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Methodology to Assess Sustainable Indicators for a Socially Responsible Company in the Polymers Manufacturing Sector

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Abstract: The aim of this paper is to develop a methodology to assess the sustainable indicators for a socially responsible company operating in the chemical industry sector and to evaluate those indicators within a specific chemical industry facility that manufactures polymers.

When drafting this document the challenge to face was how Mexican companies labeled as Socially Responsible Companies, could be sustainable, considering the Triple Bottom Line of sustainability: social, environmental and economic as well as achieving the Principle of Sustainable Development: *to meet actual needs without compromising the ability of future generations to meet their own*.

The guiding method of this research was a qualitative analysis of different tools, with a pragmatic approach gained due to professional experience in the chemical industry sector.

In general, conditions in the Mexican manufacturing sector are not optimal considering that most petrochemical products, including fuels, are imported; being this energy supply key to keep manufacturing facilities operational.

A review of the economic theory that underlies social management and sustainable development was included. The financial results of the private companies as their most important objective, as well as the environmental care and community welfare are government accountability; both are supported in the neoclassical economic theory, though this is not justified from an economics of natural resources point of view.

Modern economy encompasses several theories regarding the environment: circular economy, economy, economy of natural resources and environmental taxes were very useful as a framework of public policies implemented in Mexico. One of our major concerns relates to green taxes. Due to our eroded economic conditions any type of tax, including environmental taxes, is carefully considered by the Government in order not to affect competitiveness with Mexican companies. As soon as the Climate Change Bill was enacted in 2012, green taxes were levied on carbon and fossil fuels in order to reduce carbon dioxide emissions;

unfortunately, it is expected to get significant results in a longer time. Even the Energy Transition Law enacted in 2015 offered the opportunity to create new sources of renewable energy, but it is evident that the petrochemical industry holds a significant role in the Mexican energy market.

The persistence of intergovernmental conflicts such as the rivalries between federal and provincial environmental governments, as well as costly bureaucratic structures, resulted in a poor performance in the environmental regulation. Under these circumstances, the private industry, specifically the chemical industry, must strive to work efficiently to avoid any environmental impact, even regulation does not include any specific action. The chemical sector represents industries where preventive pollution practices are well recognized, although they are not a priority.

Indicators are the only way to monitor environmental performance. The methodology designed considered the identification of indicators in each and every one of the stages, according to the *Intersection Circles Model*. Due the broad scope of the themes, this work deepens the search for economic-environmental indicators; and under a shorter scope, the environmental-social indicators.

The methodology describes the way to find indicators in each one of the three stages: (a) individual: those aligned to the legal compliment; (b) sustainable development indicators: interrelated indicators, those addressed in the intersection of two circles. These indicators are: social-economic, environmental-economic and social-environmental; (c) the last stage referred to are the sustainable indicators (those aligned to the sustainable development principle) and addressed in the intersection of three circles. Sustainable indicators were defined with the contribution of a specialized resins chemical company (polymers manufacturer).

The results obtained in the first stage made clear that the indicators documented by companies are based solely on legal requirements, and are in no way related to social or environmental impacts.

Conclusions included further lines of investigation. In regards to the government, to monitor sustainable indicators that should be reported from the industry; this information could be an input to design public environmental policies in order to contribute to the growth of Mexican economy. In regards to the academy, to work closely with government and private sectors in order to make applied investigations. Finally, in regards to the industry, to implement a Socially Responsible Model within their strategies and pursue the objectives proposed. An interrelation among these three groups to participate as a team was a reiterated recommendation.

Lastly, we consider that this research will offer important contributions to companies that have a social responsibility, by supplying a methodology, which will enable them: (a) to identify stakeholders with whom the company has social responsibilities; (b) to identify the potential social, environmental and economic impacts to the stakeholders and prevent them; and (c) to include the Socially Responsible Model proposed, in order to render economic benefits by means of socially responsible practices.

I. PREFACE

1.1. Background

A wide variety of opinions from the Mexican businesspeople associated with their social responsibility depend on several factors: historical, economic, social, political and cultural.

A company's commitment to their social responsibility means the inclusion of social liabilities as well as their usual responsibilities of the firm's business strategies. However, including the social aspect emphasizes the incorporation of other aspects, such as a wider economy, stakeholders other than shareholders and environmental features.

For some time now, developed countries have urged specific sectors — investors, consumers and public opinion — to assume their social responsibility. These groups have been working together under the premise that not being socially responsible would mean higher costs and fewer benefits.

"Our common future", also known as the Brundtland Report, was published in 1987. It targeted multilateralism and aligned the negative externalities, looking for a sustainable development path defined in the report as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

The concept of sustainable development includes the recognition from the Socially Responsible companies to work for equilibrium under the Triple Bottom Line (TBL): environmental, social and financial in their operations and an ethical commitment towards their stakeholders.

Corporate Social Responsibility (CSR) represents a new vehicle for community economic development, education, environmental protection, health promotion and a wide range of other activities.

Annual Corporate Social Responsibility reports include information about the environmental, social and financial performance. Environmental legal compliment and philanthropic donations are common issues. However, very few companies consider their ethical conduct and good governance to make a meaningful difference in their communities; human rights initiatives to improve the quality of life of the workforce and their families, and a continuous improvement to build sustainability into every business operation and process.

Lying behind the CSR reports is the belief that the firm's main objectives are not sustainable due to the ignorance of a wide range of other actors (stakeholders) and the welfare of future generations.

Thus, the content of the reports is uncertain, not only regarding core indicators (common in all companies) but also about sustainable indicators, which must also be considered.

The research included in this paper is about the design of a methodology to find out the particular sustainable indicators for each specific manufacture process. It focuses on Mexican chemical companies and comprises a Corporate Social Responsibility Model integrated into a business model.

1.2. Research Context

Environmental pollution from operational manufactures creates markets failures. The cost of pollution is not borne by the factory but shared by society or transferred to future generations. Negative externalities should be avoided (prevention approach) or corrected (afterwards). Unfortunately, costs to restore to initial conditions are generally very high and, mostly, the impacted areas are kept untreated.

It has been clear that in the last century, the Earth's natural environment and resources have changed, and private and public organizations play a key role in the future of the environment. The economic theory that underlies this research refers to the classical dichotomy between governments and corporations to face the costs of the negative externalities. Friedman (1970) declares that private companies should continue making profits while governments should deal with public goods and externalities.

Based particularly on environmental and social factors, most CSR activities aim at reducing negative externalities (e.g. pollution abatement) or generating positive externalities and privately providing public goods (e.g. financing hospitals). Issues arising from the existence of public goods and externalities are the preserve of the government.

