

**Title:** Hydropower plants, environment e local development

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**Abstract:** Nowadays, Brazilian hydropower plants are the fundamental strategy for development based on national economic growth, receiving a budget around US\$ 400 billion (48% of current government plan), whose generated electricity will be mainly employed in ore processing to export. On the other hand, the implementation and the operation of hydropower plants cause a wide range of negative impacts in local scale, like the alteration of hydrological regime, the loss of water quality and biodiversity, the occupation of reservoir's surroundings and the emission of greenhouse gases. In this context, the hydropower plants are clearly related to the increase of National Gross Product and to with generation of local significant environmental degradation. However, the relationship between the hydropower plants and the local development has not been adequately understood, especially considering that the Brazilian current policies are still justified by government how a mechanism to improve local development. Thus, this paper aims to theoretically discuss the possible relationships between hydropower plants and the local development phenomenon. The hypothesis for this paper is based on the idea that hydropower plants are a reproduction circuit of the "development myth" to the local scale. Analyzing local alterations caused by hydropower plants, this paper proposes the built of an analysis model that may cope with the relationship between hydropower plants and local development.

*Keywords:* local development; hydropower plants.

1        **1.Introduction**

2  
3        Hydropower plants play an important role to concretize policies that aim to promote a model of development based  
4 primarily in the enlargement of economic scale, which is a model adopted in Brazil since 1940ties. Currently, Brazil counts  
5 on a Growth Acceleration Plan, called PAC, that foresees an investment of R\$ 763 billion, from an amount of R\$ 1,59  
6 trillion, in the construction of hydropower plants, aiming to increase electric energy offer, specially to ore processing to  
7 exportation.

8        Besides the high environmental costs associated to hydropower plants, Federal Government justify these projects in  
9 the name of social interest for the country development, promoting beyond raise of Gross Domestic Product (GDP),  
10 regional and local development. In this second aspect, related to the development of others scales that is not national, is

11 possible to verify the fractal reproduction of policies based in the “myth of development” from Furtado (1974), which  
12 assure that the mechanisms that enrich a country could generate wealth to the locals affected by the hydropower projects.

13 Hypothesis discussed by this paper is that hydropower plants are fractal reproductive circuits of development myth to  
14 the local scale. For this discussion are used elements from development theories, like the the sinapses from Boisier (2004),  
15 the enclaves from Cardoso e Faletto (1984), dependency theory from Teófilo dos Santos (2000) and the myth of  
16 development, from Furtado (1974).

17

## 18 **2. Development as Economic Growth**

19

20 The new economic world order established after 2<sup>nd</sup> World War resulted in a model of development inducted in poor  
21 countries, at the time classified as underdeveloped, by international cooperation mechanisms created by this time, which  
22 allowed a direct financial support to these countries coming from developed world. By the action of international  
23 organizations, like World Bank, United States Agency for International Development (USAID), Organization for  
24 Cooperation and Economic Development (OCED), underdeveloped countries started to receive financial support which was  
25 invested especially in the implementation of large infrastructure projects, like large roads and dams, it happened in most of  
26 Latin-American countries. Since this period, Brazil has tried implementation of large dams to electricity generation as base  
27 to configure an economy strongly sustained by electro-intensive ways of production.

28 In the past 40 years, GDP of many countries called underdeveloped has raised significantly, especially due to the  
29 international cooperation mechanisms, which have influenced a strong reproduction of an internal socioeconomic  
30 asymmetry, with most of society remaining in economic system’s periphery. This reproduction of global scale to national  
31 scale can be understood as the fractal reproduction of the “myth of economic development” from Furtado (1974).

32 As Furtado (1974) states in the “Myth of development”, that this model of development adopted nationally and  
33 fomented by international cooperation organisms, reproduces in Brazil the same strategy that the rich countries have  
34 implemented to the composition of its economic systems, socially building a myth that the path to development of any  
35 country is to reproduce the economic history of rich countries. The premise associated to this idea of international  
36 cooperation is related to the presumption that economic growth by itself would be enough to deal with socioeconomic  
37 problems of poor countries (KLIKSBERG, 2002). However, as Vergara (2004) states, historic results reveal that the  
38 socioeconomic gap existed among rich countries (core of global economy) and poor countries (periphery) have been  
39 internally reproduced in the poor countries.

