RELATIONSHIP BETWEEN WATER QUALITY RISK INDEX AND FISCAL PERFORMANCE INDICATOR IN COASTAL REGIONS IN COLOMBIA

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ABSTRACT: The departments of the Pacific and Caribbean coast of Colombia are classified in different ranges. The information available in the institutional repositories does not allow differentiating the proportion of the expenditure destined to basic sanitation works and particularly for the improvement of the quality of water for consumption. This research demonstrates the behavior of the water quality risk index (WQRI, IRCA in Spanish) and contrasts the variation of this index with respect to investment for expenditure and the departmental performance indicator. The study reveals that health problems arising from the quality of drinking water persist.

KEYWORDS: Community development, investment, public works, basic sanitation.
JEL classification: O13, I18.

1. Introduction

Although there is a limitation regarding the availability of water resources (Echeverría-Molina & Anaya-Morales, 2018), the initiative to generate strategies to meet the Millennium Development Goals and the Sustainable Development goals set by the United Nations has promoted the formulation of projects leading to infrastructure works that mainly improve living conditions in developing countries (Zhou, et al., 2018) (Brewis, et al., 2019). Sometimes, these works are advanced in a time that is not consistent with the growth of human settlements, which are usually located preferentially in urban areas rather than in rural areas (van Welie, Cherunya, Truffer, & Murphy, 2018) demanding great efforts to meet basic sanitation needs and maintain appropriate health standards (World Human Organization and UNICEF, 2017), (Alam, 2018), (Brewis, and others, 2019). Precisely, the solution to the problems of the communities is given through the execution of infrastructure works projects since these allow improving the quality of life of the inhabitants. Moreover, in addition of that, this type of interventions contribute to the development for reasons such as the improvement of quality of life, poverty reduction (Gehrke & Hartwig, 2018) as well as job opportunities that arise in the environment (Del Ninno, Subbarao, & Milazzo, 2009) during the construction stage and later, during the operation of the products, goods or services that are delivered. On that way a budget is required under the understanding that the works that are being planned respond to the unsatisfied basic needs, in addition to that, they constitute key pieces for the improvement of the economic conditions and quality of life of the inhabitants (Alam, 2018) and for that reason, they should be included in the government plans.

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In the case of Colombia, a developing country, these works are included in the Territorial Planning Plans (TPP, POT in Spanish), navigation charts for the administration of the treasury money (Serrano Guzmán, Pérez Ruíz, & Pardo, 2017).

Particularly, public infrastructure projects in relation to the use of water that arise in this country should consider the quality of this for consumption. For this purpose, the Water Quality Risk Index (WQRI or IRCA in Spanish) has been defined, which warns of the degree of risk of occurrence of diseases derived from water intake with non-compliance with physical, chemical and microbiological characteristics for human consumption (Ministerio de Protección Social, 2007) because its low quality has a significant impact on people's health. An WQRI of zero indicates compliance with requirements in all parameters while 100 is non-compliance in all aspects, as stated in Decree 1575 of 2007 (Ministerio de Protección Social, 2007).

This article mentions outstanding infrastructure projects that have been raised so that the Atlantic and Pacific coast of Colombia addresses the problems related to water quality evidenced by the average water quality risk index (WQRI) obtained in the localized departments in this area. Likewise, a reflection is initiated on the inconsistencies between the WQRI and the fiscal performance indicator (FPI, DFI in Spanish) of the territorial administrations of each department which, in addition to other aspects, in the field of public finances evaluates the percentage of expenditure dedicated to investment in coverage of public services and other sectors (Observatorio Transparencia y Anticorrupción, 2018).

2. Methodology

This exploratory, descriptive and comparative study was conducted using information available in institutional repositories and accountability reports of government entities in Colombia, focusing on the departments of the Atlantic Coast and the Pacific Coast. The data collected is used to infer whether there is a relationship between investments in basic sanitation and the water quality risk index (IRCA).

3. Results

Around 70% of the flow extracted in Latin America and the Caribbean is destined for consumptive use in irrigation agriculture (Banco Interamericano de Desarrollo, 2018). In relation to this resource, according to a report from the World Water Forum, Colombia has a water availability of 2,360,000 Mm3 / year which represents 8,840 m3 / hab / year (Banco Interamericano de Desarrollo, 2018). However, although there is an apparent supply of water resources, urban areas have 97.4% of coverage with a quality of 86% and rural areas represent 73.2% with a quality of 42% (Viceministerio de Agua y Saneamiento Básico Dirección de Desarrollo Territorial, 2018). As can be seen, 2.6% and 26.8% in urban and rural coverage , respectively,are missing figures that were not exceeded with the investment of € 388,640,176.08 in 2018 (Ministerio de Vivienda, Ciudad y Territorio, 2017).