On the other hand, many environmental investments seem to be aimed at reducing the costs of complying with existing regulations, thereby suggesting that the firm's environmental performance and regulations are complements rather than substitutes.

The point is that even CSR plays an important role in society; it must be involved in the restoration of the environmental impacts they have provoked.

The recent trajectory of the chemical industry in Mexico is evidenced by its contribution to the country's gross domestic product (GDP) – in 1995 the industry accounted for 5.3% of GDP (the world average was 4.6%), but its contribution had fallen to only 1.2% of GDP by 2012, and 1.8% by 2014. The reasons for the downward trend are several, but one of the most important causes is that many of the raw materials in chemical production are imported, a factor that contributes to the country's significant trade deficit. This situation has led businesses to reduce investments for operational improvements to minimize environmental and health risks.

In the recommendations of this work, we have emphasized in the prevention and innovation to increase protective measures and the use of indicators to measure these improvements.

It is evident that public institutions are also involved in the protection of the environment and population health. The necessity of a well-defined legal frame is very important as well as their initiative to conform research task groups among the three parties: industry, academy and government to define protective measures for Mexican natural resources and rates to use them.

1.3. Research Objectives

The objectives of this research are: (1) define de sustainable indicators for a chemical manufacture operation in the polymers sector; (2) define a methodology to establish sustainable indicators that will help CSR chemical companies monitor their sustainable performance along the TBL indicators: financial, social and environmental.

This procedure will help them to identify the stakeholders with whom they have a social responsibility and their needs.

1.4. Results and Contributions

- A design methodology to identify the sustainable indicators in a chemical manufacture process. This tool clarifies the understanding of the term "sustainable". In most cases, "sustainable" refers only to environmental topics missing the origin of the term, related to the definition of "sustainable development".
- This methodology is applicable to any chemical manufacture process and could be used also to identify the sustainable indicators of other departments linked to manufacture such as supply chains.

II. UNDERLYING ECONOMIC THEORY

2.1. Behavior and performance of a corporation

Performance studies of businesspeople started at the beginning of the 20th century. Keynes (1883-1946) recognized the entrepreneur. In his work about the Aggregate Demand he stated that private sector decisions sometimes lead to inefficient macroeconomic outcomes which require active policy responses by the public sector, in particular, monetary policy actions by the central bank and fiscal policy actions by the government, in order to stabilize output over the business cycle. Keynesian economics advocates a mixed economy – predominantly the private sector, but with the intervention of government during recessions.

A fiscal policy is the means an entrepreneur will be able to invest in order to increase production rates, which will as well improve employment, wages and consequently a higher consumption.

Keynes thought that true entrepreneurs were those who promote new structures pursuing their own progress along with social progress.

Schumpeter (1883-1950) disagrees with Keynes in some aspects. In his *Theory of Economic Development*, he states that development consists in the carrying out of new combinations for which possibilities exist in a static setting. These changes can be brought through innovation.

Schumpeter assumes a perfectly competitive economy, which is in a stationary equilibrium. This state is characterized by the term "circular flow", which repeats itself through time at a constant rate. In the circular flow, the same products are produced in the same manner year after year.

Before the 70s, firms functioned ignoring criticism and working to comply with the shareholders' requirements. In 1979, Friedman mentioned that the only social responsibility of businesspeople was to maximize their profits, be accountable to face the externalities costs, and provide public goods. This position is known as classical dichotomy.

For North (1993), the long-term economic impact depends on the incentive structures designed from political and economic institutions. Thus, development is not influenced by an increase in productivity but by financial and political regulations and society in general to become more productive. The idea is how incentives should be designed to boost investments in physical or human capital, greater advance in technologies and larger creativity.

III. RESEARCH METHODOLOGY

3.1. Scope

The scope of the investigation comprises only the stage of manufacture, excluding the supply chain and the use of the end product, due to the extension of those both themes.

Regarding sustainable indicators, the economic- environmental indicators were the targets. The environmental- social and economic-social indicators were only mentioned in the first two levels, according to the sustainability model chosen. This responds to the limited access to information about social issues in the private sector.

3.2. Sustainability Model

Several sustainability models are commonly supported by the Triple Bottom Line (TBL): economic, environmental and social. The selection of the model for this research considered the feasibility to adapt it to a manufacturing industrial process.

Carroll's Pyramid of Corporate Social Responsibility, (Bowie, 2012) encompasses four categories: economic responsibilities, legal compliance, ethics and philanthropy. It places the economic category as the main category on which the rest depend on.

The Concentric Circles Model is similar to the Pyramid Model. It considers the economic category as the base of the Corporate Social Responsibility performance and pays special attention to the interactions among different social responsibilities throughout the organization (Suárez, 2012).

The last model studied was the Circular Intersection Model. It considers the possibility of interrelation among the different categories and denies any hierarchy structure (Quiroga, 2009).

Their design is compatible with Keith Davis's philosophy (1960) and his "Iron Law of Responsibility" (1973).

The latter was considered appropriate for the investigation, since there are no hierarchies among the circles, which corresponds to the TBL, and considers points of interrelation and equilibrium among them (Figure 3.1).

