



FORGOTTEN EFFECTS IN THE VALUATION OF THE SOCIAL WELL-BEING INDEX IN MEXICO'S SUSTAINABLE DEVELOPMENT

G. G. Alfaro-Calderón^{a*}, N. L. Godínez-Reyes^b, R. Gómez-Monge^c,
V. Alfaro-García^d, A. M. Gil-Lafuente^e

The economic, social and environmental crises of recent years have caused a global concern for the need to find mechanisms that enable efficient development processes and that lead countries towards sustainability. In particular, emerging countries have specific characteristics that force them to face the issue of sustainable development under a very particular vision about how actions should be taken to generate public policies and programmes that suit their own needs and the well-being of their citizens. With this perspective, our study presents a methodology based on the model of forgotten effects developed by Kaufmann and Gil Aluja. This methodology quantifies (using expert groups) the relationship between the indicators of Mexico's social progress index and its sustainability to determine the incidence of the components of this index in the country's sustainability activities, with the objective of providing elements for better decision-making in the design of strategies, actions and public policies aimed at the sustainable development of the nation.

Keywords: *social progress, forgotten effects, sustainable development, Mexico.*

JEL Classification: *C00, C65, C80.*

1. INTRODUCTION

Latin American countries are well known for their great ecological diversity, profound cultural values and a population marked by low to subsistence-level income resulting from weak economic development growth and poor wealth distribution (Alimonda, 2011). In general terms, under the neoliberal economic model, Mexico has tried to maintain healthy macroeconomic conditions and to

^a Facultad de Contaduría y Ciencias Administrativas, Universidad Michoacana de San Nicolás de Hidalgo, Mexico. Email: ggalfaroc@gmail.com.

^b Facultad de Economía "Vasco de Quiroga", Universidad Michoacana de San Nicolás de Hidalgo, Mexico. Email: lgodinez5@gmail.com.

^c Facultad de Economía "Vasco de Quiroga", Universidad Michoacana de San Nicolás de Hidalgo, Mexico. Email: rogomo@gmail.com.

^d Facultad de Economía, Universidad Autónoma de San Luis Potosí, México. Email: valfaro06@gmail.com

^e Business School, Universitat de Barcelona, Spain. Email: amgil@ub.edu.

* *Corresponding author*

DOI: 10.25102/fer.2019.01.04

establish a legal framework that attracts foreign investment, so the nation has favoured open markets and foreign direct investment (FDI) to stimulate development (Guillén-Romo, 2007).

This development model has influenced a growth that has low social and environmental equity. However, because of recommendations by international organizations and consciousness of an irregular growth that has not left a positive impact on the population, in recent years Mexico has been taking steps towards a more equitable development and sustainable development goals (SDG).

As mentioned in the 1987 Brundtland report “Our Common Future” issued by the United Nations World Commission on Environment and Development, sustainable development can be defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Bermejo, 2014).

A nation’s development approach recommends actions that consider endogenous factors and the territorial economic integrations that promote the productive vocations, their internal trade markets and joint the productive chains to create value, as well as to commission the search for comprehensive strategies to improve the lives of people under equal conditions and environmental rationality. That is, where the definition of national social progress becomes important, since it is considered to be an evaluation that goes beyond traditional measurements of national income such as the GDP (gross domestic product) to determine development. Social progress as an alternative policy tool to measure a country’s success takes into account the global progress of society.

Tackling this topic takes us deeper into the causal relationship between the actions taken by countries in order to achieve economic growth focused on social progress as presented in the Social Progress Imperative¹, and the sustainable strategies in the programmes that they implement.

For the purposes of this research, we will determine the impact of the Social Progress Index (SPI) factors on Mexico’s sustainability activities aimed at better decision-making and designing strategies, actions and policies to achieve a sustainable development for the well-being of its citizens.

The limitations of the methodology used to approach this problem lie in the methods for evaluating sustainable development that don’t measure the country’s performance in three areas: social, environmental and economic areas. Some of them only measure actions for economic growth (GDP), others only address social areas (index of labour progress), and others only look at the environment

¹ Social Progress Imperative is an international non-profit organization focused on measuring the social progress of 133 countries around the world. Since 2011, it has calculated and presented the Social Progress Index (SPI) as a policy tool to provide governments and institutions with the elements to make assessments and decisions.