40 In this historic course criticisms have been made to this model of development induction, evincing the many  
41 consequences of this process like the raise of economic dependency from underdeveloped countries, the asymmetry  
42 intensification in the relations core-periphery, wealth concentration, cultural mimicry, etc. (CARDOSO E FALETO, 1969;  
43 FURTADO, 1974). According to an econometric study realized by CEPAL, PNUD and IPEA (2003), development  
44 strategies based exclusively in economic growth tend to concentrate the wealth and strength inequality. As social disparity  
45 creates assets discrepancy, like credit to education, for example, the reduction of these inequalities may be a much more  
46 effective mechanism to poverty reduction rather than economic growth. Still in Latin America, social disparity is a  
47 characteristic that persists historically.

48 It's very clear how this myth still persists as a guide to the formulation of public policies in Brazil, considering that  
49 the model of development remains oriented mainly to the increment of economic scale (GDP increase)with main strategy  
50 based on the construction of large infrastructure projects. The projects of energy sector have an important role in this  
51 process, prove of this is the amount of financial resource that is predicted to be invested mainly in the construction of  
52 hydropower plants. From a total of R\$ 1,59trillion estimated to be spent with the Growth Acceleration Plan (PAC), R\$ 1,09  
53 trillion is directed to the energy sector, with emphasis to dams construction to electricity generation, which represents 68%  
54 of whole investments. It is important to highlight that hydroelectricity is responsible for more than 70% electricity  
55 generation in Brazil (ANEEL, 2009).

56 Hydropower plants are in the middle of this development model based on the increase of GDP aimed by Brazilian  
57 public policies since 1970. During this historical course, these projects have been deeply analyzed and criticized due to the  
58 negative impacts associated, like the alterations in the hydrological regime, quality water loss, land use occupation,  
59 emission of greenhouses gases, biodiversity loss, increase of endemic diseases, among others (BERMANN, 2007).

60 However, these projects have been called as development promoters from local and regional scale. This discourse  
61 has justified the implementation of new hydropower plants despite all of the impacts well already known. In this context, it  
62 will be made a theory analyses of how is the relationship between this kind of project and the territories where it is located.  
63 For more than impacts, it is aim to analyze if alterations resulted from the whole process associated to a hydropower plant  
64 (planning, implementing and operating) are planned and oriented to the development of the localities affected.

65

### 66 **3. Hydropower and development**

67

68 The socioeconomic disparity in Brazil and also the loss of environmental quality are strongly associated to the  
69 economic growth model that the country has adopted especially since 1960 and 70. During the 1970ties Brazil has tried a

70 growth in GDP that was nearly 10% per year, still it was not felt in society better life conditions, as it was expected to be,  
71 for example, improvement in the guarantees of individual rights and in promotion of an income distribution that was less  
72 asymmetric. The opposite can be observed in the past 30 years, when the growth of economic scale was weakened, though  
73 social indicators have improved.

74 From this historical contradicted scenarios, Veiga (2010) deconstructs the idea that development is directly  
75 proportional to the raise of GDP per capita and states that development and economic growth are not synonyms. According  
76 to the author, “development of a society depends on how it takes advantages from the benefits of its economic performance  
77 to expand and distribute opportunities of access to goods, like civil liberties, health, education, decent jobs, etc.”.

78 Sachs (2004) states that development is different from economic growth especially when the benefits generated go  
79 beyond reproduction of wealth, being the growth a necessary condition for development, but not an end on itself. For the  
80 author, the term also implies in the appropriation of three groups of rights: the first one is compound by the human, political,  
81 civil rights; second one is associated to the economic, social and cultural rights, with emphasis to the right to decent jobs;  
82 and third are the collectives rights, like right to environment and development.

83 In this sense, the author proposes five dimension to analyze the process of development: social dimension, where he  
84 points out the necessity to transform a *having* civilization in a *being* civilization; environmental dimension, which  
85 represents to the author the support of life, being the dimension that supply all the necessary resources and also the ways to  
86 absorption wastes from human activities; territorial dimension that is associated to a better physical distribution of human  
87 settlements and economic activities; economic dimension to which the author discuss the allocation and efficiency  
88 management of resources, aiming to get over the local dependency of external conditions; and political dimension, Sachs  
89 considers that a democratic governance is a fundamental element in the development process, being essential to the  
90 promotion of others dimensions, and it is assure by the guarantee of freedom to public participation and the establishment of  
91 spaces that allow the materialization of this participation.

92 Boisier (2004) defines development as an intangible phenomenon which happens as an emergent property of a  
93 system, and defines economic growth as a quantitative element of material nature and only perceived by a reduced vision  
94 from reality, meaning, it represents simply the sum of internal GDPs, which the author defines as “sum syndrome”.

95 Though these themes are under intense academic debate for the past 40 years, the model of public policies planning  
96 for development still focuses in the amount of economic quantity instead its quality.