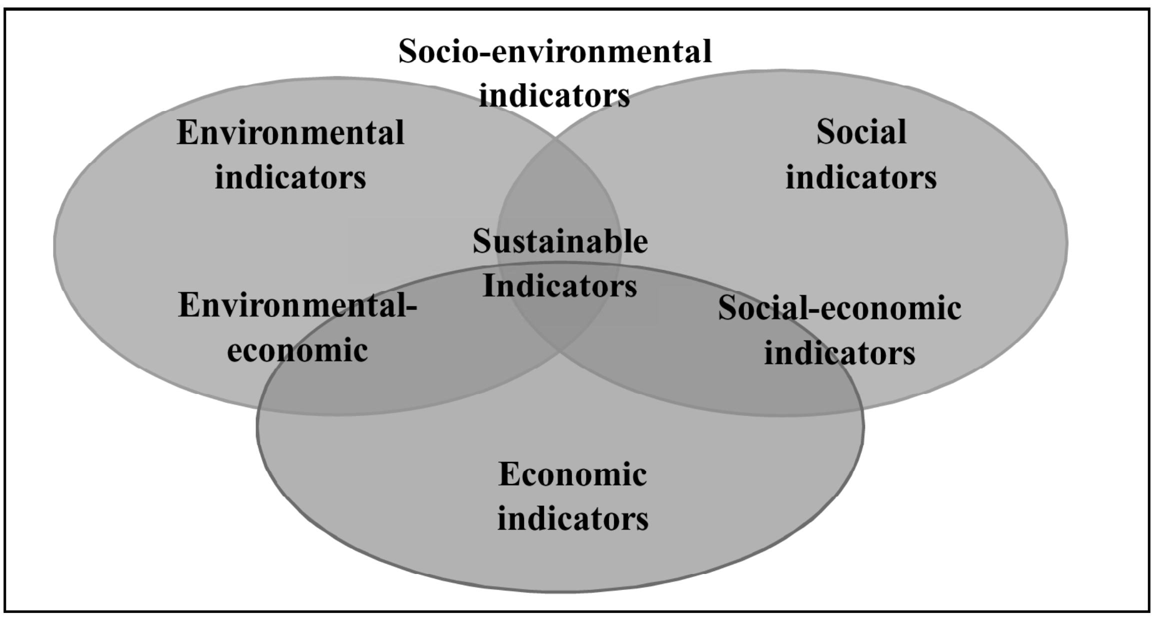


Figure 3.1. Intersection Circular Model

3.3. Reference Patterns

3.3.1. Sustainable Production

Several institutions have worked in the definition of the manufacture process indicators. For the purposes of this investigation, the following patterns were used as inputs.

- Lower Center for Sustainable Production (LCSP) from the University of Massachusetts Lowell. They proposed indicators for a sustainable manufacture (Figure 2). Sustainable manufacture means the product manufacturing where environmental impacts are minimized; the conservation of natural resources and energy efficiency are taken into account; where employees', consumers' and communities' safety is considered; and are reasonably economic. They also aim for continuous improvement (Vesela & Jurczyk, 2001).

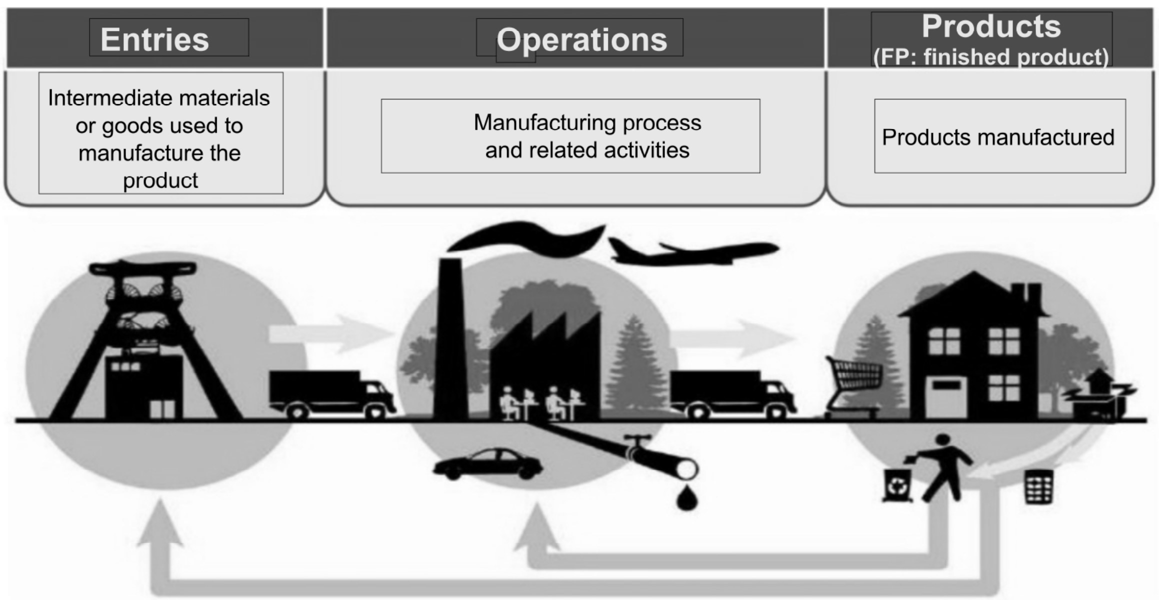


Figure 3.2. Sustainable manufacture process according to the LCSP

Reference: OECD (2011).

- OECD green manufacture and environmental impact indicators. These indicators consider a global economic vision (OECD, 2011).
- ISO 14031: International standard focused on industrial processes (ISO 14031, 1999).

3.3.2. Social responsibility reports guidelines

Measurement is the key toward providing the necessary information for decision-making, benchmarking achievements and promoting continual improvement.

Reviewing social responsibility reports from manufacture companies aimed to know the indicators they usually report. It was necessary to have a very representative guideline of a major use. The selected guideline was the Global Reporting Initiative (GRI) Guide, version 3.1, which includes 94 indicators compiled in six groups.

3.4. Methodology

The methodology consisted in the definition of the indicators in each level of the Sustainable Development Model (intersection circles) chosen for the investigation. The indicators from the first level (external and further away from the center) were used as input for the second level; subsequently, these latter were the input for the last level (intersection of the three circles at the center), sustainable indicators, and objective of the research.

3.4.1. First level. Definition of the individual indicators: economic, environmental and social

We intend to identify the representative indicators at this external level. The methodology used was a bidirectional analysis among the indicators from all reference patters chosen.

Indicators from each source were identified under specific codes: LCSD with lowercase letters, OCDE with Roman numerals, and ISO with capital letters. GRI indicators had their own codes: E (economic), EN (environmental), L (labor), HR (human resources), S (society), PR (product stewardship). PR was not taken into account because it was not included in the scope of this investigation.

The bidirectional analysis gave as a result forty-four indicators for a sustainable operation, and showed that GRI does not include indicators from a sustainable operation and environmental impact indicators either.

From the forty-four indicators, thirty-four came from the alignment between GRI and LCSD (the names of the indicators were the same as the GRI's) and 10 from the OECD, referred to as environmental impacts. Figure 3.3 shows an extract of the interrelation analysis made at this level.

