and the deforested naked terrain, leaving many aspects of the rainforest invisible to decision makers. Even though the presence of trees is a good indicator of integrity of the area, the invisible factors may be crucial to the preservation of the rainforest, as suggested by an anthropological study of the attitudes towards the environment of the different populations of the Amazon. Lima and Pozzobon (2005) point out that the environmental attitude of the different populations is bound to cultural and economical factors, where the traditional populations of the Amazon (indigenous and white/mixed small peasants) have an ecological culture that contributes towards the conservation of the environment. However, in the presence of overpopulation and lack of food, those populations change their ecological behaviour towards destructive activities, such as deforestation and mineral extraction, in order to guarantee their survival.

The Amazon monitoring system is not able to consider neither the fauna nor the micro migration process that leads to the arrival of new populations to the Amazon, and as such, those factors are invisible to monitoring, but the destructive consequences appear on the system when it is already too late to take action. Therefore, it is possible to conclude that the Amazon's monitoring system is able see

only the most apparent symptoms of the ecological degradation process, leaving invisible many of the root causes of the problem. In this context, the institutionalisation of the current shape of the monitoring system, and the consequent resistance for change may hinder the evolution of the Amazon's monitoring system from a military to a real environmental conception of control. The "greening" of the monitoring system could take the form, for example, of a system able to involve the local community in the monitoring and protection of the rainforest.

Second, the Amazon's monitoring system is the foremost symbol of a model that has dominated the Brazilian environmental policy, the command and control, and as such may block the emergence of new models. The command and control aims at ensuring the preservation of the Amazon rainforest exclusively through the application of repressive measures, such as fines and legal action against landowners responsible for illegal deforestation. In order to do so the model depends mainly on the monitoring system that detects from the outer space the areas that have been deforested. Most interviewees recognised that the command and control model has its limitations on the long term. They proposed that it is necessary to take "structural measures" such as the development of new technologies and subsides, in order to incentive sustainable development of the Amazon. However, the actions in this sense still timid when compared to the command and control campaigns carried out by the government. In this context is possible to suppose that as long as the current Amazon's monitoring system remain unchallenged as the main way to protect the area it will not be possible to warrant the long-term preservation of the Amazon rainforest.

# 8. Conclusion

The analysis argued that the evolution of the policy towards the Amazon and the shape of the Amazon's monitoring system can be understood as a competition between different conceptions of control. At each period of the history of the Amazon, the three conceptions - military, developmental and environmental - were able to influence the three layers of the Amazonian institution with different levels of intensity. The analysis also proposed that broader factors, such as changes in political system, the raise of risk society and international pressures, were behind the vicissitudes of each conception of control (see Figure 4).

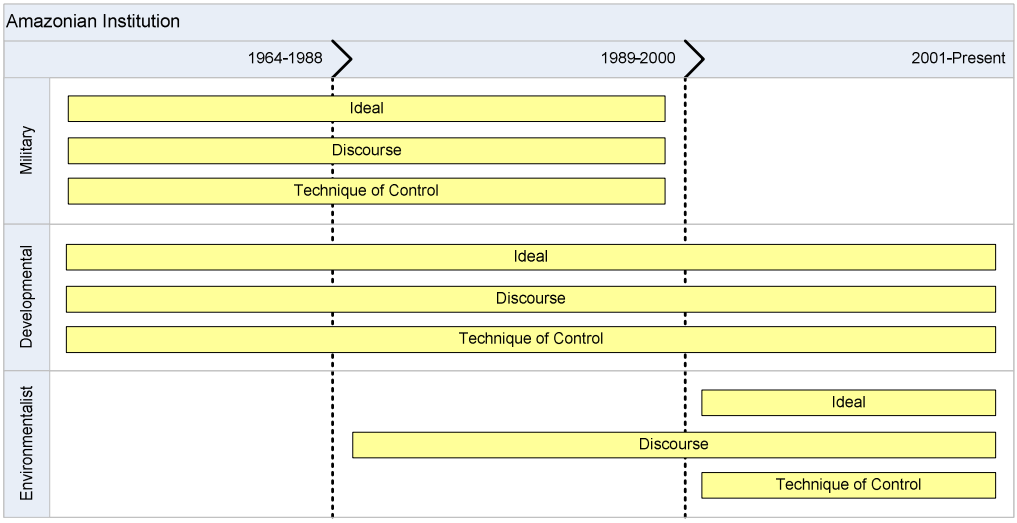


**Figure 4 The Amazonian institution and the government's conceptions of control**

More specifically, the institutionalist account of the Amazon case study suggested the transformation triggered by the establishment of the environmental conception found a formidable adversary in the developmental conception. Blackler and Regan (2006) point out that the difficult to put into practice new institutions is not anticipated in Hasselbladh and Kallinikos' (2000) or other institutional accounts found in the literature. They suggest fact that a new institution is internalised (accepted as the "right thing to do") does not imply its externalisation (translation in actual practices). Therefore, the authors conclude that institutionalisation "should be analysed as a *contested ascent* from the abstract to the concrete" (*ibid*; 1858). In this contest, old institutions, cultural infrastructures and cognitive framings may help or hinder the emergence of new institutions and its actual reflection in the realm of action.

Similarly, it is possible to read the evolution of the Amazonian institution as a reflection of the contested ascent of the environmental conception of control into the concrete realm of practices. In spite of the emergence of risk society in the Brazil, other deep cultural factors, such as the military worldview, the adventurer's work ethic and the focus on economic development contest the ascent of the environmental conception of control, and as such, pose obstacles to the sustainable development of the Amazon.

Besides the difficulties, false starts and muddles, the Brazilian society is changing and the government is following suit. Given the current local and global trends towards greening, it is very likely that the environmental conception of control will probably be further externalised. Therefore, issue is not "if" it will be externalised, but "when". The danger is that when this finally happens there may be not much of the rainforest to save, with negative consequences for the entire planet.

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