Despite the economic efforts made in Colombia, it was found that of the information collected in 1102 municipalities, taking from the total of 1123 municipalities in the country (Departamento Administrativo Nacional de Estadística (c), 2017), only

50.77% have safe water consumption (Table 1). According to this, the identification of non-compliance with the quality of water for consumption serves as a justification to ratify the need for intervention in the communities through programs of infrastructure works, preponderant, in relation to water purification as regards basic sanitation refer.

Table 1. Water quality risk rating in 1102 municipalities in Colombia

Qualification under Decree 1575 of 2007	Municipalities
No risk	529
Low risk	222
Medium risk	172
High risk	97
Unfeasible risk sanitarily	22
Non available data	60

Source: Adapted from (Viceministerio de Agua y Saneamiento Básico Dirección de Desarrollo Territorial, 2018)

In this study, WQRI behavior was evaluated in the departments located physiographically at the Pacific and Atlantic coast of Colombia.

These departments are categorized in Special category, 1, 3 and 4, according to the economic importance, population, efficiency and other aspects enshrined in Law 617 of 2000 (Ley 617 de 2000, 2000) and the economic importance that it establishes Law 1551 of 2012 (Departamento Administrativo Nacional de Estadística (c), 2017) as Table 2 shows.

Table 3. WQRI annual average of the Atlantic and Pacific coast Departments and the category of the Departments

Pacific Coast: Departaments				
	Nariño	**Cauca**	**Valle**	**Chocó**
Category	**Category 1**	**Category 3**	**Special**	**Categoría 4**
2015	high	Low	low	No risk
2016	high	Low	low	Low
2017	high	Low	low	low
2018	high	Low	low	Medium

Atlantic Coast: Departaments							
	Guajira	**Magdalena**	**Atlántico**	**Bolívar**	**Sucre**	**Córdoba**	**Cesar**
Category	**Category 4**	**Category 2**	**Category 1**	**Category 1**	**Category 3**	**Category 1**	**Category 2**
2015	low	Alto	low	medium	medium	medium	medium
2016	no data	Alto	medium	medium	medium		medium
2017	no data	Medium	no risk	alto	medium	no risk	medium
2018	low	Medium	low	medium	Low	low	medium

Source: Prepared wiht information of (Instituto Nacional de Salud, 2019) y de (Contaduría General de la Nación, 2019)

Undoubtedly, solving sanitation problems requires innovations in infrastructure and technology as well as the approach of funding mechanisms and cost recovery of investment made (van Welie, Cherunya, Truffer, & Murphy, 2018) and, particularly in developing countries such as Colombia, the economic capacity of the beneficiary communities to facilitate the payment method must be taken into account (Banco Interamericano de Desarrollo, 2018). As expected, the amounts of budgets for the execution of works involve significant sums. In the case of Colombia, currently investments have been approved to cover different needs related to basic sanitation in the coastal areas:

- On November 3rd, 2015, € 121,213 was allocated for contracting external public credit (water bonds) for the implementation of the components of the "Fund for the Development of the Plan Todos Somos PAZcífico", which includes projects related to aqueduct and sanitation basic, energization and transport connectivity(Unidad Nacional de Gestión del Riesgo, 2018).
- Between 2012 and 2015, government projects were approved for priority investment works related to aqueduct and basic sanitation in the municipalities of Malambo, Luruaco, Sabanalarga, Santo Tomás, Campo de la Cruz and Suan for an approximate value of $ 24,242,424.24 € (Secretaría de Agua Potable y Saneamiento Básico, Gobernación del Atlántico, 2015) (Secretaría de Agua Potable y Saneamiento Básico, Gobernación del Atlántico (b), 2016) (Secretaría de Agua Potable y Saneamiento Básico, Gobernación del Atlántico (c), 2017).

Local governments are aware of the needs of their municipalities, which is why they plan investments such as aqueducts and sewers, as well as other solutions that concern social investment concepts and impact the fiscal performance index (FPI, or IDF in Spanish) (Table 3), and its rating in terms of development (Departamento Nacional de Planeación, 2019). In the best case, investments are expected to exceed 70%, which means that more than half of the expenditure is being spent on investment (Observatorio transparencia y anticorrupción, 2019). The information available on institutional repositories in the departments of Colombia is dispersed so that the synthesis of the sectors to which resources are being devoted difficult.