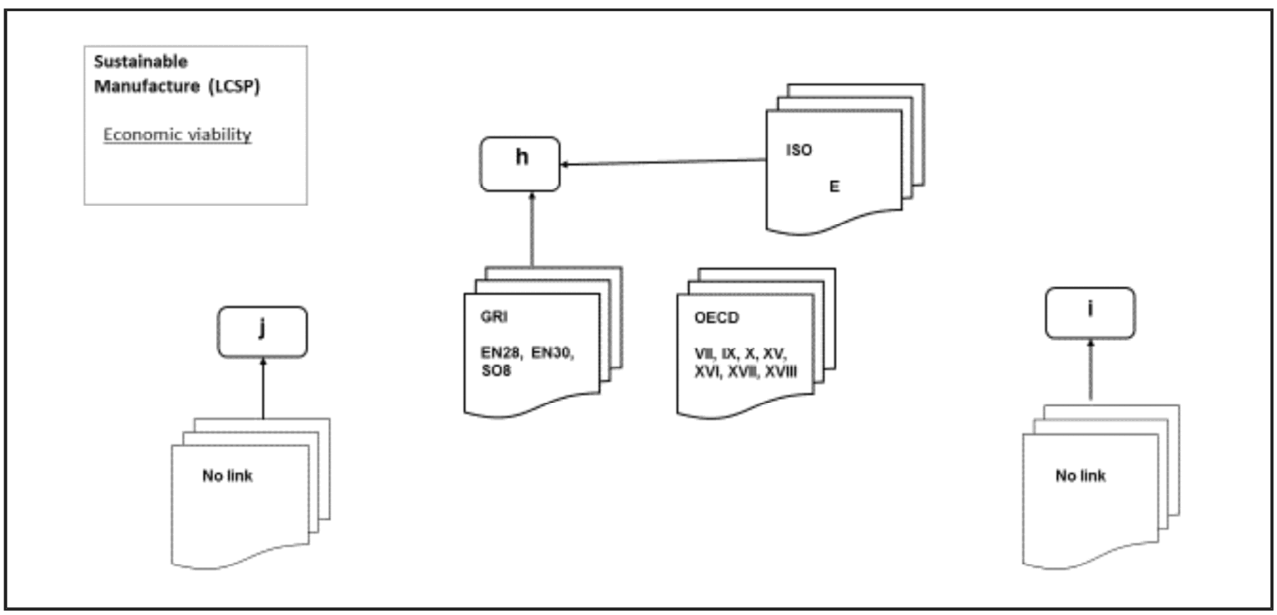


Figure 3.3: Interrelation between indicators groups

Reference: Ferat, 2016

3.5.2. Second level. Interrelated indicators or sustainable development indicators

The next level in the Circles Intersection Model is the interrelated indicators or sustainable development indicators. At this stage, socio-economic, economic-environmental and socio-environmental interrelations were the object of analysis.

The first step in the investigation led to identify that the best way to work with interrelated indicators was through systemic schemes.

The model chosen in the research was the interrelated socio-ecological system of the Statistics Division of CEPAL (Economic Commission for Latin America) applied to the project ESALC (Sustainability Evaluation in Latin America and the Caribbean) in 2004. This project performed by the Sustainable Development from CEPAL pursued the definition of public policies in the countries of the region, through a systematic and integrated evaluation combining environmental, social and financial indicators. Results were included in Badesalc (the project database).

The interrelated socio-ecological system model for Acumar, Argentina, is shown in Figure 3.4.

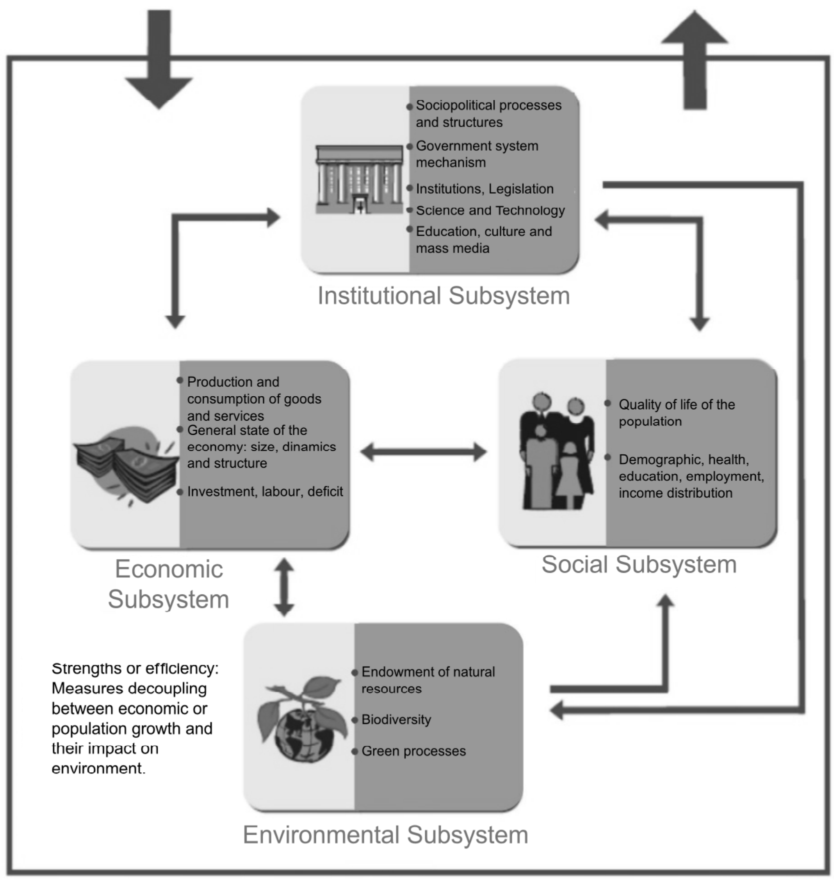


Figure 3.4. Scheme of the interrelation among economic, social and ecological systems

Reference: ACUMAR (n.d).

ESALC identified four subsystems: social, economic, environmental and institutional. The Figure shows that the interrelationships or functional couplings among subsystems include internal and external issues to a private company:

- Economic-institutional subsystem: interrelations refer to policies, economic instruments, tax payments, and cash flux, among others.

- Economic-environmental subsystem: includes flows of environmental goods and services (such as natural resources) and their economic impact or direct consumption, as well as the environmental impact of the waste generated from manufacture or consumption.
- Socio-economic subsystem: includes the effects of consumption on the quality of life and supply and demand in labor markets; the urban environmental impacts on the quality of life.
- Socio-environmental subsystem: includes the effect of natural environmental impact on human health.
- Socio-institutional subsystem: includes the effects of the institutional subsystem on the social environment (education, security, among others); impact of the quality life on the institutions (influence of the poverty rate on the social changes).
- Institutional – environmental subsystem: include phenomena such as institutional and politics impacts on the environmental subsystem (protected natural areas, military impacts from military actions and terrorism).

Badesalc included a group of indicators interrelated for each subsystem (Schuschny & Soto, 2009). This group of interrelated indicators was refined and adapted to a manufacture process and complemented with additional information from studies performed by the School of Economics of the National Autonomous University of Mexico (UNAM). Subsequently these indicators were segregated into two groups to differentiate endogenous and exogenous aspects of a manufacture process.

