

**Social and Economic deconstruction
of the El Niño phenomenon in
Lambayeque: a case study in Perú**

Enrique Ríos-Serrano

Social and Economic deconstruction of the El Niño phenomenon in Lambayeque: a case study in Perú

Periodicity and impact of business cycles, an analysis of
prevention and damage to the production and
infrastructure of 1972-1973, 1997-1998 and 2017.

Daniel Enrique Ríos-Serrano

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Preface

This case study was based in analysis and projection approach contained in the *Social and Economic deconstruction of the El Niño phenomenon in Lambayeque: a case study in Perú* is integral to understand the periodicity and impact of business cycles during El Niño phenomenon of 1972-1973, 1997-1998 and 2017.

The survey of statistics was considering across several time-series in the research made with official data of the Central Reserve Bank of Perú (BCRP), National Emergency Operation Center, Ministry of Education (MINEDU), National Institute of Civil Defense (INDECI), National Meteorology and Hydrology Service of Peru (SENHAMI), Development Bank Of Latin America (CAF), Ministry of Economy and Finance (MEF), National Institute of Statistics and informatics (INEI) and Ministry of Housing, Construction and Sanitation.

The analysis in this paper was carried out by a database study, coordination with government authorities in the Lambayeque region as well as in Lima. The approaches, in addition to a quantitative analysis, use the interdisciplinarity of historiography to order the events in a timeline from 1982-83, 1997-98 and the Niño Costero during summer of 2017.

Moreover, the complementary bibliography is based on Paul Cashin, Claude Collin, David Cook, Ignacio Alva-Meneses, Walter Alva, Gerrit Backus, Jean Bruhnes, Santiago Uceda, Luis Jaime Castillo, Giancarlo Chang, Tom Dillenhay, Jack Rossen, Carlos Elera, Ysaac Galán, Cesar Gálvez, Alejandro Garland, Lorenzo Huertas, Luis Jácome, Pablo Macera, Jorge Basadre, Eddy Montoya, Michael Moseley, Eric Mendoza, Arturo Rocha, Carlos Vergara, Julio Osoreo, Guido Pennano, Izumi Shimada, Ken Takashi, Joanna Kámiche, Elsa Galarza, Miguel Díaz, Pedro Alva, David Ayasta, Enrique Brüning, Antonio Brack.

The analysis has benefited from comments and suggestions by staff members from the Pontifical Catholic University of Peru (PUCP) Department of Economics, as well as by Professor Carlos Contreras following his discussion of the report on December 12, 2018. However, both analyses about the impact of business cycles and the developed concept of periodicity are consideration of my own property.

Finally, thank you to all who have listened to me talk about nothing else other than writing this paper and gave me support during this phase of my life, but most importantly during the whole process.

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Abstract

Peru is a phenomenological country, because of the multiple natural phenomena that affect it, one of the most outstanding is El Niño. This is a worldwide phenomenon that appears every so often, that without being periodic is cyclical and has generated and continues to generate an enormous impact in the social, political and economic sphere from pre-Hispanic times to the present. One of the regions that most affects El Niño in Peru is the north coast and within it highlights Lambayeque, a region recognized as a commercial heartland in the north of the country, due to its geostrategic position that facilitates trade with the northern highlands, the north-western jungle and other regions such as Piura and La Libertad. Analysing the historical records of the city, it was possible to identify the negative impact on the regional economic development of Lambayeque during the El Niño events of the years: 1982-83 and 1997-98 and 2017. Additionally, due to the existence of an early forecast, prevention works were carried out, economic and monetary policies that partially mitigated the negative effects of the El Niño Phenomenon. Likewise, recently in 2017 El Niño damaged 146 bridges throughout the country for a value of S / . 194 million. Therefore, the study of the relationship between the impact of the El Niño Phenomenon and the regional economic development of Lambayeque cannot be understood without an analysis of the historical damage record and the El Niño prevention plans in Lambayeque.

Keywords

El Niño Phenomenon, Prevention, periodicity, infrastructure, economic impact, business cycles, damaged, commerce sector, human capital

Table of Contents

| | |
|--|-----------|
| ABSTRACT | 6 |
| KEYWORDS | 6 |
| INTRODUCTION | 8 |
| CHAPTER 1- BACKGROUND | 9 |
| A. IMPACT OF THE NIÑO PHENOMENON IN THE HISTORY OF LAMBAYEQUE: | 9 |
| A.1. <i>Impact on Pre-Hispanic Cultures</i> | 9 |
| A.1.1. Lithic Period: | 9 |
| A.1.2. Archaic Period: | 10 |
| A.1.3. Formative Period: | 10 |
| A.1.4. Regional Developments: | 10 |
| A.1.5. Regional States Periods: | 10 |
| B. <i>Colony impact</i> | 11 |
| C. <i>Impact on the Republican Period</i> | 12 |
| CHAPTER 2 – PRODUCTION SECTOR | 13 |
| A. AGRIBUSINESS SECTOR | 15 |
| A.1. <i>Negative Effects of FEN (during 1982-1983, 1997-1998, 2017)</i> | 16 |
| A.1.1 Negative Effects of FEN (during 1982-1983, 1997-1998, 2017) | 16 |
| A.1.2 Prevention and mitigation rules | 17 |
| A.1.2.1 Preventive measures to mitigate the impact at the Central Government level (1982-1983, 1997-1998, 2017)..... | 17 |
| A.1.2.2 Preventive measures to mitigate the impact at the Local Government level (1982-1983, 1997-1998, 2017)..... | 18 |
| CHAPTER 3- COMMERCE SECTOR..... | 19 |
| A. COMMERCIAL ACTIVITY (OUTPUTS AND INPUTS) | 20 |
| 3.A.1. <i>Negative shock in the internal commercial dynamics of Lambayeque with other regions (1982-1983, 1997-1998, 2017)</i> | 21 |
| CHAPTER 4- SERVICE SECTOR..... | 23 |
| A. TRANSPORT’S NEGATIVE EFFECTS | 23 |
| B. NEGATIVE EFFECTS RELATED TO EDUCATIONAL SERVICES | 23 |
| C. NEGATIVE EFFECTS OF ROAD INFRASTRUCTURE..... | 24 |
| FINDINGS..... | 26 |
| BIBLIOGRAPHY..... | 29 |
| APPENDIXES..... | 33 |

INTRODUCTION

First it is necessary to define the study variables. That is why we will define what is the El Niño phenomenon. This is anomalous warming of the waters of the Equatorial Pacific, this huge mass of warm waters travels from the easternmost part of Southeast Asia and comes to occupy the coasts of equatorial South America and totally altering the climatic conditions of the Peruvian coast, typically characterized by cold waters and a mild climate (Senamhi, 2014). Likewise, the present study offers evidence on the negative impact of the El Niño phenomenon on the economic development in the Lambayeque region, a province in northern Peru valuable for its geostrategic position in trade (Alva, 1985). For instance, the negative impact on the economic development of the northern region is affected in the sectors: commerce, agriculture, fisheries, and infrastructure. In order to answer the following questions: What was the effectiveness of government measures to mitigate the impacts of the El Niño phenomenon? Were government measures sufficient or insufficient?

Even regardless, the analysis of the economic impact of the El Niño phenomenon in Lambayeque turns out to be a topic of great relevance to measuring the effectiveness of government prevention measures to mitigate infrastructure and disaster damage caused by events of this magnitude such as that of any natural disaster. Therefore, it is surprising that for many years the Lambayeque region, located on the north coast of Peru, has been affected by phenomena such as El Niño periodically, from our Pre-Columbian ancestors to contemporary Peruvian society (Ayasta, 2006). Moreover, the economic development and the phenomenon of the child turn out to have a negative relationship; nevertheless, the Peruvian State has been applying public and macro-prudential policies to mitigate these damages, but how effective they are. This document shows an analysis of this affectation, resulting in many cases very harmful for Lambayeque. On the other hand, this problem is very important to address, since it not only affects economic capital in that region but also largely social capital¹ - our people, our community-. In this context, the results of the study suggest contributing to the central government and regional governments identify the large costs incurred as a result of zero or little effectiveness in their plans for prevention and mitigation of impact against the FEN and Coastal Child periodically presented in the Lambayeque region. Unquestionably, the objective of this academic work is to present the results of the aforementioned study, with the purpose of contributing to the entities involved in making the best decisions in order to prevent and mitigate the negative impact of the FEN, analyzing the evaluation of the damage of the periods: 1982-1983, 1997-1998 and 2017

¹ In this academic work, the social capital is understood such as the Peruvian population that is in a position of vulnerability.

Chapter 1- Background

“With the passing of the days, heavy rains form mudflats and water currents in the main streets of northern towns and cities.” “Chiclayanos, sugar and rice have been scarce by El Niño Phenomenon, may God help us”
(El Comercio, 1982; La Industria 1998)

A. Impact of the Niño Phenomenon in the history of Lambayeque:

The aforementioned, represents the compilation of the journalistic notes that marked the effects of the El Niño phenomenon in Lambayeque, during the periods: 1982-1983, 1997-1998. Reason why, when considering the above, the direct relationship between the FEN² and the sociocultural and commercial dynamics in the Lambayeque region is evident. In the same way, Lambayeque it is a region located in the northern part of Peru, a mostly coastal region with a smaller percentage of the Andean zone. Located at 6° 26' 0" from Latitude South and 79° 52' 0" from West Longitude. In this region, most of the year has a mild climate due to the influence of the Peruvian current or Humboldt that cool the temperature of the north coast; while the north of the Lambayeque region is influenced by the El Niño current, with warm waters that causes this area to be temperate (Brunning, 1989).

Let us now consider that the Lambayeque is a region characterized by its ichthyological richness, the use of land and water, trade and agricultural activities. Therefore, Lambayeque symbolizes an element of geostrategic stronghold on the Peruvian north coast (Alva, 1985). As a consequence, the Lambayeque region has a close economic connection and large migratory processes between the northern highlands and the northern coast (Barrenechea, 1983). Likewise, to be able to analyze the facts in depth, it is essential to base the historical economic analysis of the antecedents from the perspective of the various historical periods: Pre-Hispanic, Colonial, and Republican of the Lambayeque region as a whole. Since it has been modified to some degree, in which the socio-economic relations between its inhabitants and its geographical environment have suffered a great negative impact that will be developed in the present academic research. Furthermore, we can focus on Lambayeque's historical sequence, following the periodization of the anthropologist and archaeologist Luis Guillermo Lumbreras (1979).

A.1. Impact on Pre-Hispanic Cultures

A.1.1. Lithic Period:

Lambayeque region is located in the Pacific belt of fire where the largest number of seismic events is caused, has nothing of 'peaceful' and its atmospheric variations since ancient times have originated the El Niño Phenomenon (Galan, 2009). In this context, it has a very old human occupation almost 10,000 years before our Era with the

² FEN: Fenómeno El Niño or The Niño Phenomenon

formation of the nomadic groups of Paijan (Galvez, 2010). Similarly, according to the lithic or pre-agricultural period with a Paijanense tradition in relation to the Pre-Hispanic people in question (Galan, 2009).