Table 3. FPI and score according with investment in Departments of Atlantic and Pacific Coast, 2017

Departament	Investment (%)	PFI	Score
Valle	77.63	81.23	5. Solvente (>=80)
Atlántico	82.15	79.47	4. Sustainable (>=70 y <80)
Cordoba	89.22	75.45	4. Sustainable (>=70 y <80)
Nariño	90.24	79.69	4. Sustainable (>=70 y <80)
Bolivar	83.53	70.59	4. Sustainable (>=70 y <80)
Cauca	91.04	71.52	4. Sustainable (>=70 y <80)
Cesar	90.02	73.24	4. Sustainable (>=70 y <80)
Magdalena	87.59	80.43	5. Solvente (>=80)
Sucre	90.06	76.14	4. Sustainable (>=70 y <80)
Chocó	87.65	62.41	3. Vulnerable (>=60 y <70)
Guajira	88.60	64.45	3. Vulnerable (>=60 y <70)

Source: prepared with information of (Departamento Nacional de Planeación, 2019)

On the other hand, the rating of the Chocó and Guajira performance indices is of early development (Serrano-Guzmán, Pérez-Ruiz y García-Cuellar, 2019), but in relation to investments, their condition is vulnerable. The other departments are in intermediate development.

In spite of these levels of development, the comparison between the FPI and the percentage of investment destined to spending and the WQRI (Figure 1) allows to infer that although it is true that the departments report high percentages of investment with respect to expenditure, there are following unfavorable behaviors as far as the WQRI is concerned, between 2010 and 2017:

• The departments of Nariño, Chocó, Magdalena and Bolívar have maintained a WQRI that rates drinking water as High Risk.

• On the other hand, the departments of Cauca, Guajira, Valle, Sucre, Cesar maintained a medium-risk WQRI.

• For its part, in Córdoba for 2017 a WQRI of Low risk was reported.

• Regarding the Atlantic department, despite the investments made in basic sanitation, it went from having a risk-free WQRI in the years 2010 to 2012 to low risk in 2017; that is, despite the investments made, it seems that the impacts on the works executed have not benefited this department so far.

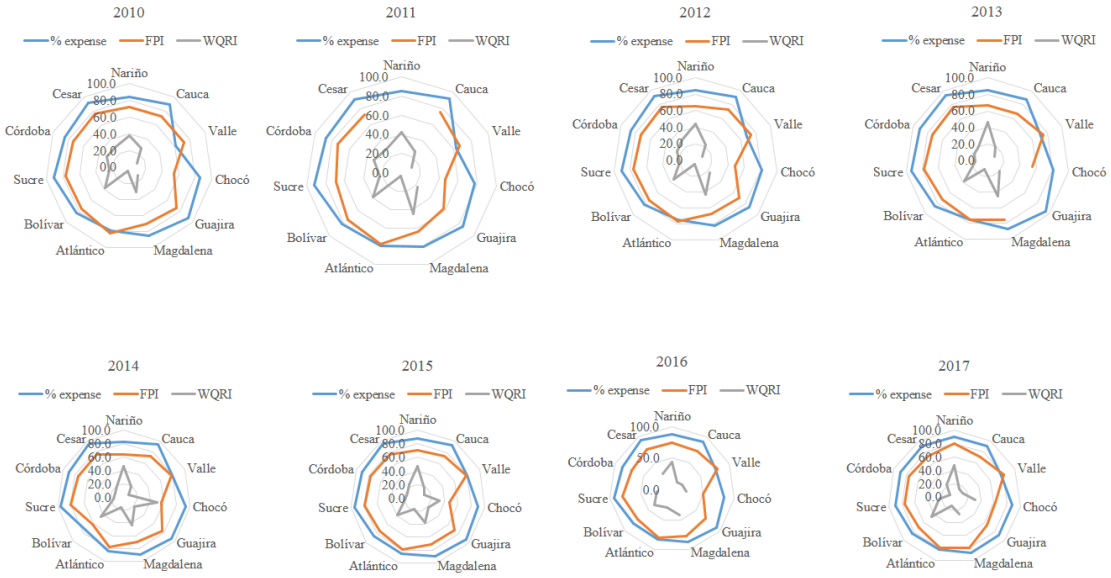

Figure 1. Representation of the percentage of expenditure, FPI and WQRI between 2010 and 2017. Source: Authors

4. Discussion

There is currently a global crisis for the quality and quantity of water available for different uses (Echeverría-Molina & Anaya-Morales, 2018) accentuated by problems of management of the precious resource. Situations such as population growth are demanding

the conditioning of spaces for adequate living (van Welie, Cherunya, Truffer, & Murphy, 2018) mainly in cities, where around 54% of the population is settled worldwide (UN-Habitat, 2016).