The forty-four indicators from the first level of the intersection circle were aligned to the Badesalc complemented indicators.

Hence, only the indicators from the first level that could be aligned to the Badesalc complemented indicators were considered as interrelated or sustainable development indicators. The interpretation of the results could be exemplified as follows:

EN28 indicator: "Monetary value of significant fines and total number of non-monetary sanctions for non-compliance with environmental laws and regulations" was defined as an interrelated indicator because it could be aligned with the exogenous indicator: "expenses for fines, donations, sanctions and costs of corrective actions". It could also be aligned with an endogenous indicator: "cleaner production; expenses for compliance". EN28 was classified in the interrelated group: economic-environmental.

Table 3.1 shows the results of the second level indicators named interrelated or sustainable development indicators.

Table 3.1
Interrelated or sustainable development indicators

Issue	*Issue*	*Indicator*	*Code*
From Social	To Economic	• Average hours of training per year per employee, disaggregated by sex and employee category.	LA10
		• Percentage of employees receiving regular performance and professional development evaluations.	LA12

contd. table 3.1

Issue	*Issue*	*Indicator*	*Code*
		• Percentage of total workers represented in joint health and safety committees of management-employees .established to help control and advise on health and safety programs in the workplace.	LA6
		• Rates of absenteeism, occupational diseases, days lost and number of work-related fatalities by region.	LA7
From Social	To Institutional (private company)	• Skills management and continuing education programs that promote the employability of workers and supports them in managing the end of their careers.	LA11
From Social	To Economic	• Percentage of operations where development programs, impact assessments and local community participation have been implemented.	SO1
		• Operations with significant or actual negative impacts on local communities.	SO9
		• Prevention and mitigation measures implemented in operations with possible or actual negative impacts on local communities.	S10
From Institutional (private company)	To Social	• Programs of education, training, counseling, prevention and risk control that apply to workers, their families or members of the community with serious illnesses.	LA8
		• Health and safety issues covered in formal agreements with trade unions	LA9
From Institutional (private company) and From Environmental	To Environmental To Social	• Water productivity (m^3/resource dollars).	IX
From environmental	To Economic	• Prevention and mitigation measures implemented in operations with possible or actual negative impacts on local communities.	EN8
		• Percentage and total volume of recycled and reused water.	EN10
		• Energy Productivity	VII
		• Energy savings due to conservation and efficiency improvements.	EN5
		• Direct energy consumption by primary source.	EN3
From Environmental	To Social	• Total, direct and indirect emissions of greenhouse gases.	EN16

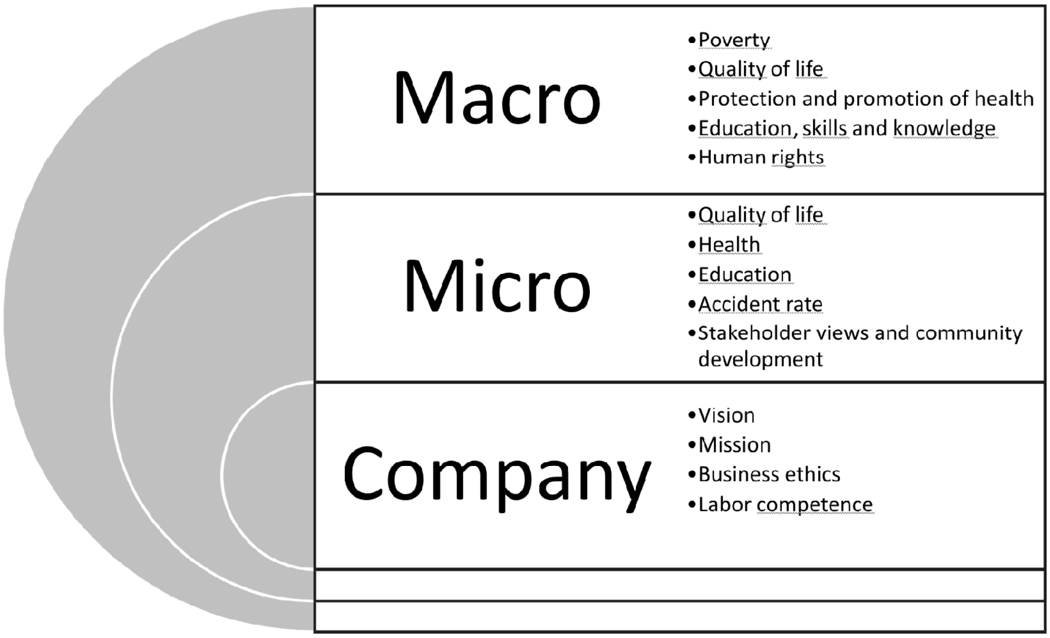
contd. table 3.1

Issue	*Issue*	*Indicator*	*Code*
From Economic	To Environmental	• NOx, SOx and other significant air emissions by type and weight. • Strategies and actions implemented and planned for the management of impacts on biodiversity. • Indirect energy consumption by primary source. • Initiatives to reduce indirect energy consumption and the reductions achieved with these initiatives. • Initiatives to reduce greenhouse gases and reductions achieved with these initiatives. • Initiatives to provide energy-efficient or renewable energy-based products and services and reductions in energy consumption as a result of such initiatives. • Generation of waste (ton / year), or filling area occupied in the disposal. • Total weight of waste managed according to type and method of treatment. • Description of lands adjacent to or located within protected natural areas or areas of high biodiversity not protected. • Carbon price. • Taxes on fuels. • Productivity of materials (ton/dollars). • Cost of significant fines and number of monetary sanctions for non-compliance with environmental regulations. • Breakdown by type of total environmental expenditures and investments. • Fossil fuels, water and subsidies.	EN20 EN14 EN4 EN7 EN18 EN6 XIII EN22 EN11 XVIII XVI VIII EN28 EN30 XV
From Economic and From Social	To Environmental and To Institutional (private company)	• Total number and volume of most significant accidental spills.	EN21
From Economic and From Economic	To Environmental and To Social	• Price of carbon (percentage of energy).	XVIII
From Economic	To Social	• Direct and distributed economic value, including expenditures, operating costs, employee compensation, donations and other investments in the community, undistributed profits and payments to capital providers and governments.	EC1

Reference: Ferat, 2016

Thirty six indicators in total.

An extract of the interrelation analysis from each issue (environmental, economic and social) is shown in Figures 3.5, 3.6, and 3.7.