(Living Planet Index, carbon footprint, Environmental Sustainability Index) (SEMARNAT, 2018). Gil-Lafuente *et al.* (2015) and Rodriguez-Rubinos *et al.* (2008) state that despite the fact that actions considered efficient and effective are usually set, there is always the possibility of avoiding some causal relationships, especially among those that are explicit, evident and not directly perceived. A strategy to solve this problem is the use of the fuzzy logical approach to find the forgotten effects in the sustainability actions of countries, which affect the goal of achieving social welfare for the citizens of a nation. More specific actions that lead nations towards sustainable development are searched by evaluating the causes and effects of several variables that impact on social welfare. The influence of social well-being activities on the nation's sustainability outcomes centers on how they modifying these outcomes. This implies a cause-effect type of relationship between $C \rightarrow E$ that can be used to assess the impacts of these social progress actions (C -social progress actions that imply E -effects for a country's economic, social and environmental development). This relationship of influence is a simple system characteristic; nevertheless, the relationship that is maintained by the actions that countries adopt to achieve social development is complex, and it is distinguished by a recursive and non-linear causality type (García, 2006). This relationship not only expresses the $C \rightarrow E$ relationship (C -actions towards social well-being that imply effects on a nation's sustainable development) but is also manifested in the population's well-being through the success of the sustainable development goals to be achieved. This shows its systemic character and the mutual interrelationships that condition and influence each other; that is, $C \rightarrow C$ (mutual impact between social progress actions) and $E \rightarrow E$ (mutual incidences of the E -effects of the results of their sustainable development actions). This type of relationship in countries concerned with social welfare actions oriented towards sustainability enables an explanation (within the limits of fuzzy logic in its non-linear behavior) of the causal relationship that considers forgotten effects (Kaufman and Gil-Aluja, 1988). Thus, it can be described as a $C \rightarrow C \rightarrow E \rightarrow E$ relationship, resulting in an explanatory table corresponding to its complex behavior that contributes to establishing its recursive causality.

As an application of this approach and the methodological implications of the complexity paradigm, this paper establishes the objective of identifying the causal relationship of a nation's social progress actions aimed at sustainability by applying the theory of forgotten effects developed by Kaufman and Gil-Aluja (1988).

This paper is divided in three sections, the first one describes the main concepts related to social progress actions with the index that we use to measure such actions (the IPS), followed by a discussion of the main variables of sustainable national development. In the second section, the forgotten effects methodology is used to analyse the direct and indirect incidences of the results of the social progress index in Mexico based on the results of its sustainable development

indicators. In the final part, the results of this research and its conclusions are presented.

2. THEORETICAL FRAMEWORK

2.1 SOCIAL PROGRESS INDEX

The Social Progress Index (SPI) is a social and environmental metrics indicator that complements GDP measurement to measure a country's sustainable development. The SPI serves to evaluate the results of a country's actions aimed at improving the quality of life of its citizens. This index offers a solid measurement model that is holistic, transparent and factually based on results that foster inclusive development, is focused on people's living conditions and the well-being of the community, and on environmental sustainability.

The index only considers social and environmental indicators (the results of the indicators only and not the efforts to achieve them), relevant indicators for the context, and indicators that can turn into public policies or social interventions for its measurement. This is so that the SPI can measure every country's performance using more than 50 indicators in the three dimensions and 12 components presented in Table 1.

Table 1. Dimensions and Components of the Social Progress Index

Basic Human Needs	Foundations of Well-Being	Opportunity
Nutrition & Basic Medical Care	Access to Basic Knowledge	Personal Rights
Water & Sanitation	Access to information & Communications	Personal Freedom & Choice
Shelter	Health & Wellness	Inclusiveness
Personal Safety	Environmental Quality	Access to Advanced Education

This index shows the level of social progress that a country can reach as a result of cumulative and progressive decisions taken by their governments, communities, citizens and businesses on how to invest their limited resources and how to work together to achieve sustainable development goals. Therefore, the results of this indicator are the causes of a nation's development, with development viewed from a complex system perspective.

2.2 SUSTAINABLE DEVELOPMENT VIEWED AS A COMPLEX SYSTEM

The concept of development in Latin American nations is enriched by contributions from social economy, development on a human scale, ecological

economy and institutionalism, thereby producing a concept of development that considers economic, social and ecological sustainability as a single whole. There has been criticism of the multiple definitions of sustainability (Baumgärtner and Quaas, 2010) because it is not clear how to achieve it (Capra, 2002) or how to measure it (Gasparatos, 2010). There is consensus that sustainability involves social, environmental and economic dimensions and that the results of actions taken must have a positive impact in these areas (Munasinghe, 1993; Santos et al., 2009). Sustainable development benefits the search for alternatives to improving people's quality of life in equitable and environmentally rational conditions. Thus, sustainable development is viewed as an economic growth that promotes the human and ecological well-being of the current generation without compromising the capacity to satisfy the needs of future generations, and which is produced from a social and structural transformation by changing the production and power social relationships, especially in the areas of decision-making and public policy impacts (Cabrera Tapia, 2015).