A.1.2. Archaic Period:

Then, approximately 7000 years before our Era, the process of domestication of plants and animals occurs. That is, the agricultural revolution and the appearance of the first horticulturists; According to Tom Dellenhay it turns out to be the community of Nanchoc, located in the upper part of the Zaña river valley that flows into Lambayeque, one of the first places of domestication of plants during the lower Archaic Period (1999). Subsequently, the first signs of civilization arise with the establishment of the first temples. The above is evidenced by the establishment of the Ventarrón Cultural group; almost 2000 years before our Era, according to Ignacio Alva Meneses called the Superior Archaic Period (2008).

A.1.3. Formative Period:

Following the periodization line, the formative process arises whose influence is centered on the Cupisnique Culture, 1500 before our Era (Collin, 1984). Also, there are the first findings of ceramics and metallurgy in Lambayeque. Primarily, there is archaeological evidence of the influence of the El Niño phenomenon in the alteration of this culture, as Ayasta mentions (2006).

A.1.4. Regional Developments:

During the early years of the Christian Era, the Great Mochica Culture emerges, one of the most prominent cultures of the Andean world, characterized by intensive irrigation agriculture that transformed the valleys of the north coast into large arable areas. Not surprisingly, the Mochicas have been called the "victors of the desert"(Alva, 2010). In the Lambayeque region, the greatest archaeological evidence is found in the Chancay Lambayeque Valley, the sites of Huaca Rajada; specifically, the mausoleum of Sipán and the citadel of Pampagrande, which was the largest Moche City in relation to what archaeologist Luis Castillo Butters says. Thus, the influence of the FEN is very noticeable in the Mochica Culture. It should be mentioned that, according to Moseley's archaeological research (1997), one of the negative influences is found, important is the destruction of not only temples, but also the same Mochica culture. Faced with this, great human sacrifices were made, which was the response of the Mochicas to the catastrophe that should have meant the effects of the FEN, which through the enormous torrential rains leads to the realization of large amounts of human sacrifices who the Mochicas believed that the only the way to resume the natural balance of the world was to deliver the most precious thing of his being, human blood (Alva, 2007).

A.1.5. Regional States Periods:

When the Mochica culture disappeared in 700 before our era, the Lambayeque or Sicán culture emerged from 750 to 1350 after our era. According to what he mentions, Izumi Shimada, this civilization had its center in the forest of Pómc or Sanctuary of Batangrande (1995). Simultaneously, in this ceremonial sanctuary spectacular archaeological finds have been found such as: the ceremonial Tumi and the lords of Sicán. However, around 1050 after our era, Carlos Elera found archaeological evidence of a huge flood; in which a clay layer of the flood deposits was found, approximately 50 cm (2018). Which demonstrates evidence about the effects of a huge Mega Child to such an extent that this area is a huge dry carob forest was completely flooded (Brack, 1986). On the other hand, the 17 pyramids

that make up the complex were uninhabitable to such an extent that they had to leave the site and move and settle around the Purgatorio or La Raya hill (Shimade,1995) which they became their new capital. This meant an important political change, the alterations that caused as evidence of this the effects of the FEN were so great this culture that caused a political change and this shows us that they stopped representing the main character of the culture, that is to say the divinity 'Ñam 'or' Naymlap 'that was previously represented in ceramics and metallurgy and the new capital would only represent an ethical divinity, definitely abandoning the deity of Naylamp.

B. Colony impact

It should also be mentioned that the effects of the FEN during the colonial era caused strong catastrophic floods in the mid-16th century. In which, one of the most affected communities was the indigenous people who not only lost material possessions; but even, they lost their own lives. At the same time, it is relevant to mention the paradigm of how positive or negative the impact of the El Niño phenomenon was in economic, social and political terms is very ambiguous. It is for this reason that Lorenzo Huertas Vallejos mentions:

In the phenomenon it is necessary to differentiate the center and the periphery, the center refers to the area where precipitation is most intense, although 'all get wet'. For example, while the people of Lambayeque in 1578 cursed the rains, the Piurans were happy, because there the rain they needed to "quench the thirst" of their arid deserts fell; 404 years later, on the other hand, the "flood" devastated the Piura region and Lambayeque managed to improve its crops. As for its cyclicity, it does not seem to occur within homogeneous lapses (1987, p.14).

Therefore, this leads us to discuss the population decline in Lambayeque between 1570 and 1580, observable in *Table 1 (Annexes)*, during that period one of the reasons for the decline was mainly due to the FEN, which the indigenous people mention that: "since the time of the 'rains and avenues' the residents were not counted, which in 1578 caused a great collapse especially in the towns of Lambayeque, Túcume, Chiclayo and Ferreñafe" (Huertas 1987, p.22). For instance, it is worth mentioning that the FEN of 1578 modified the social economic structure in Lambayeque; because, it concentrated even more the poverty condition of many indigenous people assigned to the 'encomiendas'.³

On the other hand, during the end of 1789 and 1793 there were serious climatic changes that would cause the future *ENSO phenomenon*⁴ that may have had characteristics of a Mega Child in 1728, called the agro-economic disaster of the eighteenth century (ROCHA 2017: 4). One of the most important changes that occurred in Lambayeque's design was under the colonial administration; specifically, the change in the urban pattern. While, in the Pre-Hispanic period the urban centers were located in the *eriazas zones*⁵ and away from flood areas; nevertheless, in the colony the urban pattern changed completely. The Spaniards established the cities in the valleys next to the rivers, even occupying low areas, vulnerable to flooding. Therefore, the nature of natural phenomena in Peru, including the FEN,

³ Spanish institution that entrusts a group of indigenous people to be evangelized by a conqueror, in exchange for this the conqueror takes advantage of his workforce for his own benefit and is also charged a tribute for his services rendered.

⁴ ENSO or *Effect Child Southern Oscillation*

⁵ *Erazas areas* are the not cultivable areas (RAE).

was not taken into account. This originated, that when El Niño will be presented, the cities would be completely flooded. A clear example of that is what happened in the colonial city of Saña. In accordance with the above, the following is mentioned:

Its founders did not choose a suitable place; distant to the riverbed and at a higher height, hence he suffered the punishment of the waters since early times. It is mentioned that in 1586 a great avenue of waters [sic] enters the population, in 1616 it is shaken by an earthquake that is repeated in 1703; the heavy rains of 1720 were of such magnitude that, at dawn on March 15 of that year, the waters of the Saña River violently stormed the streets of the flourishing city of Saña, demolishing public offices, houses, damaging or demolishing the churches or convents This flood of 1720 was the one that determined the stagnation of the prosperity of the city of Saña, this is how the displacement of its population to other latitudes including Lambayeque, which the latter becomes the head of the party (Montoya, 2009, p. 62).

Hence, it is relevant to mention that Saña, as a settlement of the Peruvian North, even before the colonial period was cohabited by various indigenous communities and subsequently with the permanence and protection of colonial administrators. In that sense, Rossen and Dillehay mention that the alluvial fans referred to the various El Niño Phenomena have been occurring in this territory since pre-Columbian times (1999, p.125). Where one of the stages that ended up affecting this important city was during the colonial period.

C. Impact on the Republican Period

Similarly, in the republican period there was a continuation of colonial powers regarding the field: socioeconomic, urban patterns, lack of foresight of the FEN and living in vulnerable areas that continued and even worsened over the years. Thus, for example, various constructions were established, such as houses in the channels of old *huaticos*; as the channel of Chosica. In turn, in the Lambayeque region, one of the most prominent cities at the beginning of the Republic, which nevertheless declined and worsened due to the decline in floods (Montoya,2009). Emerging then as the head city of the region, the city of Chiclayo. That being located relatively far from the most important rivers did not suffer the floods that the city of Lambayeque would suffer. Despite the above, the city of Chiclayo was repeatedly affected by the FEN. Consider, for example: the *Mojadera* of 1925, the El Niño phenomena of 1982-1983, 1997-1998 and that of 2014-2016 with the *Niño Costero*⁶ of 2017.

Specifically, the chronicler Miguel Ángel Díaz mentions that the rains of 1925 were so intense that they exceeded the impact of the damages of 1911 and 1918; since not only affected the homes and the urban area of the city of Chiclayo. But even the transport and marketing system, such as the streets, sewers and railways that transported merchandise from Ferreñafe to the port of Pimentel ended up terribly damaged. Where it turns out, the Provincial Municipality of Chiclayo had to enable the environments belonging to the Public Benefit of Chiclayo to receive the victims (2013, p. 14).

⁶ Peru since Pre-Hispanic times has experienced the phenomenon of El Niño. The current phenomenon, known as the coastal El Niño, differs from the common El Niño because it only develops along the Peruvian and Ecuadorian coasts; unlike the common one, which affects a much larger area of the Pacific Ocean.

On the other hand, the rains of 1983 caused serious damages in terms of the watering of the streets, due to heavy rains, commercial activity is restricted throughout the department. In effect, the 1983 FEN produced “total losses amounting to 59, 078.3 million (PEN), of which 23,919 were from the agriculture sector, 19,119 hectares were lost; The infrastructure sector was compromised, not only in the urban sector: 4000 homes destroyed and affected, 400 schools destroyed, 2 hospitals inoperative; but also the road and communication network of the department that was destroyed by 65% including: bridges and highways, leaving 30 dead and 100,000 victims”(Mendoza, 1985, p. 229).

Something similar happened with the FEN from 1997-1998; because it produced considerable losses in the sectors: infrastructure, production, road transport network. “Only in the department of Lambayeque the losses of 97-98 amounted to US \$ 87 389 725, while the damages of 1983 were valued at US \$ 36244 356” (Unalm, 2007). As already mentioned at the beginning of the introduction, little or nothing was done to prevent or mitigate those impacts that in the background were economically negative for the Lambayeque region, in terms of infrastructure, production and road network. The above is worrisome because at the level of central and local government, measures from both the economic and social levels failed to change the desolation landscape that many lambayecanos and lambayecanas suffered for the years 1997-1998. Therefore, during the first semester the FEN determined:

A substantial fall in the activity of the fishing sector and, to a lesser extent, the agricultural sector, as well as considerable damage to the country's infrastructure. This led to a stagnation of productive activity, the deterioration of the current account deficit and a temporary acceleration of inflation in that period. Therefore, in the first semester the gross domestic product decreased 0.3 percent with respect to the same period of 1997. The current account deficit was 7.6 percent of GDP and inflation accumulated in June reached a rate of 5.3 percent (BCRP, 1998, p. 9).

Chapter 2 – Production Sector

Economic geography deals with the productive activities carried out by men such as the use of the labor force to create wealth (Brunhes, 1964). That said, Lambayeque in particular was founded on “a semi-colonial social economic model that is to say of apparent political independence and real attachment to the great transnational capitals” (Montoya, 2009, p. 38). Moreover, it should also be mentioned that economists Paul Cashin and Kamiar Mohhades analyze natural phenomena or changes in weather patterns and specifically the FEN or ENSO; since, they have “very significant effects on agriculture, fisheries and construction industries, as well as on national and global commodity prices” (2015, p. 8). As a result, by mentioning the significant effects that positive or negative impacts may have on an economy, they serve as a link to introduce the concept of business cycles ⁷.

