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São Francisco River Transposition Civil Work: Challenges to the Brazilian Economy

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Abstract:
Locatedat the northeastern region in Brazil, the São Francisco River has recently drawn a great deal of attention from the world construction business, since its pharaonic civil work of transposition, here highlighted as a Brazilian development model for the northeast region. The transposition was initiated in 2007 and 86.3% concluded in 2016. The São Francisco River is 2.683 km long, located in a semiarid climate (caatinga) that crosses the states of Minas Gerais,Bahia, Sergipe, Alagoas, and Pernambuco, throughout 521 municipalities. The project encompasses the creation of 477 km of artificial channels that will take water to approximately 12 million people, with the aim to revitalize economically the entire region, seriously affected by constant droughts. The transposition civil work is not a recent idea. It was first idealized in 1847, during the Brazilian emperor D.Pedro II period (1840-1889). Despite the Brazilian Government initiative, its execution as a project has been controversial, because it has spent almost two times the original budget forecasted and, at least, five more years to conclusion than originally planned. This work analyzes the impacts of the São Francisco River transposition, its pitfalls and challenges faced throughout the years.

Keywords: *Transposition, São Francisco River, Brazilian economy, civil work*

1. Introduction

The present work is a descriptive single case study that investigates the challenges faced by transposition of the São Francisco River, that crosses five Brazilian states over 2.683 km, in the Northeastern region (see Figure 1).

There are six Hydroelectric Power Plants throughout the entire river extension. The original idea came from the Second Imperial period in Brazil (1840-1889). Under D. Pedro II, the worst drought in the XIX century in the Brazilian history, occurred in 1840 in the Northeastern region, especially the state of Ceará (a province, at that time) that caused death and a large migration to the Amazon region, also motivated by the economic boom provoked by the rubber extraction, at that time (MIN, 2016; IBGE,2016).Therefore, in 1847 a pilot project was designed (later abandoned), since the resources and technology at that time were not compatible with the complexity of the task in question (Aveiro, 2014).

Almost one hundred years later, the project gained a new dimension, under the Getulio Vargas Government (1940s). Later, from 1990s, almost all further governments had plans to initiate the complex civil work, despite many criticisms. However, the project was formally started under the mandate of the former president Luis Inacio da Silva (Lula), in 2007, and should be completed under his successor's government, president Dilma Roussef, in 2015.

Since the beginning, the project has been controversial. The idea was to extend the Rio São Francisco in 477 km. The problem is that the São Francisco River (for the locals "*Velho Chico*" – *velho* means old in Portuguese, and *Chico* is the sort for Francisco), has seventy times less river flow capacity than the Amazon Rover, for instance. Therefore, it would be necessary to elevate and to pump water above 165 m high, in order to fulfill this task, what would consume the power of three *Três Marias* (hydraulic power plants located along the São Francisco River), according to the *Minstério da Integração Nacional (MIN)* – National Integration Ministry (MIN, 2016).

The project was started by the Brazilian Army in 2007, responsible for the first execution part of the gigantic task of the river transposition and should be concluded by private companies in 2012 (MIN, 2016). However, in 2016, 86.3% of the project was concluded, with no estimate date to completion (MIN, 2016).

Since the beginning, the project was criticized by specialists, who pinpointed risks for irreversible damage to the local economy, as well as ecosystem.

Then, accusations of corruption, illicit acts, misuse of public funds has been under the *TCU - Tribunal de Contas da União (*Union Accounts Tribunal, roughly translated) investigation. Many irregularities were found, such as errors in project design, budgets with overprices, and so on.

Therefore, this case study aims to investigate the major pitfalls and challenges faced during the project execution, as well as the impact and further consequences within the regional economy, such as the reduction of the Rio São Francisco navigability capacity by one third that impacted in transportation costs for the distribution of the regional products. Another consequence was the reduction of

the water supply for to the local agriculture irrigation, such as grapes, mangos, bananas, among other fruits cultivated within the area, formerly supplied by the water from the São Francisco River.