These academic reflections have led to a concept of sustainability as a complex phenomenon (Vera, 2011), due to the number of actors, processes and interactions that ensue. It must be recognized that a nation's sustainable development is considered a complex system since internal and external production systems interact with its exchange processes, the environmental, infrastructure and structural conditions of the territory, culture, customs and worldview of its inhabitants, with the aim of achieving sustained human well-being over time while protecting the natural systems of the planet (Martínez Allier, 2001; Alimonda, 2011). This is based on understanding a complex system as a system with heterogeneous elements in the sense that they belong to different discipline domains but are defined as interconnected elements (García, 2006).

3. METHODOLOGY

Kaufmann and Gil-Aluja (1988) proposed the Theory of Forgotten Effects. This theory enables one to identify all the direct and indirect relationships of the analyzed phenomena with no possibility of errors. According to the authors, all that happens around us is part of a system or a subsystem. Hence, we can almost ensure that any activity is subject to a cause and effect relationship. However, despite having a good control system, there is always the possibility of voluntarily or involuntarily leaving out some causal relationships that are not always explicit, obvious or visible. Therefore, it is not uncommon to find hidden effects of the phenomena analyzed due to the incidence of other effects or outcomes. The forgotten effects theory is an innovative and efficient approach that considers all the relationships in a phenomenon, minimizing the errors that may occur in modelling (Gil-Lafuente and Bassa, 2011). In this study, we have two sets of elements: causes (*A*) and effects (*B*) (Kaufmann and Gil-Aluja, 1988).

$A = \{a_i / i = 1, 2, \dots, n\}$: Social Welfare results

$B = \{b_j / j = 1, 2, \dots, m\}$: Sustainability variables

We assume that there is an occurrence of a_i over b_j if the value of the membership functions of the feature pair $(a_i b_j)$ is estimated between $[0, 1]$ (the value of each cell in the array cannot be smaller than 0 or greater than 1, as if we had valued from 0 to 10, but in decimals); i.e. $\forall(a_i b_j) \Rightarrow \mu(a_i b_j) \in [0, 1]$

The set of evaluated elements define the “direct relationship matrix”, M , which shows the cause - effect relationships that occur between the joint elements of the set A and the joint elements of the set B .

$$\begin{matrix}
 & & b_1 & b_2 & b_3 & b_4 & b_5 & \dots & b_m \\
 & a_1 & \mu_{a_1 b_1} & \mu_{a_1 b_2} & \mu_{a_1 b_3} & \mu_{a_1 b_4} & \mu_{a_1 b_5} & \dots & \mu_{a_1 b_m} \\
 & a_2 & \mu_{a_2 b_1} & \mu_{a_2 b_2} & \mu_{a_2 b_3} & \mu_{a_2 b_4} & \mu_{a_2 b_5} & \dots & \mu_{a_2 b_m} \\
 M = & a_3 & \mu_{a_3 b_1} & \mu_{a_3 b_2} & \mu_{a_3 b_3} & \mu_{a_3 b_4} & \mu_{a_3 b_5} & \dots & \mu_{a_3 b_m} \\
 & a_4 & \mu_{a_4 b_1} & \mu_{a_4 b_2} & \mu_{a_4 b_3} & \mu_{a_4 b_4} & \mu_{a_4 b_5} & \dots & \mu_{a_4 b_m} \\
 & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\
 & a_n & \mu_{a_n b_1} & \mu_{a_n b_2} & \mu_{a_n b_3} & \mu_{a_n b_4} & \mu_{a_n b_5} & \dots & \mu_{a_n b_m}
 \end{matrix}$$

To continue with the explanation of the model, below we show how the effects can accumulate. For this we need to define a third set of elements, different from the previous two:

$$C = \{c_k / k = 1, 2, \dots, z\}$$

This consists of the elements that are the effects of the set B :

$$\begin{matrix}
 & & c_1 & c_2 & \dots & c_z \\
 & b_1 & \mu_{b_1 c_1} & \mu_{b_1 c_2} & \dots & \mu_{b_1 c_z} \\
 N = & b_2 & \mu_{b_2 c_1} & \mu_{b_2 c_2} & \dots & \mu_{b_2 c_z} \\
 & \vdots & \dots & \dots & \dots & \dots \\
 & b_m & \mu_{b_m c_1} & \mu_{b_m c_2} & \dots & \mu_{b_m c_z}
 \end{matrix}$$

And having the common elements of the set B , we can say that the P matrix defines the causal relationships between the first set of elements A and the elements of the third set C , with the intensity or degree that leads to consider the elements belonging to set B .