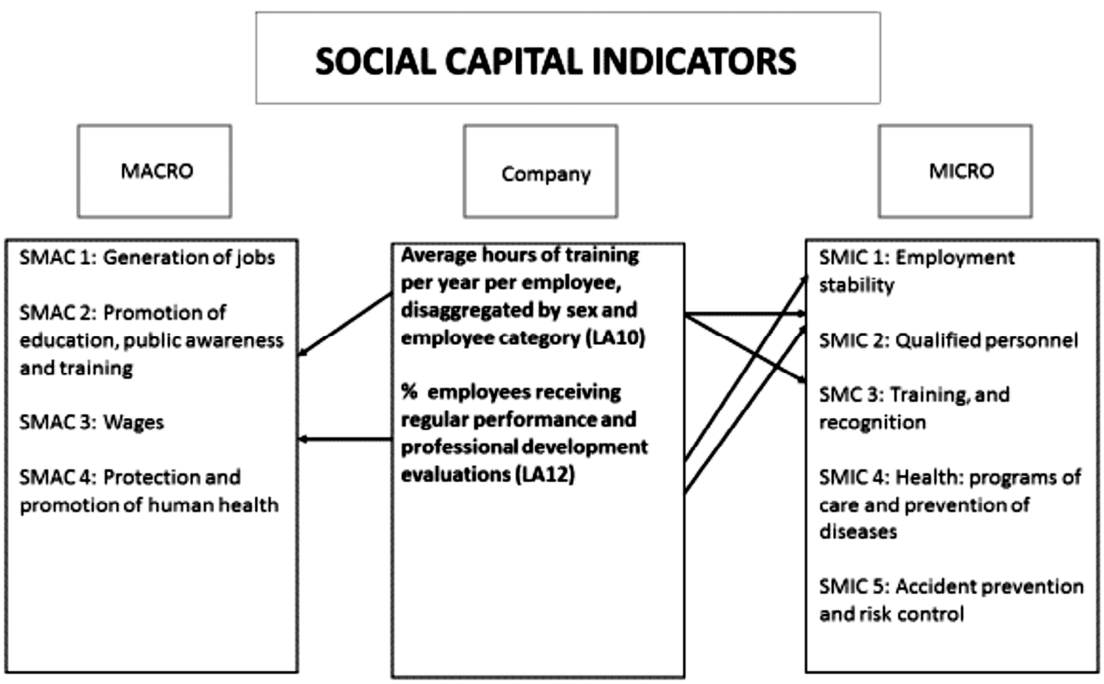
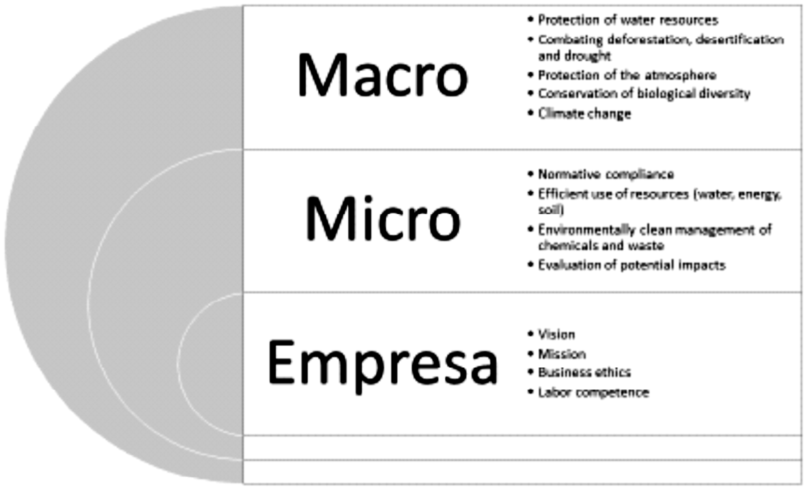