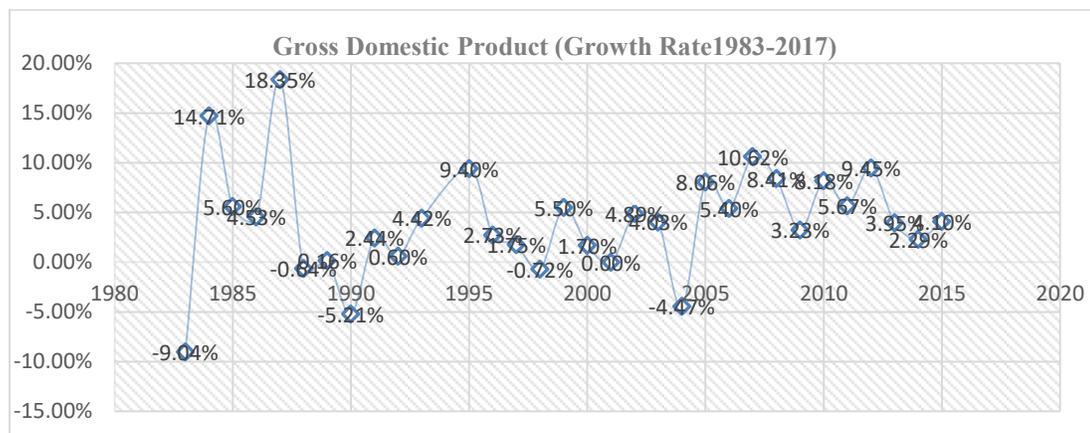
⁷ Business cycles o *ciclos económicos* are phenomena which correspond to reiterated oscillations in the growth rates of production, employment and other macro - economic variables, in the short term and over a certain period of time, generally several years. Economic cycles have a number of common features that tend to repeat but have very variable amplitudes and periods.

The Economic history of this region has been affected by the various FENs that have been repeated periodically, directly affecting the economy of the northern region. A clear example of the above is the chronicle of what happened in Zaña during the colonial administration: “He suffered continuous looting of the English pirates in 1686 and then, there was a great flood in 1720 that led to wealthy families moving to Lambayeque”(BCRP, 2008, p.20). However, the Lambayeque region according to the social economic report of the BCRP projections mentions that,

Lambayeque has a strategic location as an area of confluence of economic agents that come from the coast, mountains and jungle; making Chiclayo, the city with the highest commercial influx of Peru (trade as a percentage of the added value of the region has a weight of 25.4 percent, followed by Ucayali with 18.3 percent and Lima with 16.5 percent). The commercial tradition of this region dates back to Pre-Hispanic times⁸ (2008, p. 98).

To sum up, the main development activities in the production of the Lambayeque region are fishing, agricultural, agricultural export and public investment activities. Which are fundamental pillars for the full economic development of the northern region. In that sense, it is necessary to analyze the GDP from 1983 to 2017 in order to analyze in more detail the impact of the various El Niño Phenomena.

Table No. 01



Source: BCRP Serie of GDP // Lambayeque Region

Moreover, when analyzing the regional GDP of Lambayeque from 1980 to 2017, and economic fluctuations with negative propensity can be observed during the periods 1982-1983 (-9.04%), 1997-1998 (-0.72%) and 2014 (-1.66 %) according to official sources of the BCRP. What results in the short and long term very harmful for the economic growth of the Lambayeque macro-region. Since, it affects too much the correct socio-economic development of its main agro-export actors and mainly, the northern consumers that are terribly affected by the shortage and various

⁸ According to researcher Carlos Elera, there have been vestiges that the mochices traded not only with people around their geographical area, but also with other prehispanic villages of Equateur and Colombia.

variations in the CPI and the inflation caused by the FEN in certain essential products, such as: rice, sugarcane and other agro-export products. The above can also be understood as a negative shock in the growth rates of Lambayeque's GDP during the periods in which the various El Niño Phenomenon occurs, and the most recent in 2017, the *Niño Costero*.

A. Agribusiness Sector

Historically, Pablo Macera mentions that “on the Peruvian coast, pre-Hispanic farmers came to channel about 40 rivers, a very high amount compared to the ancient irrigation systems of Egypt and Mesopotamia; This is how in Lambayeque, through the training of man in the use of arable land, it is very old, since the pre-Hispanic cultures of that region created and managed a complex and interconnected irrigation system ”(1983). As a result, it should be mentioned that the Lambayeque region is characterized by the efficient use of its comparative advantages of the development of its own agriculture, given the uniform climate that gives it the possibility of cultivating throughout the year; as well as the capacity of a regulated irrigation (Berp, 2008, p.70). Similarly, the crops that characterize the Lambayeque region are sugarcane, lemon, rice, mango and yellow sweet corn. In this sense, due to the low rainfall, the irrigated land is the only one used, which generates a dependence on agriculture in relation to the volume of water in the rivers (Montoya, 2009). Precisely, any natural change is called FEN or Coastal Child terribly affects the full development of not only commercial activities, but also of agriculture in the northern region.

Table No. 02

Total annual mass of Lambayeque rivers 1975-1983 (in billions of m³)

| YEARS | CHANCAY | ZAÑA | LA LECHE | MOTUPE | TOTAL |
|--------------|---------|------|----------|--------|-------|
| 1975 | 1745 | 337 | 362 | 59 | 2503 |
| 1976 | 898 | 211 | 221 | 48 | 1377 |
| 1977 | 1034 | 224 | 225 | 32 | 1515 |
| 1978 | 575 | 134 | 105 | 39 | 858 |
| 1979 | 779 | 147 | 91 | 34 | 1051 |
| 1980 | 546 | 79 | 103 | 20 | 748 |
| 1981 | 884 | 162 | 141 | 29 | 1216 |
| 1982 | 947 | 136 | 73 | 19 | 1135 |
| 1983 | 1444 | 665 | 472 | 502 | 3083 |
| TOTAL | 1066 | 257 | 225 | 79 | 1625 |

Source: INEI Statistical Yearbook of Lambayeque

As can be seen, on an annual average in the 9 years considered, of 1745 million m³, the water mass of the rivers decreased by up to 31.2% in the mid-1980s. The harvest and planting of various agricultural products, and in special transients⁹ were directly influenced by the FEN of 1982 and 1983. The above is closely related to the amount of water contained in the Tinajones reservoir¹⁰. It is worth mentioning that there is a substantial decrease in the total annual mass of the rivers with respect to the *La Leche* and *Motupe* river during 1982. However, by increasing the impact of the 1982-1983 FEN, an increase of more than 1000% can be seen in terms of the total annual mass of the *La Leche* and *Motupe* rivers during 1983. Therefore, the Tinajones reserve reached its maximum capacity in years, approximately 313 million m³ (Mendoza, 1985, p.226).

A.1. Negative Effects of FEN (during 1982-1983, 1997-1998, 2017)

A.1.1 Negative Effects of FEN (during 1982-1983, 1997-1998, 2017)

We will now address the negative effects of the FEN during the most disruptive periods that are the following 1982-1983, 1997-1998, 2017 (BCRP, 2017a). In contrast, while President Fernando Belaunde Terry took the reins of the country in the 1980s, construction of the Carhuaquero hydroelectric plant begins¹¹. Nevertheless by 1983 heavy rains begin to scourge the department of Lambayeque, with an immense plague of insects that were affecting the entire population periodically, about 40,000 hectares of rice were lost. As a result, in view of the above, the government of President Belaunde applied mitigation measures of the terrible negative impact of the 1983 FEN for Lambayeque. Therefore, the National Reconstruction Law (BCRP, 1983) is enacted. A. Macroeconomic level, as mentioned by the official figures of the Central Reserve Bank, the national production of 1983 contracted by 11.8% compared to that of 1982. Likewise, agricultural activity was seriously affected by the floods of the FEN and the droughts. All of the above resulted in the contraction of 8% in the production of 1983, one of the affected departments being Lambayeque (1983: 8). On the other hand, during the second government of President Fujimori there were the various FENs of 1997 and 1998, which seriously affected the north Peruvian coast and especially the Lambayeque region. Since, “the production of the fishing sector decreased 35.6 percent, reflecting the lower extraction of species determined to fishmeal and fish oil (-50 %), as well as the species destined to produce products direct human consumption (-16 %), which was largely due to lower anchovy landings ”(BCRP, 1998, p. 27).

⁹ They are crops of agricultural products characterized by a vegetative or growth cycle generally smaller than one year, even to a few months. These crops are intended for human consumption and/or animal feed or for industrial raw materials or other uses.

¹⁰ Located in Chongoyape district, 55 km from Chiclayo, the reservoir is the largest infrastructure built in the Tinajon system. It uses water resources of the Chancay river watershed basins to store the quantities of surplus and Derivable water that it captures in summer, which is used in the irrigation areas during the winter.

¹¹ Located in the northern Sierra del estuca, in the flame district, the province of Chota, Cajamarca department, 377 meters above sea level. It was started to build Electro Perú in 1980, but, for lack of funding, only in 1991 was able to enter operation, with an installed power of 75 Mega watts (mw), generated by three vertical axis Pelton Pelton turbines each, driven by the waters of the Chancay river.

Further, during the period 2015 to 2017 and the arrival of the Niño Costero phenomenon that in the short term strongly affected the yields and production expectations regarding the sowing of sugar cane and that the “price of sugar increased 19% what was related to supply problems. National sugarcane production declined 10% This was influenced by the increase in temperature that reduced the formation of sucrose from sugarcane, to which was added the work stoppage of some companies located in Lambayeque” (BCRP, 2015, p. 99).

Table No. 03

LAMBAYEQUE: Fisheries Sector 1/
(In tonnes)

| | November | | | January - November | | |
|---------------------------------|----------|------|-------------|--------------------|------|-------------|
| | 2016 | 2017 | Var. % 1/ | 2016 | 2017 | Var. % 1/ |
| Direct Human Consumption | | | | | | |
| <i>Capacity</i> | 281 | 351 | | 19978 | 9067 | |
| TOTAL | | | 42.1 | | | 40.3 |

1/ Variation in real terms at 2007 prices

Source: *Gerencia Regional* Office of Production – Lambayeque

It should be mentioned that, the fishing sector was severely affected; Since in accordance with Table N° 03 presented, it is shown that fishing activity decreased considerably by 40.3% during the period January to November 2017, with a smaller number of fish such as mackerel and bonito (BCRP 2017 b). As well as analyzing the table shown in Annex N° 04, it can be seen that the Coastal Child of 2017 affects the Lambayeque region in about 3964 hectares of lost crop and approximately 2492 hectares of lost crop, including the most affected province of Lambayeque with 1821.34 hectares affected and the province of Chiclayo with 1346.5 hectares (Sinpad, 2017).

A.1.2 Prevention and mitigation rules

Now, it is necessary to know what preventive measures the government implemented to mitigate the negative impact of the various FEN. This has been the case of the measures being applied from regional or local governments and central government. In that regard, the government employed prevention measures managed by the INDECI, which are designed to design and adopt preventive measures in response to a possible emergency and thereby promote a culture of prevention (Coen, 2017)

A.1.2.1 Preventive measures to mitigate the impact at the Central Government level (1982-1983, 1997-1998, 2017).