The mathematical operator to determine the effect of A on C is the max-min composition. In fact, when there are three impact relationships, we would have:

$$M \subset A \times B, N \subset B \times C \text{ and } P \subset A \times C$$

and the Kaufmann and Henry-Labordère (1977) equation is invoked to:

$$M \circ N = P$$

where the symbol \circ represents precisely the max-min composition. The composition of two relationships is uncertain such that:

$$\forall (a_i, c_k) \in A \times C$$

$$\mu(a_i, c_k)_{\bar{M} \circ \bar{N}} = \vee_{b_j} (\mu_{\bar{M}}(a_i, b_j) \wedge \mu_{\bar{N}}(b_j, c_k))$$

Therefore, we affirm that the relationship of impact P defines the causal relationships between the elements of the A set and the C set in the intensity or degree of the elements belonging to the B set.

3.1 APPLICATION OF THE MODEL TO MEXICO

Mexico is a country with great cultural and natural wealth, and is one of the most mega-diverse countries. The economic development of recent years has benefited the Mexican macro economy, but it has also affected biodiversity, the environment and the quality of life of the country's population. According to the Gini index, it is among the 10 most unequal countries in the world (World Bank, 2016). The Mexican economy has maintained steady progress in the last two decades, but this growth has occurred asymmetrically in country's different regions, revealing the insufficiency of policies that seek to reduce poverty, generate decent employment, improve infrastructure and communications, and the competitiveness of their organizations. The development of the country is complex, and as previously mentioned, it must take different approaches. In this paper, we will analyse the impact of social progress as measured by the SPI, on the sustainability of the country, as measured by the results of its public policies on the three dimensions of development: economic, social and environmental. The results of the measurement of social progress in Mexico have a direct impact on development in the country since they show the results of its sustainability policies and activities. The SPI indicators are presented in Table 2, while their effects on the dimensions of sustainability and the international indicators are presented in Table 3.

The actions of countries aimed at sustainable development can be observed in the 12 components of the social development index defined in Table 2 thus, the effects will be the five indicators from the dimensions of sustainable development in Table 3. With this principle, we evaluate the degree to which the strengthening of the social progress components (set A) impact the sustainable development of the country (set B) using estimated values between $[0,1]$ to assess worth, as shown in the semantic scale in Table 4.

Table 2. Causes – Social Well-Being

Dimensions	Index of social progress	
Basic Human Needs	C1	Nutrition and Basic Medical Care
	C2	Water and sanitation
	C3	Shelter
	C4	Personal Safety
Foundations of Well-Being	C5	Access to Basic Knowledge
	C6	Access to Information and Communication
	C7	Health and Wellness
	C8	Environmental Quality
Opportunity	C9	Personal Rights
	C10	Personal Freedom and Choice
	C11	Inclusiveness
	C12	Access to Advanced Education

Source: Own elaboration based on the IPS 2017 model.

Table 3. Effects – Sustainable Development

Dimensions	Indicators	
Economic Development	E1	Competitiveness
	E2	Employment
Social Development	E3	Decrease in Poverty
	E4	Communications and Infrastructure
Environmental Development	E5	Conservation and Environmental Wellbeing

Table 4. Semantic scale

Level	Semantic label
0.0	No incidence
0.1	Very weak incidence
0.2	Weak incidence
0.3	Low incidence
0.4	Moderated incidence
0.5	Medium incidence
0.6	Considerable incidence
0.7	High incidence
0.8	Strong incidence
0.9	Very strong incidence
1.0	Total incidence

Source: Kaufmann and Gil Aluja (1988)

The incidence of effect-cause, cause-cause and effect-effect was estimated by 10 experts on sustainability, competitiveness, poverty, conservation, infrastructure and employment. By being aware of possible intermediate incidences, a higher inner coherence can be achieved, according to Gento *et al.* (2001). The results are shown in Tables 5, 6 and 7².