97 Among many theories that discuss the development phenomenon, it is emphases in this work the theory of  
98 endogenous development, that was organized in the beginning of 1980, and which starts from the premise that territory is  
99 far from receive and process passively strategies from external corporations and organizations. According to Vázquez

100 Barquero (1999), territory has its own strategy of development and of incidence in the local economic dynamics – strategy  
101 that is directly related to the complexity of territory internal elements, which are called endogenous factors.

102 Vázquez Barquero (2007), states that the social, cultural and environmental aspects of a territory are central to its  
103 development. To the author, development is a complex process that alters the space in different plans – economic,  
104 technologic, social, cultural, political and environmental – and the notion of endogenous development allows the  
105 interpretation of these alterations. The endogenous aspects can be associated to the territory autonomy in the process of  
106 appropriation and use of resources by local agents (VÁZQUEZ BARQUERO, 2007).

107 Haesbaert (2006) defines territory as a result of relations among different forces with variable intensities that  
108 establish political and economic control over the space elements, which represent a symbolical appropriation of the internal  
109 aspects of a social system. In this case, hydropower plants are exogenous forces to a territorial system, which establish a  
110 new order of endogenous factors appropriation, including the control over natural resources. Depending on the intervention  
111 magnitude resulted from a hydropower plant and the territorial vulnerability where the project was implemented the result  
112 could be a completely reconstruction and reconfiguration of the territory.

113 In this sense, according to Vainer and Araújo (1992), great infrastructure projects can be understand as mechanism  
114 that “generate new regions”, because they reconfigure the territorial relations preexistent, generating new factors. Vainer  
115 (2008) states the appearance of new socioeconomic dynamics and new social groups that lead to the configuration of new  
116 interests and issues.

117 According to the ideas exposed and with the analyzes model of development presented by Sachs (2004), it was  
118 sought to verify in literature how the alterations provoked in the territory, induced by hydropower plants are related to the  
119 dimensions define by the author.

120 The World Commission on Dams report (WCD, 2000) lists the main local alterations caused by hydropower plants  
121 in biophysical and socioeconomic dimensions. Regarding biophysical, it highlights the negative impact in terrestrial  
122 ecosystems and in biodiversity, the emission of greenhouse gases, the impact on water flow of downstream ecosystems, the  
123 alteration of upstream flood plains and the impact in fisheries in upstream, in downstream and in the reservoir. Regarding  
124 socioeconomics, the report lists the increasing of job offering during the construction of the dam, the new productive  
125 possibilities generated by the local provision of water and electricity, the displacement of people (both physical and  
126 livelihood’s), the non-consideration of downstream population as affected people, the effects of the project over gender  
127 inequality, the adverse effects on local cultural heritage and adverse effects on public health.

128 Considering the endogenous development theory already presented to analyze the local alterations in biophysical  
129 dimension, it can be addressed that none of them contributes positively to the process of development. All of them concern

130 the depletion of biophysical conditions, which compromises the stocks of natural capital that both maintain the local support  
131 life system and provide natural resources potentially useful in local productive process, a central factor to guarantee an  
132 endogenous process of development. The alteration in fisheries is a clear example of the loss of natural capital influencing  
133 the process of development beyond the biophysical dimension. Alterations in fisheries concern the local economic activity,  
134 consisting in a rupture in the space of social/cultural reproduction of those who used to practice it (BERMANN, 2007). This  
135 rupture generates conflicts that evidence the rights privation suffered by the affected people, which is negative to the  
136 process of endogenous development.

137 Socioeconomic alteration will be analyzed separately. The increase in job offering during the construction of the dam  
138 is a factor that, despite be always considered positive, has its contribution to the process of development attached to the  
139 existence of local infrastructure and to the institutional capacity in managing labor force's demands. Besides, local workers  
140 leave their former occupation to dedicate themselves to the dam edification in jobs that generally belong to the lower  
141 positions of the labour market (RIBEIRO, 1987). Additionally, when the demand for workers is not supplied by local  
142 people, foreign workers do the job. The migratory flux of workers generates pressure on the local community. As Ribeiro (1987),  
143 Vainer and Araújo (1992), Bortoleto (2001) e Zhouri and Oliveira (2006) mention, hydropower plants are traditionally  
144 undertaken in small communities and it intensifies the pressure, once those communities have lower chance to respond up to  
145 local population pressures.