Continuing, the government not only applied political and humanitarian aid measures to mitigate the terrible impacts of the FEN during the years: 1982-1983, 1997-1998 7 2017; It also applied economic measures.As a consequence,

from the Central government through the BCRP, various macroprudential policies¹² were applied. In a broader perspective, “those that use prudential instruments to prevent the accumulation of systemic risks, thus limiting their impact on the real economy through possible interruptions in the provision of financial services” (Jácome, 2013, p. 95).

Otherwise, for example, Law No. 23509, promulgated on December 11, 1983, in which it is “authorized by article 22, to consolidate in the BCRP the portion of the debt contracted by the public treasury until December 31, 1981, with the Bank of the Nation and financed with resources of the BCRP and, in article 24, also [sic], the consolidation of the debt that the local governments have pending with the Bank of the Nation ”(BCRP, 1983, p.177). Because, these debts were contracted by local governments to manage prevention works on the north coast in order to mitigate the impact of the 1983 FEN, such as the construction of dikes and dams in the La Leche and Jequetepeque rivers in the region from Lambayeque.

A.1.2.2 Preventive measures to mitigate the impact at the Local Government level (1982-1983, 1997-1998, 2017).

Hence, from the Regional Government of Lambayeque and in conjunction with institutions such as MINAG¹³ and INADE¹⁴. Those institutions carried out prevention projects during the years 1997-1998 at the level of basins and dikes, riverbeds with the aim of protecting the population through infrastructure works. As, for example, the “River diversions such as Motupe and La Leche to the Morrope desert through a canal, to protect cities such as Jayanca, Pacora, Illimo, and 17 additional centers, plus agricultural areas” (CAF, 2000, p. 45).

Fortunately, during 2017 with the arrival of the Niño Costero Phenomenon the impact level was similar, it should be noted that the affected areas not only compromise the urban area of the metropolis city of Lambayeque that is Chiclayo. But, in addition, it seriously compromises the surrounding districts, which to a large extent as an essential economic activity are engaged in livestock and agriculture. Therefore, when analyzing the table shown in Annex N° 05, the area of lost crops is more than 2000 hectares, as well as the affected crop area borders 4000 hectares (COEN, 2017). Specifically, including the affectation of the water supply used in the area for sowing irrigation. Besides, the Regional Government of Lambayeque and the Provincial Municipality of Chiclayo managed the

“coordination between the Housing, Construction and Sanitation Ministries; Transportation and Communications; in conjunction with personnel from the Regional Agriculture Office of the Regional Government, INDECI and the *Reconstrucción con Cambios* Office in order to allocate heavy machinery to support the work of agrarian reconstruction of the affected areas. In compliance with

¹² The term *macro-prudential regulation* is characterized by the focus on financial regulation aimed at mitigating the risk of the financial system. After the financial crisis, as the end of the 2000s, there was a growing consensus among policy makers and economic researchers about the need to reorient the regulatory framework towards a prudential macro perspective.

¹³ MINAG or **Peru Department of Agriculture** (*Ministry of Agriculture o Peru*)

¹⁴ INADE or *National Development Institute*

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Supreme Decree No. 007-2017, 457.5 tons of fertilizers were delivered to the Regional Agriculture Office in Lambayeque to be delivered to the affected agricultural producers” (COEN, 2017, p.13).

Surprisingly, so far it is necessary to mention that government mitigation plans are effective to the extent that there is a supervisory Department that fiscal the development, coordination, and resolution of projects. On the other hand, with the course of the various FEN it has not been possible to establish a true preventive culture in the Lambayeque region. That is why, during each period of FEN that plagues Lambayeque, there is still a strong negative impact on the region, regarding the few prevention policies implemented by local government authorities when managing the prevention budget in case of natural disasters.

Chapter 3- Commerce Sector

Although, the predominant economic activity of the Lambayeque region is agriculture since pre-Hispanic times (BRUNING, 1989). In turn, this city is known as the Phoenician city, in allusion to the best merchants of antiquity, which nowadays trade, and transport represent the most important activities of economic dynamics in the city of Chiclayo (PENNANO, 1979). For instance, the great sugar and rice plantations were consolidated at the beginning of the 20th century with the emergence of capitalism; more specifically with the establishment of agricultural companies and railways¹⁵ that encouraged trade not only with the national market, but also with the international one (ORELLANA, SÁENZ, Et. to 1977). Therefore, the railway development promoted by the period of the aristocratic republic served as an impetus for the development of not only the Lambayeque region but the entire Peruvian north coast (BASADRE, 1968). Traditionally, the following chronicle attests to the above: “starts the line from a port located on the beaches of the Pacific, and after traveling a few kilometers through the center of cotton sown fields and crossing sugar cane farms, take some from the narrow gorges, open at the foot of the mountain range, by the erosion of the waters of some stormy river when heading towards the ocean” (GARLAND, 1906, p. 24).

It should also be recognized that the railroads boosted the existing commercial circuit of the Lambayeque region with economies such as those in England and Chile, by exporting its main crops: sugar and cotton (GOMEZ and BAZÁN, 1989). Provided that of course the establishment of a commercial circuit and a structuring of the economic space. Therefore, the formation of railway companies developed the secondary sector of the Lambayeque region; since, factories were installed near the farms and surrounding plantations (BACKUS, 1967, p.134). Consequence, the mercantile circuit continued to develop thanks to the transit of the peasant people towards the commercial city in which merchandise intermediates. However, the continuity of the mercantile circuit and the production volumes of the Lambayeque region were severely affected by the recurrent presence of various natural phenomena on the Peruvian north coast, such as the newspaper El Niño phenomenon.

¹⁵ The remarkable effects of the presence of the railways are related to their modernizing character.

As mentioned earlier, during the expansion of the mercantile circuit¹⁶ in Chiclayo at the beginning of the 20th century, the character of an urban shopping center was preserved. In that sense, agribusiness and commerce promoted the development of the local economy of Lambayeque.

Table No. 04

Rice production volume, Lambayeque and Zaña valleys, across 1900-1901 and 1927-1928

| YEAR | LAMBAYEQUE | ZAÑA | SUM |
|---------------|------------|---------|----------|
| 1900-1901 (1) | 11,772.0 | 4,140.0 | 17,912.0 |
| 1915-1916 (2) | 11,219.6 | 4,420.0 | 15,639.6 |
| 1922-1923 (3) | 21,505.0 | 3,911.0 | 25,416.0 |
| 1925-1926 (4) | 5,864.0 | 1,449.0 | 7,313.0 |
| 1927-1928 (5) | 21,750.0 | 3,726.0 | 25,476.0 |

Source:

- (1) Estimates of the private water judge in its administrative report corresponding to 1902 (OSORES 1902).
- (2) Statistics of the rice industry in Peru, agricultural year 1915-1916, Ministry of Development or Department of Promotion of Peru
- (3) , (4) y (5) Statistical Excerpt from Peru, years 1924 to 1929-1930.

Clearly, a progressive increase in Lambayeque with respect to the volume of rice production until 1923, almost double its productive capacity, can be observed in Table No. 02. Apparently, during the 1925 period, there is a bias that is represented in more than half in losses of rice production volume, due to the 1925 FEN that had a negative impact on local Lambayeque agriculture.

A. Commercial activity (outputs and inputs)

By the other hand, when overcoming the ravages of nature, as in the beginning were the droughts, later the heavy rains of the El Niño Phenomena in its various historical periods, with the destruction of its infrastructure, dynamism will be affected economically in the region of Lambayeque (ORELLANA, SÁENZ, Et. to 1977). Because, the Lambayeque region is based on its strong economic movement and to some extent is one of the country's largest contributors to the national treasury (ODAR, 1985, p. 259). That is why commercial activity is currently related to approximately 70 branches of goods and services. Highlighting thus, the update of its products as department stores, jewellery, watches, fabrics, clothing; and the creation of new jobs indirectly. According to database figures for an EAR rate¹⁷ of 220,000 people are estimated at 35,000 who are engaged in purely commercial activity (INEI, 2017). Since, sales can be close to 400,000 million soles for goods and 2,900 million soles for services. In that sense, the

¹⁶ According to historiographic studies, the mercantile circuit of the north dates from the establishment of pre-Hispanic civilizations such as the Mochica and Sicán culture.

¹⁷ Workforce or labour force is the labour pool in employment. It is generally used to describe those working for a single company or industry, but can also apply to a geographic region like a city, state, or country. The **labour force participation rate, LFPR** (or **economic activity rate, EAR**), is the ratio between the labour force and the overall size of their cohort (national population of the same age range).

contribution of the Lambayeque region to the national treasury can be estimated at about 4,500 million soles per year. However, trade in the city of Chiclayo has been particularly relevant, which has influenced factors such as the development of sugar production and population growth (Montoya, 2009)

3.A.1. Negative shock in the internal commercial dynamics of Lambayeque with other regions (1982-1983, 1997-1998, 2017).

It should be mentioned that the commercial dynamics of Lambayeque is based on agriculture; since, it represents almost a tenth of the regional GDP (BCRP, 2008). Therefore, its production mainly consists of various crops of rice, sugar cane and cotton.

Table No. 05

RELATIVE PARTICIPTION OF LAMBAYEQUE IN NATIONAL AGRICULTURE PRODUCTION: 2007 (Thousands of MT)

| Crops | Lambayeque | Perú | %Lambayeque/Perú |
|--|----------------|-------------------|------------------|
| Sugarcane | 2 120 | 8 228 | 25.8% |
| Lemon | 57 | 269 | 21.1% |
| Rice | 359 | 2 456 | 14.6% |
| Cotton | 30 | 213 | 13.9% |
| Mango | 14 | 293 | 4.7% |
| Maize | 5 | 117 | 0.4% |
| Gross Production Value (Thousands of S/.) | 478 630 | 10 571 963 | 4.5% |