Table 5. Estimated incidence between causes and effects (R_{CE})




	E ₁	E ₂	E ₃	E ₄	E ₅
C ₁	0.6	0.5	0.8	0.2	0.5
C ₂	0.6	0.5	0.8	0.3	0.6
C ₃	0.5	0.5	0.8	0.4	0.4
C ₄	0.7	0.6	0.6	0.3	0.4
C ₅	0.8	0.7	0.7	0.3	0.4
C ₆	0.7	0.5	0.5	0.8	0.3
C ₇	0.7	0.7	0.8	0.5	0.5
C ₈	0.6	0.5	0.5	0.4	0.5
C ₉	0.6	0.7	0.7	0.4	0.4
C ₁₀	0.6	0.5	0.5	0.5	0.4
C ₁₁	0.6	0.6	0.6	0.4	0.4
C ₁₂	0.8	0.8	0.6	0.6	0.6

Table 6. Incidence between the SPI components (causes) (R_{CC})

	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇	C ₈	C ₉	C ₁₀	C ₁₁	C ₁₂
C ₁	1	0.4	0.4	0.5	0.7	0.3	0.9	0.5	0.2	0.3	0.2	0.5
C ₂	0.8	1	0.6	0.5	0.5	0.3	0.8	0.8	0.4	0.4	0.3	0.5
C ₃	0.3	0.5	1	0.6	0.5	0.5	0.6	0.6	0.5	0.4	0.3	0.4
C ₄	0.2	0.3	0.2	1	0.4	0.4	0.5	0.3	0.6	0.6	0.6	0.5
C ₅	0.7	0.4	0.5	0.4	1	0.5	0.6	0.5	0.5	0.5	0.6	0.8
C ₆	0.2	0.3	0.5	0.5	0.6	1	0.5	0.5	0.5	0.5	0.5	0.7
C ₇	0.7	0.6	0.5	0.5	0.7	0.4	1	0.4	0.5	0.5	0.4	0.5
C ₈	0.7	0.7	0.6	0.3	0.4	0.4	0.7	1	0.4	0.4	0.4	0.3
C ₉	0.3	0.3	0.5	0.7	0.7	0.6	0.5	0.5	1	0.8	0.8	0.7
C ₁₀	0.5	0.3	0.5	0.6	0.7	0.6	0.5	0.3	0.7	1	0.7	0.7
C ₁₁	0.7	0.8	0.3	0.5	0.7	0.4	0.4	0.3	0.7	0.7	1	0.6
C ₁₂	0.5	0.5	0.5	0.6	0.7	0.6	0.5	0.3	0.7	0.6	0.6	1

² The results are obtained using the software: www.fuzzyeconomics.com/fuzzylog/

Table 7. Incidence in sustainable development indicators (effects) (R_{EE})

	E ₁	E ₂	E ₃	E ₄	E ₅
E ₁	1	0.9	0.8	0.7	0.6
E ₂	0.8	1	0.9	0.6	0.6
E ₃	0.7	0.6	1	0.5	0.7
E ₄	0.8	0.6	0.6	1	0.5
E ₅	0.6	0.5	0.6	0.5	1

These results are produced by assessing the value of how much social progress components directly affect Mexico’s sustainable development indicators. As we previously mentioned, expressing the development phenomena with this evaluation is not enough, so it should be analysed more deeply to help us explain the effects on sustainability (not only by its direct causes but also by the crossover effects). It is thus necessary to develop two more matrices of cross-relationships. Table 6 inter-relates the indicators of the population’s social well-being, while Table 7 presents the incidence that every one of the indicators of the sustainable development dimensions pursue in an inter-related manner.

In agreement with the explained model, from the max-min composition of the three matrices above we execute matrix convolution according to the matrices $R_{CE}^1 = R_{CC} \circ R_{CE}$, followed by $R_{CE}^2 = R_{CE}^1 \circ R_{EE}$, that are shown on Table 8 and Table 9, obtaining the matrix that includes the forgotten effects (Table 10), that is, the global incidence that every one of the nation’s social progress components over its sustainable development.