Figure 3.5. Social aspects and the interrelation analysis

Reference: Ferat, 2016



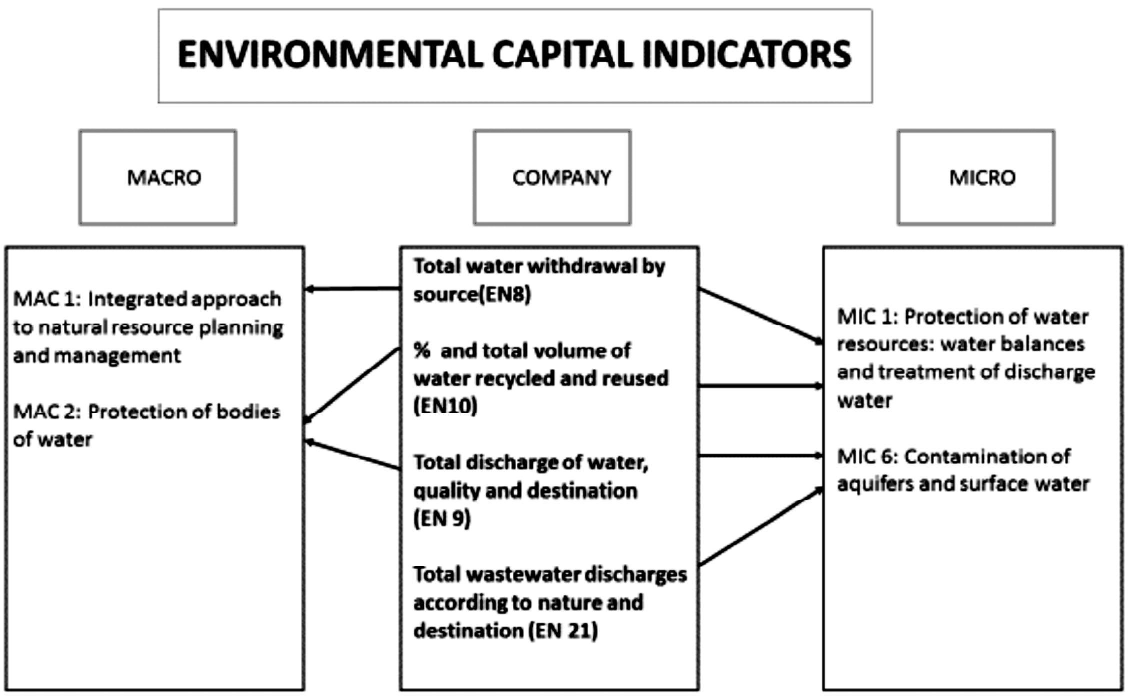


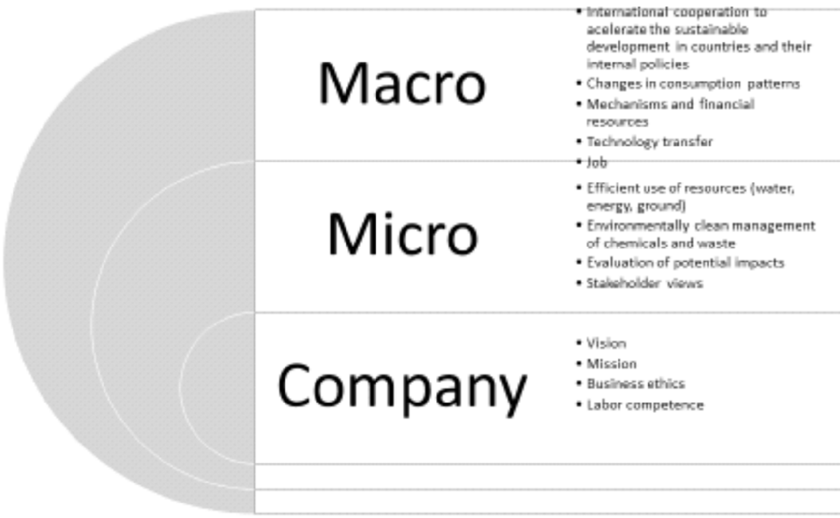
Figure 3.6. Environmental aspects and the interrelation analysis

Reference: Ferat, 2016

3.4.3. Third level. Definition of the sustainable indicators

The definition of the interrelated indicators in the second level was important because it means that there is a step further towards sustainability under an integrated focus.

At the last level, the investigation had to be addressed to comply the requirement: *to meet the needs of the present without compromising the ability of future generations to meet their own needs*.



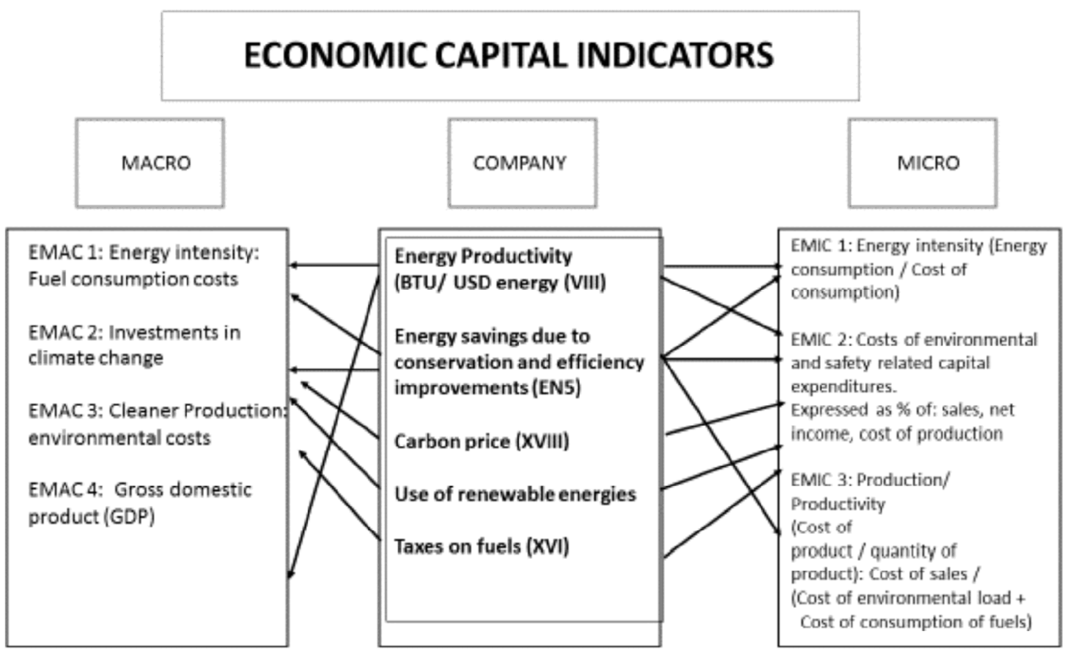


Figure 3.7: Economic aspects and the interrelation analysis

Reference: Ferat, 2016

The scheme or "syndromes", a powerful tool developed by CEPAL in ESALC studies was used at this level.

Syndromes are methodological schemes supported in an interrelation analysis. They represent a cause-effect analysis and consequently identify environmental degradation risks. The head of the arrow means impacts, and the tails are the causes. Syndromes schemes also identify "aggravating factors", which is to say, factors that could increase the severity of the impact.

To evaluate environmental impacts of a manufacture facility, it is necessary to collect initial and current geological, environmental, social and economic conditions of the region where the operational plant is located. Sources of fresh water and their physicochemical and biological conditions, habitat types in the zone, maximum use of natural resources to allow their regeneration, are examples of the information used. A polymer company that manufactures specialized resins for automotive parts and food containers in Mexico provided information at this level of the research.

Figure 3.8 includes a logic diagram that defines the environmental and health impacts, and their costs.

ESALC studies include three syndromes: utilization, development and contamination (Tudela, 2002). Development syndrome also includes syndromes related to three major environmental problems in Mexico: (1) soil structure changes, (2) hydric insecurity, and (3) vulnerability facing natural disaster (caused by the climate change).