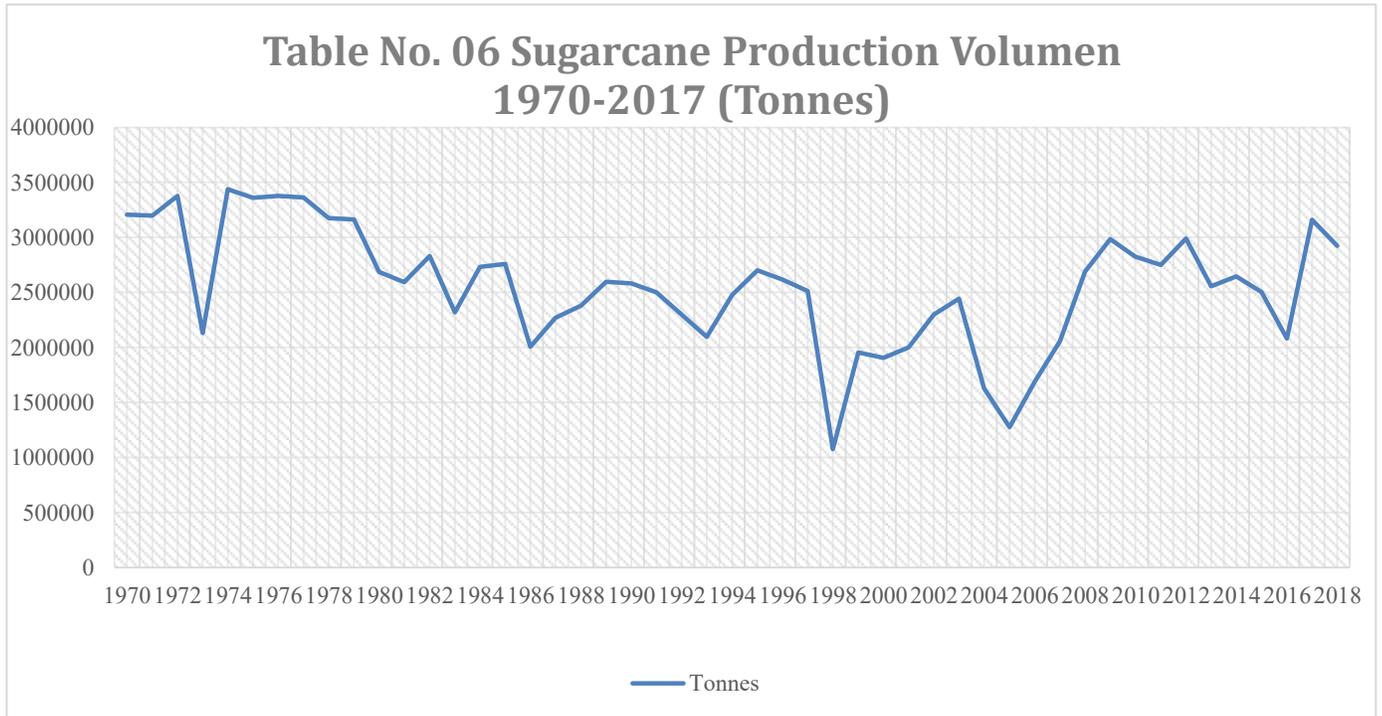
Source: Peru Department of Agriculture or *Ministry of Agriculture of Peru*

Analyzing Table N° 03, the gross production value can be observed in thousands of Lambayeque soles, representing almost half of the participation in the national agricultural production during the period of 2007. Under that premise, is that from the government the initiative arises to conclude the *Olmos Project*¹⁸ that was proposed by the first government of President Belaunde, to encourage agricultural production within the country. In that sense, it seeks to expand the irrigation project of not only Olmos, but also Tinajones, Zaña and Jequetepeque (BCRP, 2008, p.72).

Originally, analyzing the historical records of the Lambayeque region, it was possible to analyze a negative impact on the regional economic development after each cycle of the El Niño phenomenon, mainly during the periods: 1982-83 and 1997-98 and recently that of 2017, listed as Coastal Child (BCRP, 2017; Grippa, 2015). Additionally, the FEN events mentioned are considered the most intense events recently occurred in the country (Takashi, 2017, p. 5).

¹⁸ Approach to irrigate the pampas of Olmos raised by the explorer Manuel Mesones-Muro and the engineer Charles Sutton during 1924 and 1929, through the commission of Irrigation Piura-Lambayeque; during the government of President Leguía.

Although both phenomena are considered of severe magnitude, the impact of the FEN 1997-98 was minor, since there was no drought in the south of the country, which reduced only agricultural losses in Lambayeque (BCRP, 2017; BCRP, 2018). For instance, it was considered to analyze the evolutionary graph of one of the main raw materials of the region, such as the production of sugarcane from the period of 1970 to 2017, so that the FEN of the



years: 1982-83 and 1997-98 and 2017.

Source: Peru Department of Agriculture or Ministry of Agriculture of Peru

Therefore, analyzing the above, during the periods of 1982-1983 there is a fall of about 350,000 tons in production compared to last years; the most severe during the period 1997-1998 of about 1,300,000 tons in losses, and 2017 in 400,000 tons in losses. According to official sources of the Peru’s Department of Agriculture and Irrigation. From where, it can be inferred that there was a negative shock in the commercial dynamics of sugarcane production during the periods of 1997 and 1998.

The foregoing is reflected in the reduction of the capital stock¹⁹ in the region and especially the profits of agribusiness companies such as: Batangrande, Tután and Pucalá in the Lambayeque region (Montoya, 2009). In accordance with Annex N° 05, for the year 1998 the agribusiness company had debts that exceed 50 million soles, due to the low production they had due to the effects of the FEN of 1997-1998. Similarly, an environment with

¹⁹ The capital stock is a set of durable goods used in production. The gross capital stock is calculated to measure the contribution of fixed assets in production; while the net capital stock is used to measure the wealth of the owners of the means of production.

considerable losses in the commercial fishing sector during the 2017 Niño Costero in the northern region could be seen.

The negative impact of trade is linked to the collapsed road infrastructure, since trade represents 11% of the Lambayeque Regional GDP (BCRP, 2017 d). That is why, it is reflected in the recession in trade and a consequent speculation and hoarding given by the increase in prices of essential products.

Chapter 4- Service Sector

Activities that provide the services inevitably improve personal situations, social relationships and even existing assets (Montoya, 1980). Therefore, the improvement of services in the Lambayeque region can be appreciated by its contribution to the local GDP; due to its increase from 25.4% in 1970 to 38% in 1994 (OREI, 1997). It is for them that the services sector has been grouped into the following branches: road infrastructure, transportation and educational services. As already mentioned throughout the development of the previous chapters, the negative relationship between the FEN and the development of the Lambayeque region, linked to the social, economic, commercial and even the services sector itself, is evident. Therefore, in the following we will develop the negative effects of the FEN in relation to its relationship with the mentioned branches.

A. Transport's Negative Effects

There is a close relationship regarding the socioeconomic development of Lambayeque and the means of transport, from our pre-Hispanic ancestors with the commercial network built by the Mochicas and their sister towns in northern Ecuador (Alva, 2007). Accordingly, the sea turns out to be the means of transport and communication with more antiquity, since the incursion of the small totora rafts. As later during the colony the use of sails and more recently, in the Republic the modernization and asphalt of the roads for the use of automobiles and the development of aviation.

In view of this, one of the first roads to be built was during 1920 with the construction of the Chiclayo-Pimentel road, executed by the Lambayeque and Piura Irrigation Commission (Montoya, 2009). The above can be seen in Annex N° 05, on the Lambayeque road network (1975-2004); since it is clear the evolution in the construction of transport roads from trails to roads, in an approximate of more than 1500 km of paved roads or in process. However, analyzing the damage estimate table presented in Annex N° 05, during the last Niño Costero phenomenon of 2017, the Lambayeque region was affected in: 98.36 km of roads destroyed, 122.34 km of roads affected and even nearby of 61 destroyed bridges and 85 bridges in affected condition. In which, the province most affected with de Ferreñafe with almost 80% of the total roads affected to its constituency (SINPAD, 2017, p. 4).

B. Negative effects related to Educational Services

It is worth mentioning that educational services are fundamental as institutions that provide services in a community, be they colleges, institutes or universities. However, analyzing the historical record of Lambayeque, no record of prevention plans could be found during the years 1982-1983, and 1997-1996. Therefore, it is clear that almost 20 years after the 1982-1983 FEN, it is only with the creation of INDECI that prevention plans are proposed in the

various ministerial portfolios, such as that of the MINEDU. In view of the above, MINEDU²⁰ proposes a methodological guide for the participatory elaboration of the Disaster Risk Management Plan in schools of Elementary and High School in our country.

Which is based on the following axes: the development of a risk map, prevention actions, contingency plan design and response protocols for I. E²¹ ante el fenómeno El Niño. In addition, the approaches proposed by the *Autoridad para la Reconstrucción con Cambios* are just having concrete results. Because, after almost a year of the catastrophe caused by the Niño Costero phenomenon of 2017, PRONIED's²² work has just been visible With technical assistance to the regional government of Lambayeque, for projects covering 218 schools and affecting 39,059 students (MINEDU, 2018).

Likewise, PREVAED²³ is formed through joint work between COEN and INDECI, those institutions were in charge of the various meetings scheduled with the authorities of the Regional Office of Education of Lambayeque, Chiclayo and Ferreñafe to carry out the damage assessment and the disposal of heavy machinery for the drainage of said institutions, collapsed by torrential rains during the last Niño Costero of 2017 (COEN,. 2017, p. 19). By the other hand, analyzing Annex N° 06 we can see that in the entire Lambayeque region 26 schools were affected as uninhabitable conditions, in which the largest number of affected institutions were in the districts of Pacora, Cañaris, Pítipo and Mochumí (SINPAD, 2017); These districts represent the agricultural zone in the region, who are in a condition of extreme vulnerability of poverty during this type of phenomenon.

C. Negative Effects of Road Infrastructure

Therefore, during the FEN of 1982- 1983, infrastructure damage was estimated almost \$456 million, equivalent to 2.5 percent of Peruvian GDP, the most affected sectors was transport, communications and hydrocarbons. During the time, 2 600 kilometers of roads were damaged, 47 bridges and 4 airports at national level" (BCRP, 2014, p. 50). Further, Lambayeque, one of the bridges that the greatest damage received was the one that interconnects the city of Chiclayo and the city of Reque.

Table No. 07 // Infrastructure affected (1997-1998)

| | Quantity | | Valuation |
|---------------|------------|-------------|-------------------|
| | Units | Km | (Millions of S/.) |
| Total | 228 | 6578 | 1266 |
| 1. Bridges 1/ | 146 | - | 194 |
| 2. Roads 1/ | - | 6395 | 850 |

²⁰ MINEDU or Ministry of Education (Peru Department of Education)

²¹ I.E o Instituciones Educativas or Schools

²² PRONIED o Programa Nacional de Infraestructura Educativa

²³ PREVAED: *Programa de reducción de la vulnerabilidad y Atención de Emergencias por Desastres*, Vulnerability reduction and Disaster Emergency Assistance Program.

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| | | | |
|-------------------|----|-------------|-------------|
| Cold Asphalt | | 441 | 161 |
| Hot Asphalt | | 622 | 385 |
| Surface Treatment | | 26 | 7 |
| Affirmed | | 4683 | 281 |
| Not Affirmed | | 623 | 16 |
| Railways | 57 | 183 | 212 |
| Airports | 7 | - | 10 |
| Communications | 18 | - | 0 |
| | | 42.1 | 40.3 |

Source: **BCRP** (Inflation Report 2014)

To sum up, during the 1997-1998 FEN it was estimated that “the transport, communications, housing and construction sector was the most affected, with an amount of S/. 1,266 million” (BCRP, 2014, p. 51). As also, “erosion and blockages on the roads; Chiclayo-Puente Chumbil, Pomalca-Sipán, Chiclayo-Ferreñafe, the collapse of the Reque and Virú bridge in CP; the fall of slopes, blockages and erosion of the Chongoyape-Llamas-Santa Cruz highway platform, via Chiclayo” (CAF, 2000, p. 63). However, during the 2017 FEN and the existence of an early forecast, prevention works were carried out that partially mitigated the negative effects of the FEN. Thus, the “FEN of 2017 damaged 146 bridges across the country for a value of S/. 194 million” (BCRP, 2017). Unfortunately, prevention mechanisms were not the most suitable; given that, in terms of recovery, the damages reached the highest levels in the department of Lambayeque with S/. 291 million in losses (BCRP 2017).