Table 8. Convolution matrix for max-min among matrices (R_{CE}^1)


	E ₁	E ₂	E ₃	E ₄	E ₅
C ₁	0.7	0.7	0.8	0.5	0.5
C ₂	0.7	0.7	0.8	0.5	0.6
C ₃	0.6	0.6	0.8	0.5	0.5
C ₄	0.7	0.6	0.6	0.5	0.5
C ₅	0.8	0.8	0.7	0.6	0.6
C ₆	0.7	0.7	0.6	0.8	0.6
C ₇	0.7	0.7	0.8	0.5	0.6
C ₈	0.7	0.7	0.7	0.5	0.6
C ₉	0.7	0.7	0.7	0.6	0.6
C ₁₀	0.7	0.7	0.7	0.6	0.6
C ₁₁	0.7	0.7	0.8	0.6	0.6
C ₁₂	0.8	0.8	0.7	0.6	0.6

Table 9. Convolution matrix for max-min among matrices (R_{CE}^2)



	E ₁	E ₂	E ₃	E ₄	E ₅
C ₁	0.7	0.7	0.8	0.7	0.7
C ₂	0.7	0.7	0.8	0.7	0.7
C ₃	0.7	0.6	0.8	0.6	0.7
C ₄	0.7	0.7	0.7	0.7	0.6
C ₅	0.8	0.8	0.8	0.7	0.7
C ₆	0.8	0.7	0.7	0.8	0.6
C ₇	0.7	0.7	0.8	0.7	0.7
C ₈	0.7	0.7	0.7	0.7	0.7
C ₉	0.7	0.7	0.7	0.7	0.7
C ₁₀	0.7	0.7	0.7	0.7	0.7
C ₁₁	0.7	0.7	0.8	0.7	0.7
C ₁₂	0.8	0.8	0.8	0.7	0.7

Table 10. Total accumulation of forgotten effects ($R_{CE}^2 - R_{CE}$)

	E ₁	E ₂	E ₃	E ₄	E ₅
C ₁	0.1	0.2	0	0.5	0.2
C ₂	0.1	0.2	0	0.4	0.1
C ₃	0.2	0.1	0	0.2	0.3
C ₄	0	0.1	0.1	0.4	0.2
C ₅	0	0.1	0.1	0.4	0.3
C ₆	0.1	0.2	0.2	0	0.3
C ₇	0	0	0	0.2	0.2
C ₈	0.1	0.2	0.2	0.3	0.2
C ₉	0.1	0	0	0.3	0.3
C ₁₀	0.1	0.2	0.2	0.2	0.3
C ₁₁	0.1	0.1	0.2	0.3	0.3
C ₁₂	0	0	0.2	0.1	0.1

4. RESULTS AND DISCUSSION

The forgotten effects theory allows us to analyse the direct and indirect impacts of Mexico's social progress index results on its sustainable development indicators. With this model, we can observe secondary effects (forgotten effects)

that are not directly considered in Mexico’s public policies to improve competitiveness indicators, jobs, poverty, infrastructure and communications, and natural resource conservation.

Applying the model, the study show’s forgotten effects in Mexico’s sustainability indicators that were not directly evaluated in the social progress index’s components, but through the cross-effects convolution we can observe effects that were not directly considered. From these incidences, we can observe the four significant differences with moderate and medium significance presented in Table 11.

The R_{CE} is the initial estimate value, R_{CE}^1 and R_{CE}^2 is the accumulated value cause-effect and $R_{CE}^2 - R_{CE}$ is the differences among values (forgotten effects).

Table 11. Major incidences of forgotten effects

Social Well-Being	Sustainability	R_{CE}	R_{CE}^1	R_{CE}^2	$R_{CE}^2 - R_{CE}$
C1 Basic medical needs and nutrition	E4 Communications	0.2	0.5	0.7	0.5
C2 Water and sanitation	E4 Communications	0.3	0.5	0.7	0.4
C4 Personal security	E4 Communications	0.3	0.5	0.7	0.4
C5 Access to basic education	E4 Communications	0.3	0.6	0.7	0.4

Regarding these results, we can observe that the estimated value of the incidence of actions for nutrition well-being and basic medical assistance communications had a score of 0.2. Nevertheless, nutrition and medical assistance have a strong average incidence in access to basic education, and basic education has a strong incidence on competitiveness. Therefore, two effects exist that modified the direct incidence value on communications, resulting in a secondary (forgotten) effect of average incidence on basic medical assistance and nutrition on communications. Likewise, the incidence estimated value from actions for clean water and sanitation, social security and access to basic education had a score of 0.3 (low incidence). But as we ran the model, we realized that these social well-being indicators present secondary incidences in the communications indicator. With these results, we can observe that if we further improved nutrition policies and basic medical assistance, clean water and sanitation, social security and access to basic education, we can indirectly expect a significant improvement in the communications indicators. This moderate incidence can be observed in Figure 1.

Likewise, there are three medium incidences: water and sanitation, personal security, and basic education access. These are presented in Figures 2, 3 and 4, and show a maximum aggregated effect in the communications indicator of 0.4.