2. Methodology

The present research combines descriptive case study (Yin, 1988) with extensive literature review, qualitative in-depth interviews and direct observation. Primary data was collected through a qualitative interview (Goffman, 1959, 1961). The chosen unit of analysis is the transposition of the Rio São Francisco civil work (Yin, 1988).

Five in-depth key qualitative interviews were conducted through semi-structured interviews.All interviewees were invited by phone calls, with 100% response rate. Primary data were collected by audio or video recording, registered on field notes and photos. All respondents answered one hundred percent out of three questions posed. One of the respondents is a TCU auditor, responsible for auditing the civil work. The interviews were conducted in Portuguese. Quoting was not formally allowed; therefore, names are kept confidential, in order to respect privacy and disclosure. Data gathered were transcribed and coded through In Vivo coding. Data were then analyzed through contentand discourse analysis. Secondary data came from extensive literature review, as well as governmental archives.

2.1. Research limitations

This research is limited to the Transposition of the São Francisco River civil work. Similar works in the Brazilian history are not object of the present research, neither private investments in local infrastructure that followed the project under investigation.

2.1.1. Background: The San Francisco River in Northeastern Brazil

The São Francisco River crosses the states of Minas Gerais,Bahia, Sergipe, Alagoas, and Pernambuco, over 521 municipalities. It was born at the Serra da Canastra, at Minas Gerais state (Southeastern region), passing through the Northeastern states of Bahia, Pernambuco, of Alagoas and Sergipe, draining a geographic area of 641,000 km^2 (IBGE, 2016) and flowing into the Atlantic Ocean, as shown in Figure 1, as follows:

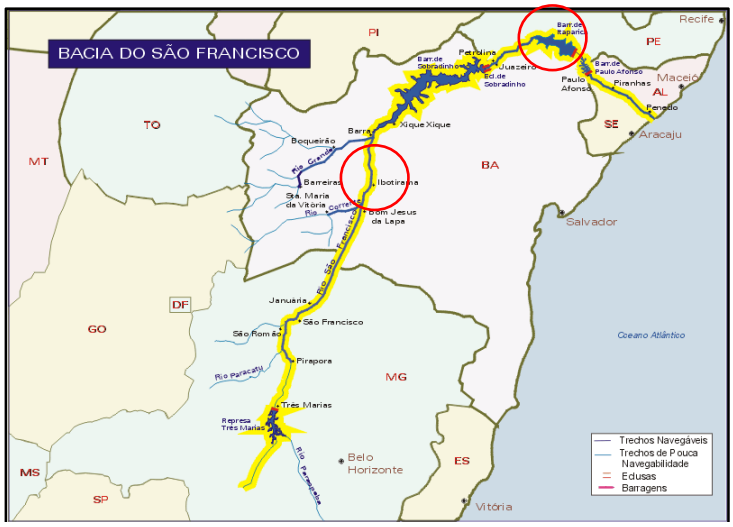

Figure 1: San Francisco River (in yellow) crossing five Brazilian states. Bahia and Permambuco states are circled in red
Source: TCU, 2016

The São Francisco River is a major inland waterway responsible for distribution of the production of the region is distributed to the rest of the court and exported through the Suape port in Pernambuco state and the Port of Aratu in Salvador, Bahia. (EMBRAPA, 2016).]

The Brazilian Federal Governmentinvests in the agriculture through irrigation projects, especially regarding the cities of Petrolina, in Pernambuco, andJuazeiro in Bahia (see the states circled in red in Figure 1), to foster fruits and vegetable cultivations (EMBRAPA, 2016).

The population surrounding the São Francisco River is near 17 million inhabitants, (IBGE, 2016). One of the most important agriculture projects at that area is the*Mango and Grape Integrated Production Project* (EMBRAPA 2016).