146 Otherwise, population growth is followed by the creation of local markets. Local residents glimpse there an  
147 opportunity to generate and accumulate financial capital (BORTOLETO, 2001). Once again, the potential market depends  
148 on the provision of due local infrastructure to diversify and generate benefits in socioeconomic dimension (WCD, 2000).  
149 However, the diversification benefits will be real only if its influence reaches long-term scale and, besides, if urban  
150 infrastructure be provided to local community (BORTOLETO, 2001). If well managed, the project potential to diversify the  
151 local economy may be a factor that contributes substantially to the process of endogenous development. Unfortunately, the  
152 Brazilian practice has not demonstrated this ability in hydropower plants management (VAINER and ARAÚJO, 1992;  
153 BORTOLETO, 2001; BERMANN, 2007).

154 The two types of displacement (physical and livelihood) are distinct, but linked by the loss of land by the reservoir.  
155 To Bermann (2007), the physical displacement must be carefully accompanied by the maintenance of the community's  
156 conditions of social reproduction. According to the author, however, in practice riverine people were violently separated  
157 from their cultural and material basis, which indicates a rupture in the process of endogenous development once local  
158 inhabitants have their rights expropriated by the project demands.

159           Livelihood displacement concerns the forced alteration of local population's activities, caused by the loss of the  
160 resources that make them feasible, such as the loss of land to low-scale family farming and the loss of ecosystems to the  
161 riverine way of life.

162           The non-consideration of downstream population as affected people is more a mistake in project's planning process  
163 than a local alteration *per se*. Nevertheless, it generates negative consequences to downstream communities' process of  
164 endogenous development. As mentioned by WCD (2000), the consequences of large dams may be extended kilometers  
165 downstream. Do not considering those effects in projects' planning process is to not observe the right of those who live  
166 downstream.

167           Concerning the effects of dams over gender inequalities, WCD (2000) points out that there is no pattern in  
168 worldwide experiences. However, Vainer and Araújo (1992) mention the increase in prostitution cases within hydropower  
169 plants sites as a serious social problem whose consequences are felt over years. Along with the prostitution comes, cases of  
170 violence also become more frequent, compromising local social cohesion and influencing negatively the process of  
171 development.

172           The adverse effects over cultural heritage come from several aspects of the project, but all of them linked to the  
173 privation of local communities' rights and freedoms. As Bermann (2007) points, the non-identification, by the investor, of  
174 the actors and their interests, their history and cultures, it is an element to conceive the invisibility of riverine populations.

175           Finally, dams generate adverse effects in public health. The construction of the reservoir creates conditions to the  
176 propagation of illness vectors. Also, it causes a rise in demography that generates pressure over the public health system  
177 (generally incapable of cope with the pressure).

178           These effects occur in the direct affected local in many ways, which turns hard the apprehension of the relationship  
179 between hydropower plants and the endogenous development of their implantation site. Therefore, it must be built an  
180 analysis model capable of coping both with the dynamics generated by the project and with the multidimensionality of the  
181 process of endogenous development.

182           Some authors have dedicated their studies to build analyses models that represent the process of development as the  
183 product of the interaction between "capitals". Guimarães (1998) and Boisier (1999) list some types of capital that, in  
184 systemic articulation, constitute the development phenomenon. These capitals can be approximate to endogenous  
185 development dimensions discussed by Sachs (2002) and Vázquez Barquero (2007). Boisier's Economic, cognitive,  
186 symbolic, cultural, institutional, psychosocial, social, civic, human and natural capitals have similarity to Vázquez  
187 Barquero's economic, technological, social, cultural, political and environmental dimensions.

188 Thus, it is proposed an analysis model in which each one of the alterations caused by hydropower plants would  
189 influence territories' capitals distribution, interaction and, therefore, the conduction development process to a path that  
190 could be more or less endogenous.

191 Bortoleto (2001) affirms that the development achieved through these kind of projects is ultimately restrict to the  
192 hegemonic centre of the national economy, a statement corroborated by the description of the local consequences of dams  
193 given by the WCD report. Alterations in local biophysical and socioeconomic aspects tend to hamper the process of  
194 endogenous development. As Ribeiro (1987), Vainer and Araújo (1992) and Bortoleto (2001) affirm, big projects usually  
195 embrace their implantation sites within their own logic of resources appropriation, imposing a dynamics which small  
196 affected communities are not capable to cope with.

197

#### 198 **4. Final considerations**

199

200 Local alterations caused by hydropower plants may be well known, nevertheless the influence of projects over  
201 territories' development is a subject described and analyzed within several methodological approaches. The idea to analyze  
202 the development of territories affected by hydropower plants by analyzing the distribution of different kinds of capital over  
203 the territory can be a way to deal with both complexity of the development process and the dynamics imposed by the  
204 hydropower plant. Gathering the analysis of local capitals' distribution together with a systemic approach may be a step  
205 forward in the analysis of the relationship between local development and hydropower plants.

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