In general, it can be affirmed that public works projects must be planned and managed taking into account the benefits they represent in the community over the possible income that could be generated with the commissioning of these works (Gehrke & Hartwig, 2018) . In fact, government agencies and non-governmental organizations (Alam, 2018) usually participate in these projects to fulfill one of the Millennium Goals of ensuring the availability and sustainability of water systems (Zhou, and others, 2018) which includes In addition to the distribution systems for drinking water and sewage treatment, other aspects related to waste management. However, despite the efforts made jointly by the different participants, the proposed goals are still far from being achieved (World Health Organization, 2015) since the execution of different programs that involve related projects is required.

The execution of infrastructure projects around the use of water resources in Colombia, as in other Latin American countries, depends on the limited contribution that beneficiaries can make and, primarily, on the investments of government entities, to whom it corresponds continue to propose policies that allow increasing the percentage of people with access to drinking water and in general to adequate basic sanitation conditions (Financiera del Desarrollo, 2017) for which, surely, dialogue with the service providers will have to be initiated.

Regarding water quality, it is important to point out that it affects the health conditions of people who may be affected by hepatitis B and intestinal parasitism among other aspects of public health. Statistics indicate that for example, worldwide, intestinal parasitosis caused by *Entamoeba histolytica* / dispar and *Giardia lamblia* is part of the 10 most common infections, *E. histolytica* being responsible for the death of around 70 thousand people per year (Giraldo-Ospina, and others, 2015). For a period of more than 60 years, intestinal parasitism has been present in Latin America and the Caribbean (Giraldo-Ospina, and others, 2015), which is why this situation is also common in different populations of Colombia. In this study, the following realities were found in the Atlantic and Pacific coastlines:

A total of 6045 samples collected in 26 coastal municipalities in the 2012-2015 period revealed a high incidence of *T. trichiura*, *Hymenolepis nana* and *A. Lumbricoides* in the Sierra Nevada de Santa Marta (Magdalena), *Uncinarias* in Chocó and Magdalena, three cases of *Taenia solium/saginata* in the Caribbean region (Ministerio de Protección Social y Facultad Nacional de Salud Pública de la Universidad de Antioquia, 2015). These parasites occur mainly due to the intake of waters of low physical-chemical, bacteriological and microbiological quality.

In a total of 62 children of the 8679 inhabitants of the Nasa indigenous community in the Department of Cauca during 2015, a 95.2% prevalence of intestinal parasitism was found, mainly with a 93.5% prevalence of pathogenic parasites of *Blastocystis spp.* and *Entamoeba* (Gaviria, Soscue, Campo Polanco, Cardona Arias, & Galván-Diaz, 2017).

According to Giraldo-Ospina et al. (2015) the presence of parasitosis, which is heterogeneous worldwide, occurs mainly in the regions where poverty is accentuated, so the non-presence of it can be considered as a marker of development. The aforementioned

confirms the need for infrastructure works that allow improving the quality standards of the water that is being sent to the communities.

On the other hand, the works submitted must be continuously supervised and maintain a periodic evaluation scheme (Banco Interamericano de Desenvolmiento, 2018). In that way, the participation of the community is essential, because they can contribute to the operation of those systems related to basic sanitation and can inform about irregularities that arise and affect them directly (Shuka, 2012).

5. Conclusions

The fiscal performance index of departments in Colombia evaluates different aspects, with the percentage of investment spending being one of them. The information available in the institutional repositories does not allow clarification on the percentage of expenditure destined to works aimed at basic sanitation and particularly those destined to the improvement of water for consumption. Precisely, the water quality risk index (WQRI) is adequate for 48% of Colombia's municipalities. The WQRI of the Magdalena and Sucre Departments presented an improvement, leaving them at medium and low risk, respectively, that may be reflect the sanitation works developed in these departments. However, there is no report of works for departments such as Chocó and Nariño, and in the case of the last one, it has maintained a high risk of WQRI in the period from 2015 to 2018. As it is observed, infrastructure works are required to favor the improvement of basic sanitation conditions and achieve a change in the quality of life and in the development of the departments of Colombia.

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