2.1.2. Background: The San Francisco Transposition civil work

The "*Transposição do Rio São Francisco*" (San Francisco River Transposition), or the"*Projeto de Integração do Rio São Francisco com Bacias Hidrográficas do Nordeste Setentrional*" (Northeastern integration Project between San Francisco River and regional rivers), or), is an 8 billion BRL project, building more than 477 km of artificial channels to deviate the course of San Francisco River. The original idea was to irrigate the entire semi-arid region at the Northeast Brazil (MIN, 2016), as shown in Figure 2, as follows:

Figure 2 : San Francisco Rio Transposition. Source: MIN, 2016

The project was first idealized by the emperor D. Pedro II in 1847 and revisited during the first Getulio Vargas Government (1930-1945).

The transposition of the São Francisco River was formally approved as a project in 1985 by the former*DNOS – Departamento Nacional de Obras e Saneamento* (Sanitation and Construction National Depatrment), according to Aveiro (2014). It has been officially started in 2007 to be concluded in 2012.

On December 2016, only 86.3% of the project has been finished (MIN, 2016). The project supposed to reach over 12 million peoplealong 390 cities, including the states of Pernambuco, Ceará, Paraíba, andRio Grande do Norte, where droughts are frequent, according to the low yearlyrainfall regime(MIN, 2016).

The project forecasted the building of thirteen aqueducts, 27 reservoirs, nine pumping stations, 270 kilometers of high-voltage transmission lines, nine 230-kilowatt substations, and four tunnels, generated 10.394 direct jobs and demanded 3.221 machinery equipment (MIN, 2016), as shown in Figure 3, as follows:

Figure 3 : San Francisco River Aqueduct. Source: MIN, 2016

2.1.3. The São Francisco Transposition: auditing and fraud

In theory, the project is atwo hundred years' dream coming true. However, it has been controversial. According to the TCU (2016), the São Francisco River had a loss of 35% of its original river flow. It is directly related to the water distribution, and acts as an imitator factor to the expansion to the regional irrigated agriculture. The lesser the water supply, the lesser irrigation, and consequently, cultivated areas, as show in Figure 4, as follows:

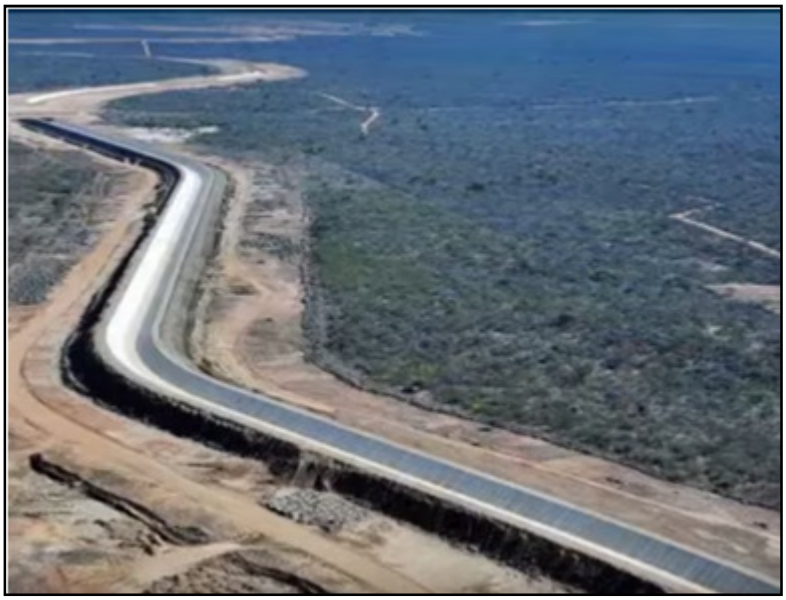

Figure 4 : São Francisco River civil work. Source: TCU, 2016

For instance, the San Francisco River was 2.943 m^3/s river flow, almost 70 times less than the Amazon, which is 209.000 m^3/s, i.e. seventy times smaller than the Amazon river flow, in comparison. It is equal to 1,58% of the National average flow, which is 179.516 m^3/s (ANA, 2016). According to the Brazilian San Francisco Basin Committee (CBHSF), the San Francisco river flow in December 2016 was approximately 900 m^3/s. It has been reduced by two-thirds its original river flow (CBHSF, 2016).
Inland waterways navigation also suffers. Its navigation depth was reduced to 1.5m (1.2m during the drought period), according to DNIT (2016). The major civil constructions are disposed to attend 390 municipalities, as show in Figure 5, as follows:

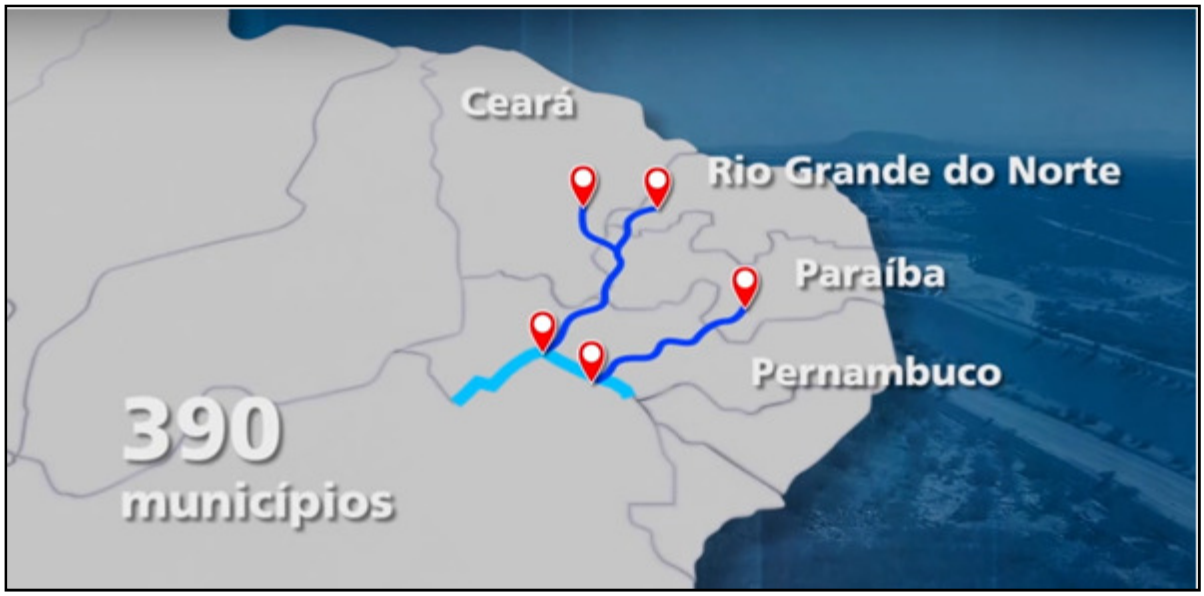

Figure 5 : The Transposition River civil work on 390 municipalities. Source: TCU, 2016

Initially estimated in 4 billion BRL, the construction has spent so far 8 billion, or 100% more expensive than the original forecast. According to the Tribunal de Contas da União's (TCU) minister, Raimundo Carreiro:

> the executive Project was poorly done, and poorly structured. The project was launched in these conditions, and it is being mended and amended, parts are included without planning, misappropriations, with no specific project, all these contributed to these problems (TCU, 2016).