In this context of routine disasters, the government, from its central authority, promoted in 2002 the signing of the Agreement between the “United Nations Development Program - UNDP and INDECI - National Institute of Civil Defense, to establish the application of programs for Disaster Prevention and Reduction where the Sustainable Cities project is considered” (INDECI, 2003, p. 15). Typically, the study of Danger Maps for each city and mitigation measures for each city is promoted from provincial and local governments. In which the possible exposure to the danger of its infrastructure in terms of drainage, irrigation, water resources, and urban area remains evident²⁴ from the core city of the region, Chiclayo. Also, during 2017 the sections of channels, infrastructure works and villages that required protection were identified, observing the vulnerability of certain basins. Therefore, the Regional Government of Lambayeque “managed the cleaning and channeling of rivers and streams; construction of dikes and protective walls, drainage of valleys, river diversions such as the Motupe river, La Leche; to protect the cities of Jayanca, Pacora and Illimo”(COEN, 2017).

²⁴ Urban space, also called urban center, urban center, urban center. For geography, the urban center is based on its high population density and the services provided by the core city, such as water and sewage, transportation network, hospitals and schools; in conclusion, infrastructure.

Apart from that, MTC²⁵ long after the Niño Costero phenomenon of 2017, through the Provías Decentralized executing unit, it installed several modular bridges, such as Laquipampa in the Lambayeque region. In that sense, the investment amount is US \$ 295,354.41 and was part of the Reconstruction process initiated by the Government because of the Niño Costero of 2017 (MTC, 2018).

Findings

Finally, El Niño Phenomenon turns out to be a climatic event that has been presented periodically throughout our Peruvian coast since pre-Hispanic times and has affected various civilizations in terms of their relationship with the worldview and their socio-economic, political and cultural relations (ALBA: 1985). According to various studies and data, it has been shown that the FEN can become very severe, from events such as the Mega Niño (ROCHA 2017: 4) to the successive FEN and Niño Costero that have been exacerbated by the impact of global warming and the greenhouse effect (COLLINS, Et.al 2010). Similarly, the events with the greatest economic impact in the Lambayeque region have been the FEN of 1982-1983, 1997-1998 and recently, the one of 2017.

Although the FEN mentioned above have been severe, the last one was called Coastal Child, due to its particular intensity and the intense rains that were irregular in the north and south of the country (SENAMHI 2014). Therefore, it was essential to analyze the damages caused by the various FENs in order to sustain that prevention measures from a social, political and economic level have not been effective in mitigating the negative impact in the Lambayeque region; from humanitarian aid to prudential macro policies applied by the BCRP in mitigating the negative impact on the region (CHOY and CHANG, 2014). Likewise, the FEN has shaped the economic development of the northern region and its own commercial and social dynamics; given that, analyzing Annex N° 03, a sharp drop in GDP was observed during the FEN of 1982-1983, 1997-1998 and 2017, the most serious being the FEN of 1997-1998. However, so far it is necessary to mention that the government's mitigation plans have only been fairly 'effective' to the extent that there is a supervisory body that oversees the development, coordination and resolution of the projects and that has recently occurred with the formation of INDECI in 2002 and the *Autoridad para la Reconstrucción con Cambios* which were responsible for mitigating the impacts of the Niño Costero in 2017, for the reconstruction of the north of the country.

Table No. 08

Comparison of sectoral damages during the FEN of 1982-1983 and 1997-1998

(Billions of dollars of 1998)

| SECTOR | FEN 1982-1983 | FEN 1997-1998 |
|-----------------------|---------------|---------------|
| SERVICE SECTOR | 124 | 451 |

²⁵ MTC or Ministry of Transportation and Communications, Peru Department of Transportation and Communications, similar to Federal Communication Commission.

| | | |
|------------------------------|------|------|
| HOUSING | 115 | 223 |
| STREETS AND AVENUES | 9 | 228 |
| PRODUCTION SECTOR | 2026 | 1582 |
| AGRICULTURAL | 1064 | 612 |
| FISHING | 174 | 26 |
| INDUSTRY | 786 | 675 |
| COMMERCE | 2 | 269 |
| SECTOR INFRAESTRUCTUR | 582 | 1389 |
| TRANSPORT | 497 | 686 |
| ELECTRICITY | 32 | 165 |
| OTHERS | 3 | 538 |
| TOTAL | 2732 | 3422 |
| GDP AVERAGE | 7.0% | 4.5% |

Source: Development Bank of Latin America (2010).

As a result, comparing the FEN of 1982-1983 and 1997-1998 of table N° 05, the damages exceed 5000 million dollars in destruction. Considering the data shown, it is observable that during the course of the various FENs it has not been established to establish a true preventive culture in the Lambayeque region. That is why, during each period of FEN that plagues Lambayeque there is still a strong negative economic impact in the region, regarding the little prevention that local government authorities manage the prevention budget in case of natural disasters (COEN, 2017).

Similarly, the impact of the FEN on the local population of Lambayeque has compromised the worldview itself and its socio-economic, cultural and political relations. Under this logic, this academic work began with the appointment collected by local and national newspapers about the "heavy rains in the north of the country" in the early 1980s and their possible effects on the socioeconomic development of the resident population of Lambayeque. For that, it was appropriate to have consolidated the analysis of the damage assessment in Lambayeque, to reflect on the following assumption: Would it be advisable to invest billions of dollars to adapt the Lambayeque infrastructure for the prevention of large-scale rainfall events such as FEN and Coastal Child?

As well as reflecting on the effectiveness of the preventive measures of regional governments and the central government, which only at the end of the twentieth century have been consolidated into preventive measures, an issue that had not been implemented before, which is why the impacts of 1982-1983 and 1997-1998 caused more damage than the last FEN of 2017. In summary, did the government manage to mitigate the negative impact on

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Lambayeque's economic development? It is evident that the government's prevention and mitigation plans did not have the expected impact in the expected time to "prevent" and not just rebuild.

Let us not forget that, in the background of economic dynamics is human capital, who are the main potential victims of a debacle that can be prevented; mitigating millionaires damages in infrastructure, services, production and, above all, protecting human capital from the possible condition of vulnerability to which they are exposed.

Finally, the findings of this study reconfirms the theory of the importance of a timely design of public policies focused on the prevention of infrastructure and the protection of population in a condition of vulnerability, it remains a challenge in the future to model the various endogenous variables to find a regression that shows through the econometrics a coefficient of loss in private investment and public for the impertinence of not applying preventive policies in the Lambayeque region.

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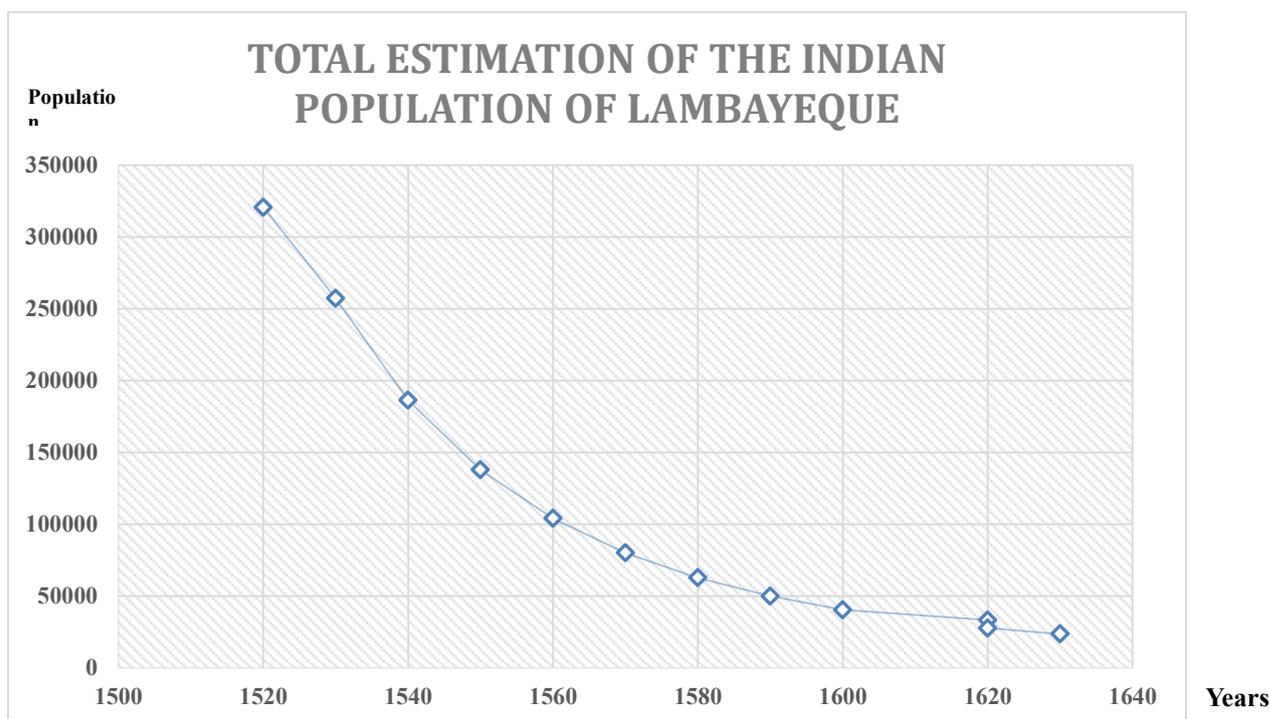
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Annex No. 01



Source: Demographic Collapse Indian Peru 1520. Cambridge University. 1981. Page 94.

Annex No. 02

List of Meganiños of the North Peruvian coast (1523-2013)

| YEAR | INTER-VAL | FEATURES |
|------|-----------|--|
| 1578 | 142 | Heavy rains in Lambayeque (40 days). Heavy rains in Ferreñafe, Jayanca, Chiclayo, Chicama, Trujillo and Zaña. River overflow. Destruction of channels Great damage to agriculture. Epidemics Locust plague. There are no measurements, but numerous descriptions. There is only information from Peru. |
| 1720 | 8 | Heavy rains in Trujillo, Piura and Paita. River overflow. Destruction of Zaña. Huge economic damage to agriculture, especially in Lambayeque. There are no measurements, but numerous descriptions. There is only information from Peru. |
| 1728 | 63 | Very close to the previous one. Rains in Piura (lightning and thunder), Paita, Zaña (12 days), Chocope, Trujillo (40 days, rivers of water ran through the streets). River overflow. Economic ruin of agriculture in Lambayeque. |
| 1791 | | World Impact Heavy rains in Piura, Paita, Lambayeque, Chiclayo and throughout the north coast. Damage to agriculture in |