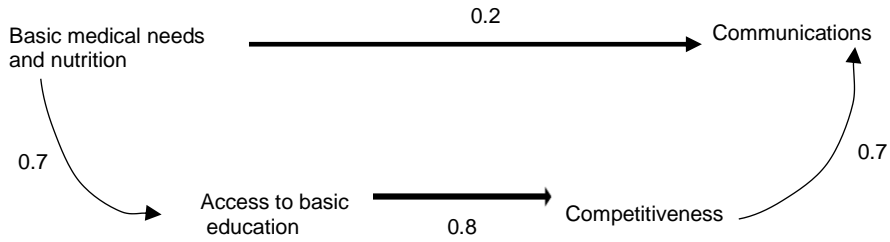


Figure 1. Moderate incidence of basic medical needs and nutrition in communications

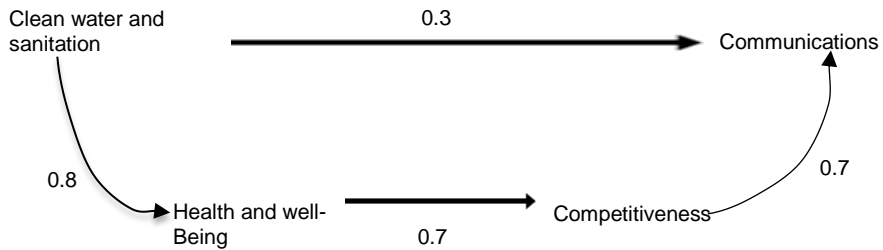


Figure 2. Medium incidence of clean water and sanitation in communications

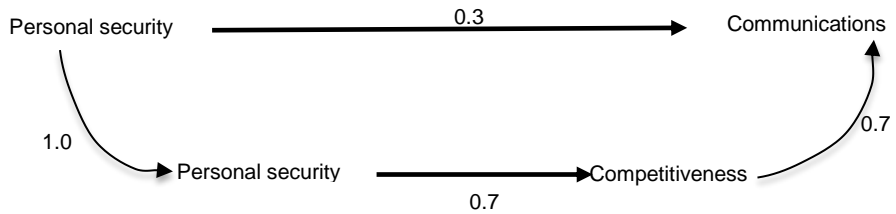


Figure 3. Medium incidence of personal security in communications

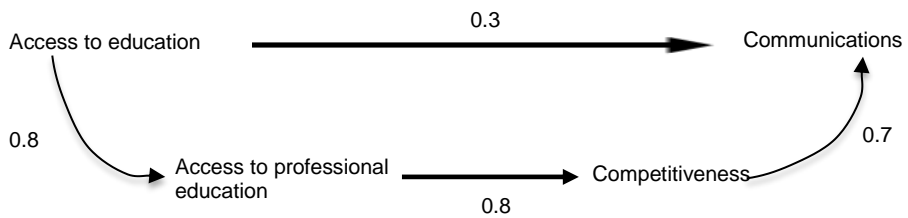


Figure 4. Medium incidence of access to basic education in communications

This study's results show that using expert valuations of sustainability policies, we can very well identify the social progress components that affect the sustainable development of Mexico. We could only identify maximum forgotten effects in the nutrition components, and in basic medical assistance, water and sanitation, personal security and access to basic education that have impacts on the communications and infrastructure indicators. If we wanted to positively impact this sustainable development indicator, we should take into account policies aimed at these indicators to improve a country's infrastructure and communications.

4. CONCLUSIONS AND FURTHER WORK

It is indisputable that the results of the social progress index developed by the Social Progress Imperative contribute to the generation of programmes and public policies that contribute to the sustainable development of the country and therefore to the well-being of the citizens and their resources. However, by applying forgotten effects theory to an emerging country's case (Mexico), we have demonstrated that some effects have not been fully considered since we detected indicators from this index that were not manifested in the country's sustainable development outcomes. This is because our model considered indirect incidences, and if we had taken them into account, they could have contributed to better decision-making.

This model showed that, for Mexico, indicators such as nutrition and basic care assistance, water and sanitation, personal security and access to basic education have not been fully considered since the cumulative effect of other indicators such as infrastructure and communications are eliminating positive incidences that should be incorporated to consolidate the efforts of public policies and programmes regarding the sustainable development of the country. This paper points out the need to produce a broader study about incidence in indicators of social progress in order to develop stronger programmes and public policies for the sustainability of emerging nations. Likewise, for future lines of research, it is recommended to measure competitiveness' cause-effect to determine its impact on sustainable national development. With the results obtained in this study, we can clearly identify that the infrastructure and communications areas have been an indicator of "forgotten effects" in this development area. As such, strengthening the social progress indicators already mentioned will significantly improve this area and thus the sustainable development of the country.