The TCU has found projects disconnected to the local reality, unusual financial transactions between companies involved, overpricing, and environmental licenses expired, among others (TCU, 2016).
The project is marked by the lack of project planning and integration. The overall project had to be redesigned. Figure 6 shows the pumping station at the São Francisco River, as follows:

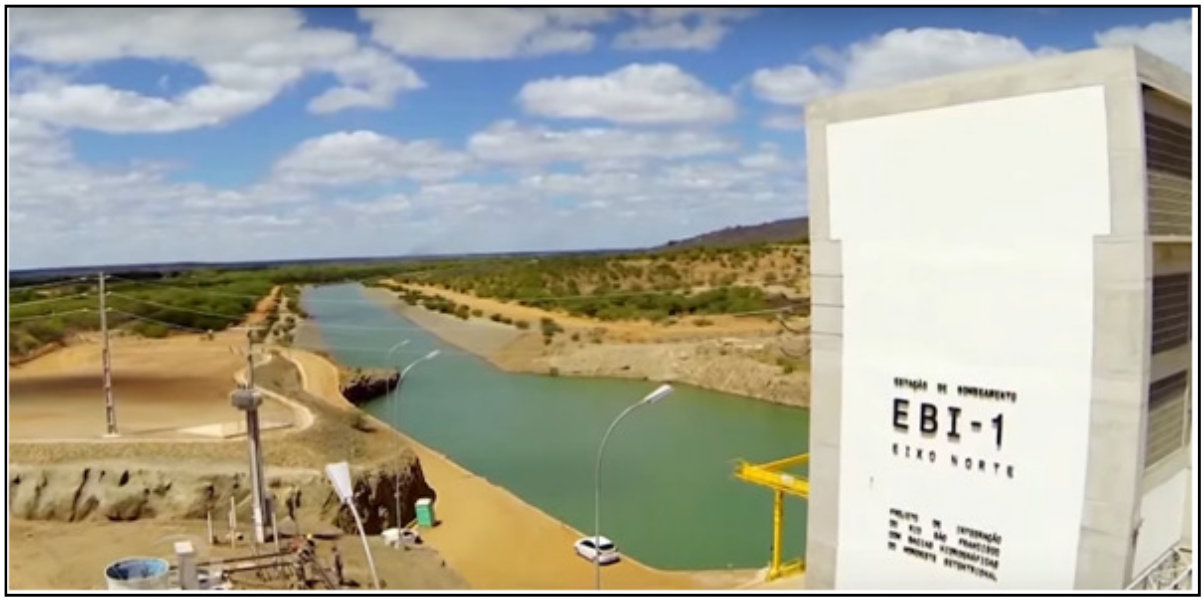

Figure 6: Pumping station EBT-1. Source: TCU, 2016

The lack of due planning has driven the São Francisco river to get dry, according to Figures 7 and 8, as follows:

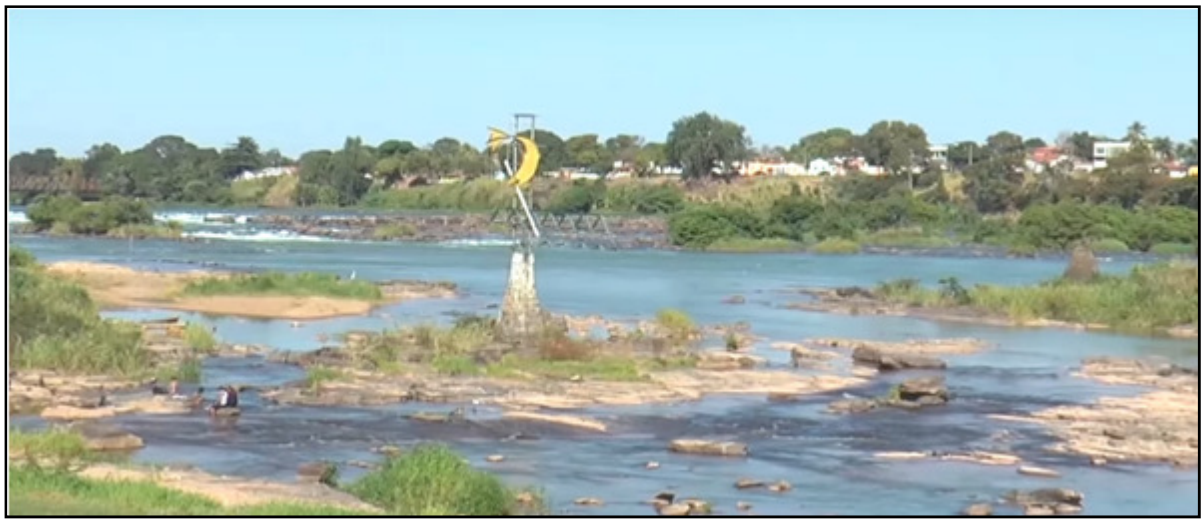

Figure 7 : The São Francisco River getting dry. Source: TCU, 2016

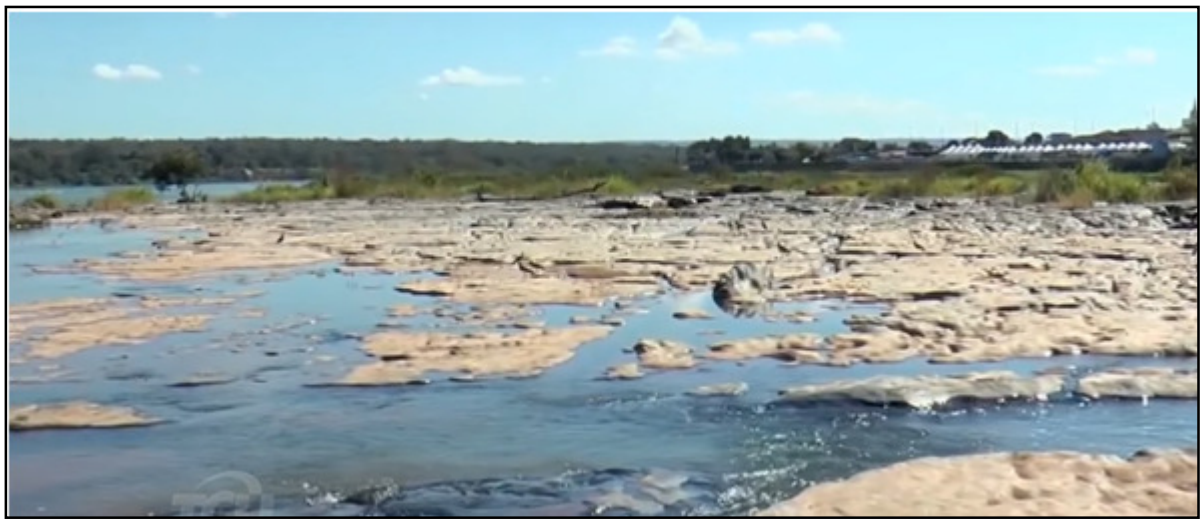

Figure 8 : The lack of integrated planning and corruption led the São Francisco River to its exhaustion. Source: TCU, 2016

According to Anivaldo Miranda, president of the São Francisco Basin Committee, "Excessive demands over the river, responsible for the water distribution to the São Francisco River (...) that affects large scale exportation agriculture production" (TCU, 2016).

3. Discussion: the Future of the São Francisco River

The São Francisco River suffers from lack of correct project management integration in large scale. The consequence is water misuse, and the destruction of the São Francisco River. It just does not support that kind of water distribution. The fauna and flora have suffered changes due to the ecosystem changings.

The local economy, based on irrigated agriculture has been limited to the remaining water supply. The president Dilma Rousseff was impeached on May 2016, with accusations of misuse of Public funds, including the São Francisco Transposition civil work.

With this scenario, for future researchers, it is valid to revisit the subject under investigation, to analyze the impacts on the regional and the overall Brazilian economy, and if it is possible, to save the "Velho Chico" from its extinction, while it is possible to do so.

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