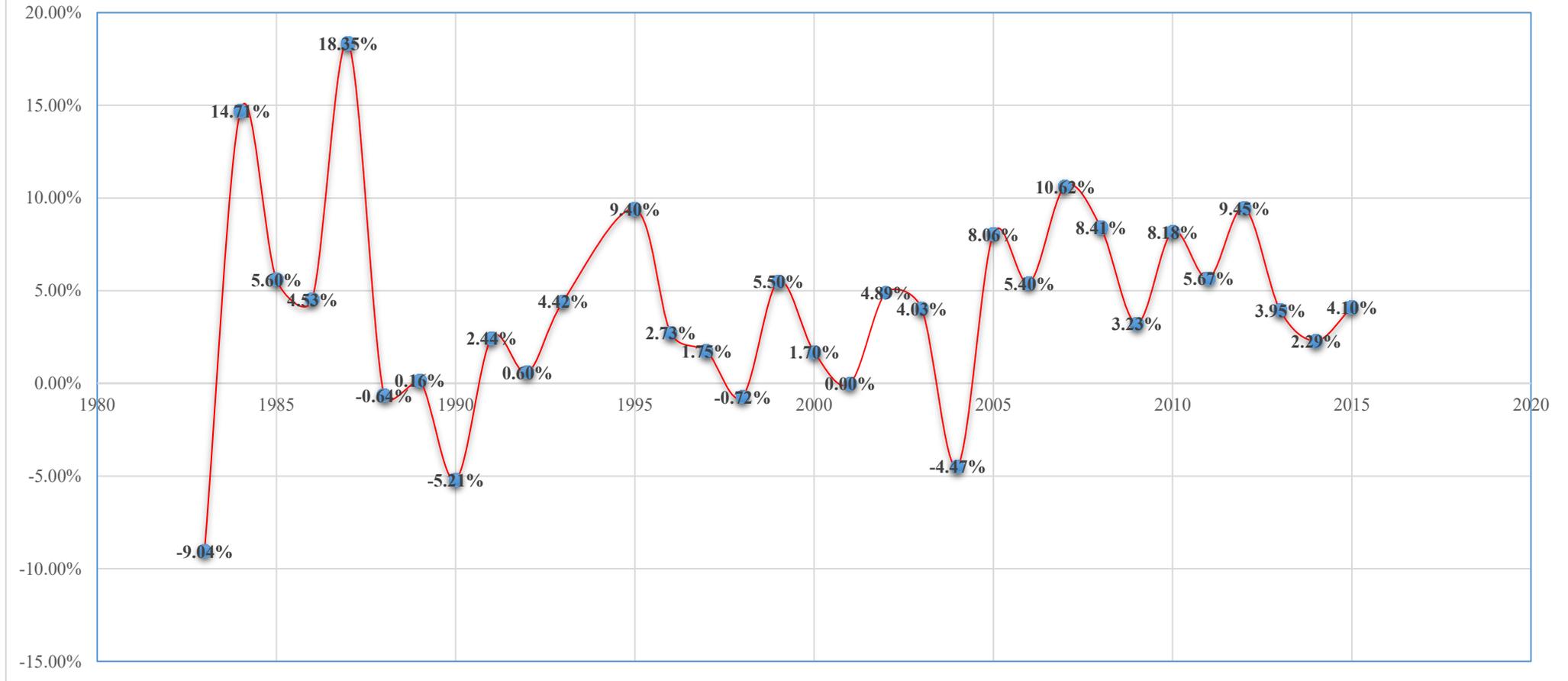
| | | |
|-----------------------------|----------|---|
| | 37 | Lambayeque. Heavy rains between Chíncha and Pativilca |
| 1828 | 49 | Heavy rains between Trujillo and Piura (14 days). Tempest River overflows. Lambayeque flood and ruin of agriculture department. Formation of a river in Sechura. |
| 1877-1878** | 13 | World Impact Wet period of two years in a row. Heavy rains on the north coast. Great damage in Lambayeque: total ruin of agriculture. World Impact The Southern Oscillation Index (IOS) became negative: June 1877 (-16.8); February 1878 (-21.1). The biennium had negative continuous IOS for nineteen months. |
| 1891 | 34 | He was the first who began to study scientifically in Peru. Heavy rains throughout the north coast. In Piura, Trujillo and Chiclayo it rained two months. Chimbote, Casma and Supe were left in ruins. 2000 dead, 50 000 victims. Rímac river overflows. The Southern Oscillation Index did not acquire negative values. |
| 1925 | 1 | Heavy rains throughout the north. In Tumbes, 1524 mm. In the lower basin of the Chancay-Lambayeque river, 1000 mm. The Rimac reached 600 m ³ / s. River overflow. Showers to Pisco. Increase in the temperature of the sea and the environment. Pests, epidemics and diseases. Great economic damages. The Southern Oscillation Index did not acquire negative values during the summer of the North-Peruvian coast. |
| 1926 | 57 | Heavy rains throughout the north for three months. In Tumbes, 1265 mm. Pests, epidemics and diseases. The Southern Oscillation Index became negative: February (-14.5). The biennium 1925-1926 had sixteen consecutive months of negative IOS. |
| 1983 | 15 | Great global impact Heavy rainfall across the north coast: six months in Piura. In Tumbes, 5466 mm. Road interruption Heavy losses in the fishery. Abundant information The Southern Oscillation Index became strongly negative: February (-33.3). |
| 1998 | ? | Huge global impact. Great rains throughout the north. Strong river discharges. Many losses. 58 bridges fell. Locust plague. Big economic losses. Extensive information The Southern Oscillation Index became strongly negative: March (-28.5). |
| Medium Interval (1578-1998) | 42 years | |

Source: ROCHA, Arturo (2017) "The Meganiño of 1791 in Peru and the world "

Annex No. 03: *GDP a constant prices of 1994 (PEN)

| YEAR | GDP* | GDP* (Percentage variation of GDP) |
|------|------------|------------------------------------|
| 1980 | 100764 | |
| 1981 | 128555 | 27.58% |
| 1982 | 118068 | -8.16% |
| 1983 | 117958 | -9.04% |
| 1984 | 135309 | 14.71% |
| 1985 | 142892 | 5.60% |
| 1986 | 149359 | 4.53% |
| 1987 | 176762 | 18.35% |
| 1988 | 159726 | -0.64% |
| 1989 | 159983 | 0.16% |
| 1990 | 148397 | -5.21% |
| 1991 | 152012 | 2.44% |
| 1992 | 152918 | 0.60% |
| 1993 | 159681 | 4.42% |
| 1995 | 3261141 | 9.40% |
| 1996 | 3350149 | 2.73% |
| 1997 | 3408629 | 1.75% |
| 1998 | 3384106 | -0.72% |
| 1999 | 3570247 | 5.50% |
| 2000 | 3630849 | 1.70% |
| 2001 | 3232646 | 0.00% |
| 2002 | 3390632 | 4.89% |
| 2003 | 3527421 | 4.03% |
| 2004 | 3369789 | -4.47% |
| 2005 | 3641260 | 8.06% |
| 2006 | 3837890 | 5.40% |
| 2007 | 4245403 | 10.62% |
| 2008 | 4602479 | 8.41% |
| 2009 | 4751336 | 3.23% |
| 2010 | 5140162 | 8.18% |
| 2011 | 5431684 | 5.67% |
| 2012 | 5945135.33 | 9.45% |
| 2013 | 6179766.08 | 3.95% |
| 2014 | 6321474.47 | 2.29% |
| 2015 | 6580903.27 | 4.10% |

Regional Gross Domestic Product of Lambayeque (Growth Rate 1983-2015)



Source: BCRP Serie of Lambayeque GDP, period 1980 – 2015.

Elaborated: Daniel Enrique Ríos-Serrano

Annex No. 04

Evaluation of damages in agriculture of Lambayeque of the year 2017.

| UBICACIÓN | AGRICULTURA | | | | | | |
|---------------------------|-------------------------|---------------------|--------------------|--------------------------------|-------------------------------|----------------------------------|-----------------------------------|
| | POZOS DE AGUA AFECTADOS | PERDIDA DE ANIMALES | ANIMALES AFECTADOS | AREA DE CULTIVO AFECTADO (Has) | AREA DE CULTIVO PERDIDO (Has) | COBERTURA NATURAL AFECTADO (Has) | COBERTURA NATURAL DESTRUIDO (Has) |
| DPTO. LAMBAYEQUE | 15 | 2937 | 6925 | 3964 | 2492 | 76 | 237 |
| PROV. LAMBAYEQUE | 15 | 2245 | 334 | 1821.34 | 1097.04 | 46.3 | 201 |
| DISTR. MOTUPE | | | | 150 | 100 | | |
| DISTR. SALAS | | 16 | | | 130 | | 180 |
| DISTR. PACORA | | 218 | | 240 | | 30 | 10 |
| DISTR. MOCHUMI | | 320 | | | | | |
| DISTR. OLMOS | | | | | | | |
| DISTR. CHOCHOPE | | 3 | | 117 | | | |
| DISTR. JAYANCA | | 360 | | 250 | | | |
| DISTR. MORROPE | | 1286 | 334 | | 699.65 | | |
| DISTR. TUCUME | | | | | | | |
| DISTR. ILLIMO | 15 | | | 4 | 0.1 | | |
| DISTR. LAMBAYEQUE | | | | 1055.34 | 167.29 | 16.3 | 6 |
| DISTR. SAN JOSE | | 42 | | 5 | | | 5 |
| PROV. CHICLAYO | | 100 | 460 | 1346.5 | 141.25 | 28 | 25 |
| DISTR. LAGUNAS | | | 300 | | 53.25 | | |
| DISTR. CHICLAYO | | | | | | | |
| DISTR. PUCALA | | | | | | | |
| DISTR. SANTA ROSA | | | | | | | |
| DISTR. ETEN | | 100 | 25 | | 60 | | 15 |
| DISTR. TUMAN | | | | | | | |
| DISTR. CHONGOYAPE | | | | | | | |
| DISTR. REQUE | | | | 50 | 20 | 20 | 10 |
| DISTR. CAYALTI | | | | 5 | | 5 | |
| DISTR. SAÑA | | | | 11 | | | |
| DISTR. POMALCA | | | | | | | |
| DISTR. LA VICTORIA | | | | | | | |
| DISTR. PICSÍ | | | | | | | |
| DISTR. JOSE L. ORTIZ | | | | | | | |
| DISTR. PIMENTEL | | | | | | | |
| DISTR. MONSEFU | | | | | | | |
| DISTR. PATAPO | | | 103 | | 8 | | |
| DISTR. NUEVA ARICA | | | | 978.5 | | | |
| DISTR. ETEN PUERTO | | | | | | | |
| DISTR. OYOTUN | | | 32 | 302 | | 3 | |
| PROV. FERREÑAFE | | 592 | 6131 | 796.38 | 1254.13 | 2 | 11 |
| DISTR. PUEBLO NUEVO | | | | 4 | | | |
| DISTR. M. A. MESONES MURO | | | | | 34 | | |
| DISTR. FERREÑAFE | | | | | | | |
| DISTR. PITIPO | | 81 | 5105 | 620 | 363 | | |
| DISTR. CAÑARIS | | 464 | 1026 | | 704.5 | | 9 |
| DISTR. INCAHUASI | | 47 | | 172.38 | 152.63 | 2 | 2 |

Source: SINPAD

National Emergency Operations Center

Excerpted from Emergency Report N° 725- August 24, 2017- Rainfall in the department of Lambayeque (INDECI).