ACKNOWLEDGE

This document is part of the project supported by the "Red Iberoamericana para la Competitividad, Innovación y Desarrollo" (REDCID), number 616RT0515 in "Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo" (CYTED).

REFERENCES

- Alfaro, G., Zaragoza, A., Alfaro, V., & Gil, A. (2018). Innovation capabilities and innovation systems: A forgotten effects analysis of its components. Paper presented at MS`2018, Girona, Spain.
- Alimonda, H. (2011). *La Naturaleza Colonizada. Ecología política y minería en América Latina*. Buenos Aires, Argentina: CLACSO.
- Baumgärtner, S., & Quaas, M. F. (2010). What is sustainability economics? *Ecological Economics*, 69(3), 445-450.
- Bermejo, R. (2014). *Del desarrollo sostenible según Brundtland a la sostenibilidad como biomimesis*. Bilbao, España: Hegoa.
- Cabrera Tapia, C. F. (2015). *Evaluación social de la política pública para el desarrollo. En enfoque económico, social y ecológico*. México: UMSNH.
- Capra, F. (2002). *La trama de la vida. Una nueva perspectiva de los sistemas vivos*. Barcelona, España: Anagrama.
- Constanza, R. (1999). *Una introducción a la economía ecológica*. España: Grupo Editorial Patria.
- García, R. (2006). *Sistemas complejos. Conceptos, método y fundamentos epistemológica de la investigación interdisciplinaria*. Barcelona, España: Gedisa.
- Gento, A., Lazzari, L. L., & Machado, E. (2001). Reflexiones acerca de las matrices de incidencia y la recuperación de efectos olvidados. *Cuadernos del CIMBAGE*, 4, 11-27.
- Gil-Lafuente, A. M., & Bassa, C. L. (2011). The forgotten effects model in a CRM strategy. *Fuzzy Economic Review*, 16(1), 3-19.
- Gil-Lafuente, A. M., González, F., & Flores, B. (2015). Teoría de los efectos olvidados en la incidencia de la actividad económica en la calidad de vida de los habitantes y cuantificación de los efectos para un reequilibrio territorial. *INCEPTUM*, 10(19), 105-124.
- Gasparatos, A. (2010) Embedded value systems in sustainability assessment tolls and their implications. *Journal of Environmental Management*, 91(8), 1613-1622.
- Guillén-Romo, A. (2007). La teoría latinoamericana del desarrollo. Reflexiones para una estrategia al neoliberalismo. In G. Vidal, & A. Guillén-Romo (Eds.), *Repensar la teoría del desarrollo en un contexto de globalización. Homenaje a Celso Furtado* (pp.489-518). Mexico: CLACSO.
- Kaufmann, A., Gil-Aluja, J. (1988). *Modelos para la investigación de efectos olvidados*. Vigo, España: Milladoiro.
- Kaufmann, A., Henry-Labordère, A. (1977) *Integer and Mixed Programming: Theory and Applications*. Academic Press. USA
- Martínez Allier, J. (2001). *Economía Ecológica y Política Ambiental*. México: Fondo de Cultura Económica.
- Munasinghe, M. (1993). Economy wide Policies and the Environmental. Lesson from Experience. *World Bank Environment Paper*, The World Bank, Washington.
- Rodríguez-Rubinos, J. M., Ramírez-Reyes, M. A., & Díaz, V. (2008). Forgotten effects of the causality relationships in the knowledge Management in tourism organizations. *Revista de Métodos Cuantitativos para la Economía y la Empresa*, 5, 29-48.
- Santos, R., Wennersten, R., Leal, O. (2009). *Strategies for competitiveness and sustainability: Adaptation of a Brazilian subsidiary of a Swedish multinational corporation*. *Journal of Environmental Management* 90 (12) p- 3708-3716.
- SEMARNAT (2018). Indicadores Básicos del Desempeño Ambiental de México.
- Vera, P. (2011). *La sustentabilidad y la teoría de las partes interesadas bajo el enfoque de los sistemas complejos*. Mexico: Cuadernos de complejidad.
- World Bank (2016). Talking on inequality, recovered in July 2018 from <<https://openknowledge.worldbank.org/bitstream/handle/10986/25078/210958ovSP.pdf?sequence=20&isAllowed=y>>