Annex No. 05:

Lambayeque transport damage assessment of the year 2017

| UBICACIÓN | TRANSPORTES | | | | | |
|---------------------------|----------------------------|---------------------------|--------------------|-------------------|---------------------------------------|--|
| | CARRETERAS DESTRUIDAS (Km) | CARRETERAS AFECTADAS (Km) | PUENTES DESTRUIDOS | PUENTES AFECTADOS | TELEFONIA FIJA AFECTADA (% CAPACIDAD) | TELEFONIA MOVIL AFECTADA (% CAPACIDAD) |
| DPTO. LAMBAYEQUE | 98.36 | 122.34 | 61 | 85 | | |
| PROV. LAMBAYEQUE | 32.04 | 18.3 | 23 | 19 | | |
| DISTR. MOTUPE | | 1 | | 3 | | |
| DISTR. SALAS | 20 | | 5 | | | |
| DISTR. PACORA | | 0.6 | | 3 | | |
| DISTR. MOCHUMI | 5.67 | | 8 | 10 | | |
| DISTR. OLMOS | | | | | | |
| DISTR. CHOCHOPE | 1.5 | 1.5 | | 3 | | |
| DISTR. JAYANCA | 0.9 | | 2 | | | |
| DISTR. MORROPE | 3.97 | | 6 | | | |
| DISTR. TUCUME | | | 2 | | | |
| DISTR. ILLIMO | | 15 | | | | |
| DISTR. LAMBAYEQUE | | | | | | |
| DISTR. SAN JOSE | | 0.2 | | | | |
| PROV. CHICLAYO | 2 | 5.6 | 35 | 30 | | |
| DISTR. LAGUNAS | | | | | | |
| DISTR. CHICLAYO | | | | | | |
| DISTR. PUCALA | | | | | | |
| DISTR. SANTA ROSA | | | | | | |
| DISTR. ETEN | | | 1 | | 2.0 | 1.0 |
| DISTR. TUMAN | | | | | | |
| DISTR. CHONGOYAPE | | | 1 | | 55.0 | 55.0 |
| DISTR. REQUE | | | | | | |
| DISTR. CAYALTI | | | 4 | | | |
| DISTR. SAÑA | | | 2 | | | |
| DISTR. POMALCA | | | | | | |
| DISTR. LA VICTORIA | | 1.6 | | | | |
| DISTR. PCSI | | | | | | |
| DISTR. JOSE L. ORTIZ | | | | | | |
| DISTR. PIMENTEL | | | 10 | 15 | | |
| DISTR. MONSEFU | | | 4 | 10 | | |
| DISTR. PATAPO | | | | 2 | | |
| DISTR. NUEVA ARICA | | | | 3 | | 35.0 |
| DISTR. ETEN PUERTO | | | | | | |
| DISTR. OYOTUN | 2 | 4 | 13 | | | |
| PROV. FERREÑAFE | 64.32 | 98.44 | 3 | 36 | | |
| DISTR. PUEBLO NUEVO | | | | | | |
| DISTR. M. A. MESONES MURO | | | | | | |
| DISTR. FERREÑAFE | | | | | | |
| DISTR. PITIPO | 0.03 | 0.4 | | | 70.0 | 70.0 |
| DISTR. CAÑARIS | 0.09 | | | 33 | | |
| DISTR. INCAHUASI | 64.2 | 98.04 | 3 | 3 | 7.5 | 12.5 |

Source: SINPAD

National Emergency Operations Center

Excerpted from Emergency Report N° 725- August 24, 2017- Rainfall in the department of Lambayeque (INDECI).

Annex No. 06:
Lambayeque Road Network (1975-2004)



| Type of road | 1975 | | 1983 | | 1995 | | 2004 | |
|----------------------|-------------|--------------|-------------|--------------|-----------------|--------------|---------------|--------------|
| | Km | % | Km | % | Km | % | Km | % |
| Paved Road | 603 | 19.8 | 712 | 23.4 | 710.90 | 37.2 | 680.9 | 37.1 |
| Affirmed Road | 623 | 20.4 | 418 | 13.8 | 89.95 | 4.7 | 109.3 | 6.0 |
| Unsigned Road | 101 | 3.3 | 73 | 2.4 | 187.30 | 9.8 | 198.9 | 10.8 |
| Trolley | 1722 | 56.5 | 1834 | 60.4 | 922.35 | 48.3 | 845.3 | 46.1 |
| Total | 3049 | 100.0 | 3097 | 100.0 | 1,910.50 | 100.0 | 1834.4 | 100.0 |

Source: INEI 2004-2005 Statistical Compendium

Annex No. 07:

Damage assessment in housing and public premises of Lambayeque of 2017..

| UBICACIÓN | VIVIENDAS Y LOCALES PUBLICOS | | | | | TRANSPORTES | |
|---------------------------|------------------------------|------------------|-------------------|---------------------|------------------------------|---------------------------------|--------------------------------|
| | II.EE. INHABITABLES | EE.SS. AFECTADOS | EE.SS. COLAPSADOS | EE.SS. INHABITABLES | ESTABLEC. COMERCIAL AFECTADO | CAMINOS RURALES DESTRUIDOS (Km) | CAMINOS RURALES AFECTADOS (Km) |
| DPTO. LAMBAYEQUE | 26 | 83 | 7 | 3 | 1 | 345.59 | 684.88 |
| PROV. LAMBAYEQUE | 11 | 37 | 4 | 1 | 1 | 191.36 | 340.51 |
| DISTR. MOTUPE | 2 | 7 | | | | 4 | 90.83 |
| DISTR. SALAS | | 5 | | | | 30 | 150 |
| DISTR. PACORA | 5 | 2 | | | | 24.31 | |
| DISTR. MOCHUMI | 3 | 2 | | 1 | | 40 | |
| DISTR. OLMOS | | 1 | | | | | 9.71 |
| DISTR. CHOCHOPE | | 1 | | | | 3.4 | 0.72 |
| DISTR. JAYANCA | | 1 | | | | 13.5 | 15.1 |
| DISTR. MORROPE | 1 | 9 | 4 | | | 68.74 | |
| DISTR. TUCUME | | 2 | | | | 3.51 | 6 |
| DISTR. ILLIMO | | 3 | | | | | 31 |
| DISTR. LAMBAYEQUE | | 2 | | | | | 32.18 |
| DISTR. SAN JOSE | | 2 | | | 1 | 3.9 | 4.97 |
| PROV. CHICLAYO | 7 | 26 | 3 | 2 | | 48.7 | 101.59 |
| DISTR. LAGUNAS | | 1 | 1 | | | | 3 |
| DISTR. CHICLAYO | | | | | | | |
| DISTR. PUCALA | | | | | | | 13.05 |
| DISTR. SANTA ROSA | | | | | | | 1.4 |
| DISTR. ETEN | 1 | 2 | | | | | 5.3 |
| DISTR. TUMAN | | | | | | | |
| DISTR. CHONGOYAPE | 2 | 2 | | | | | 14 |
| DISTR. REQUE | 1 | 2 | | | | 1.7 | 3.4 |
| DISTR. CAYALTI | | 2 | | | | 1 | 3 |
| DISTR. SAÑA | | 1 | | | | | 5.34 |
| DISTR. POMALCA | | | | | | | 0.4 |
| DISTR. LA VICTORIA | | 3 | 2 | | | | |
| DISTR. PICSI | | | | | | 15 | 1 |
| DISTR. JOSE L. ORTIZ | | | | | | | |
| DISTR. PIMENTEL | | | | 2 | | 7.8 | 9.2 |
| DISTR. MONSEFU | | 5 | | | | 5.2 | 6 |
| DISTR. PATAPO | | | | | | | 3 |
| DISTR. NUEVA ARICA | 2 | 4 | | | | | 7.5 |
| DISTR. ETEN PUERTO | 1 | 1 | | | | | 2 |
| DISTR. OYOTUN | | 3 | | | | 18 | 24 |
| PROV. FERREÑAFE | 8 | 20 | | | | 105.53 | 242.78 |
| DISTR. PUEBLO NUEVO | | | | | | | 1 |
| DISTR. M. A. MESONES MURO | | | | | | | 0.63 |
| DISTR. FERREÑAFE | | | | | | | 69 |
| DISTR. PITIPO | 3 | 12 | | | | 6 | 36.15 |
| DISTR. CAÑARIS | 5 | 4 | | | | 12.03 | 39.34 |
| DISTR. INCAHUASI | | 4 | | | | 87.5 | 96.66 |

Source: SINPAD

National Emergency Operations Center

Excerpted from Emergency Report N° 725- August 24, 2017- Rainfall in the department of Lambayeque (INDECI)

*SECTORS**Economic impacts related to the FEN from 1997-1998*

| | |
|---|---|
| <i>Agricultural Sector</i> | <ul style="list-style-type: none"> • Impossibility of planting in flooded areas. • Destruction of irrigation infrastructure. • Emergence of pests and diseases. • Decrease in constant yields in crops and production. • Affectation of arable soil by mud and sediments. |
| <i>Services and Infrastructure Sector</i> | <ul style="list-style-type: none"> • Collapse of sewer network systems. • Contamination of drinking water by wastewater. • Damage in electrical transmission substations. • Collapse of water grounds. • Total or partial destruction of homes in vulnerable communities. • Sludge housing and loss of household goods. • Total and partial deterioration or destruction of sections of roads and bridges. |
| <i>Commerce Sector</i> | <ul style="list-style-type: none"> • Increase in freight transport costs. • Isolation of agricultural and populated areas. • Limitation of commercial profits in markets due to the few transport routes. • Increase in the prices of essential products. |

Source: Development Bank of Latin America (2010)

Excerpted from the Technical Report 1- Impacts of the El Niño Phenomenon (FEN) on the regional economy of Piura, Lambayeque, La Libertad (2012).

Analysis of Data in Lambayeque Region (Sugarcane in Tonnes)

| YEAR | TONNES |
|-------------|---------------|
| 1970 | 3205196 |
| 1971 | 3198700 |
| 1972 | 3377856 |
| 1973 | 2132105 |
| 1974 | 3438798 |
| 1975 | 3360744 |
| 1976 | 3377380 |
| 1977 | 3363890 |
| 1978 | 3175521 |
| 1979 | 3164474 |
| 1980 | 2687093 |
| 1981 | 2593600 |
| 1982 | 2829097 |
| 1983 | 2318489 |
| 1984 | 2731462 |
| 1985 | 2758950 |
| 1986 | 2007577 |
| 1987 | 2270294 |
| 1988 | 2379506 |
| 1989 | 2596780 |
| 1990 | 2580437 |
| 1991 | 2499663 |
| 1992 | 2298182 |
| 1993 | 2095548 |
| 1994 | 2476336 |
| 1995 | 2700941 |
| 1996 | 2616543 |
| 1997 | 2513030 |
| 1998 | 1076107 |
| 1999 | 1953646 |
| 2000 | 1904269 |
| 2001 | 2001106 |
| 2002 | 2298645 |
| 2003 | 2444064 |
| 2004 | 1627206 |
| 2005 | 1274400 |

| | |
|-------------|---------|
| 2006 | 1689427 |
| 2007 | 2056475 |
| 2008 | 2689532 |
| 2009 | 2982819 |
| 2010 | 2824847 |
| 2011 | 2748163 |
| 2012 | 2988190 |
| 2013 | 2555340 |
| 2014 | 2645530 |
| 2015 | 2504370 |
| 2016 | 2082470 |
| 2017 | 3161250 |
| 2018 | 2924240 |

Source: Peru Department of Agriculture or Ministry of Agriculture of Peru

<http://webapp.inei.gob.pe:8080/sirtod-series/>