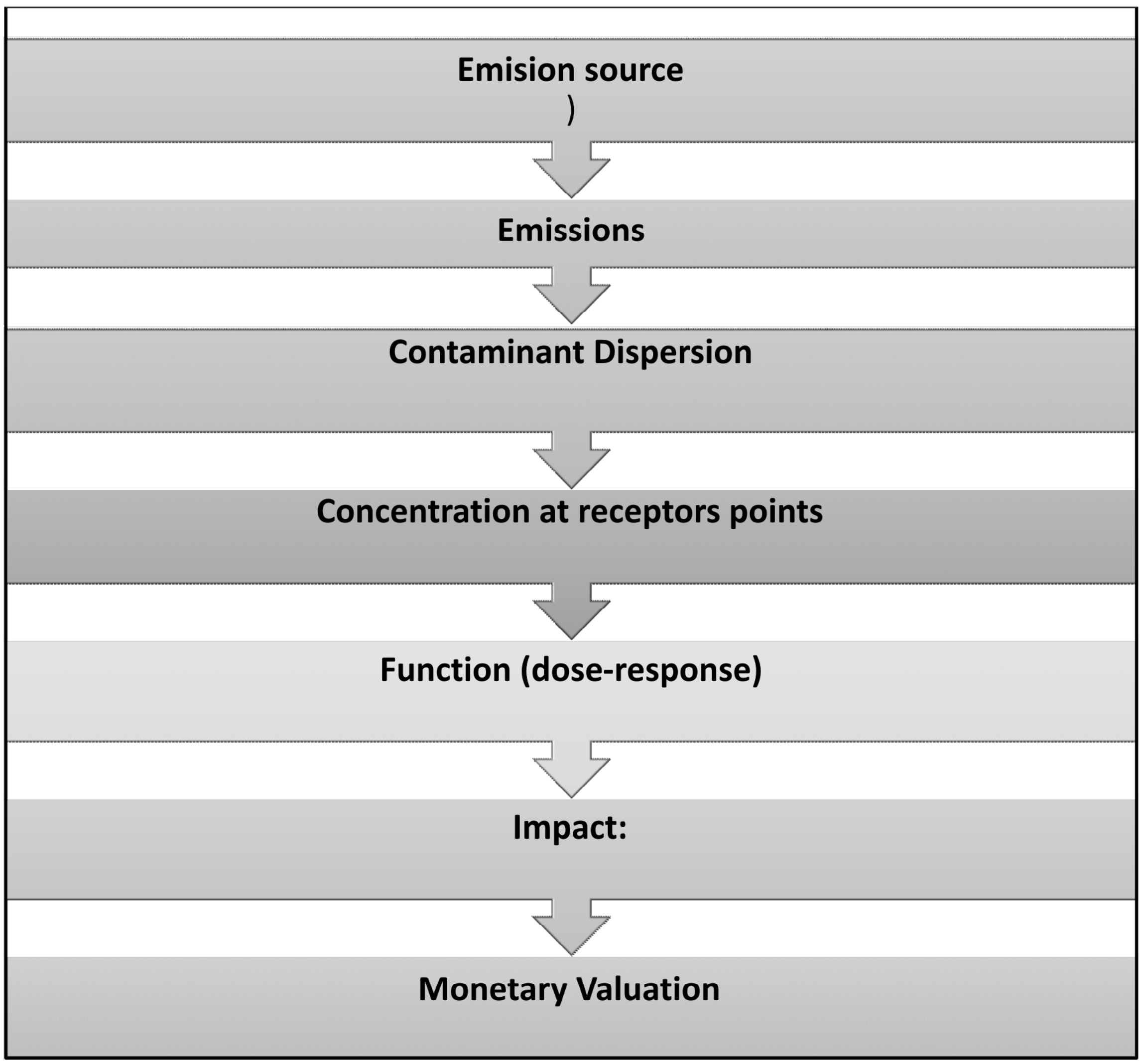


Figure 3.8. Logic diagram to define the environmental and health impact and their costs

Reference: Sánchez, Porras &. Gutiérrez.

After analyzing the information of these three syndromes and the resultant indicators from the second level of the sustainable model, a new Syndrome named "industrial operation syndrome" was designed, which is shown in Figure 3.9; their aggravating factors are included in Table 3.2.

The impacts of aggravating factors were very important inputs in identifying sustainable indicators. The interrelation analysis diagrams are included in the Figure 3.10.

To name the sustainable indicator it was necessary to have a clear understanding that may lead to identifying the quantified measure to monitor it during its improvement.

Private companies need to rank, monitor, measure and improve the sustainable indicators. Expenses incurred in these works are common, and they require many man-hours.

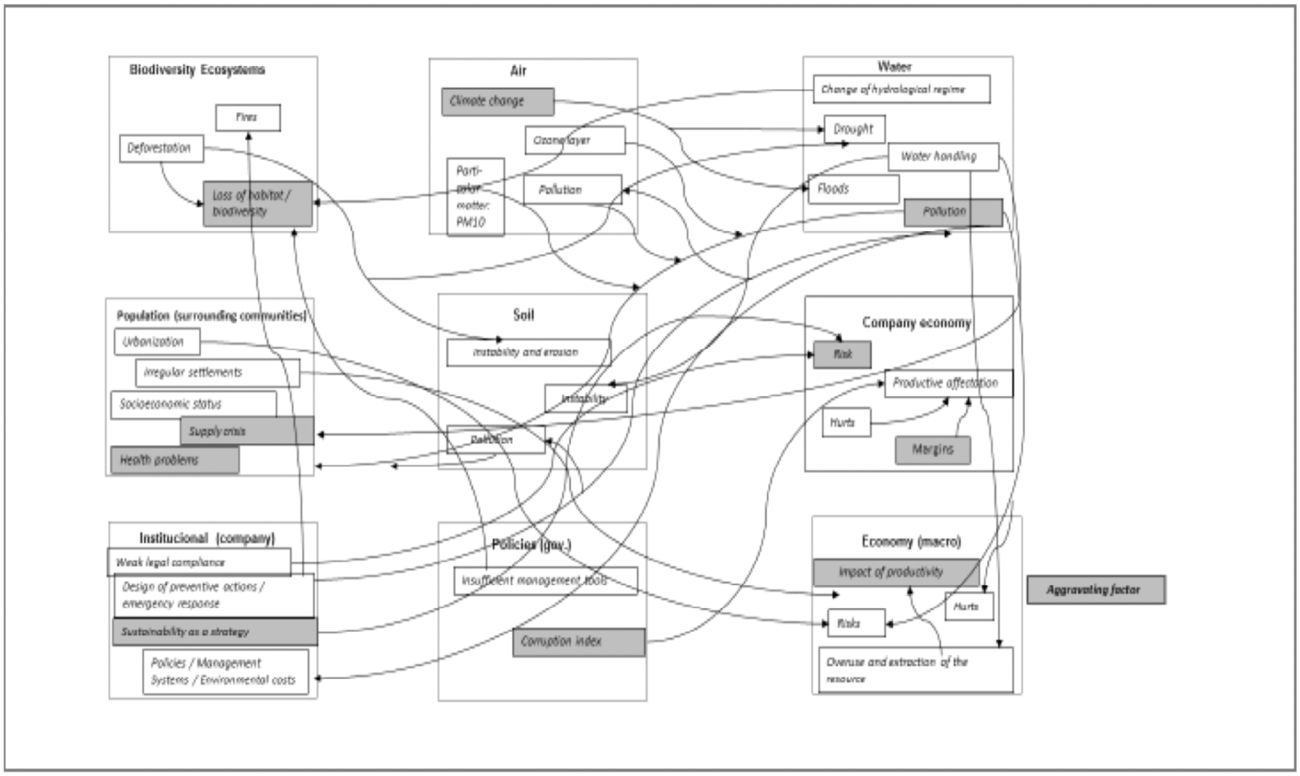


Figure 3.9: Syndrome of an industrial operation

Reference: Ferat, 2016.

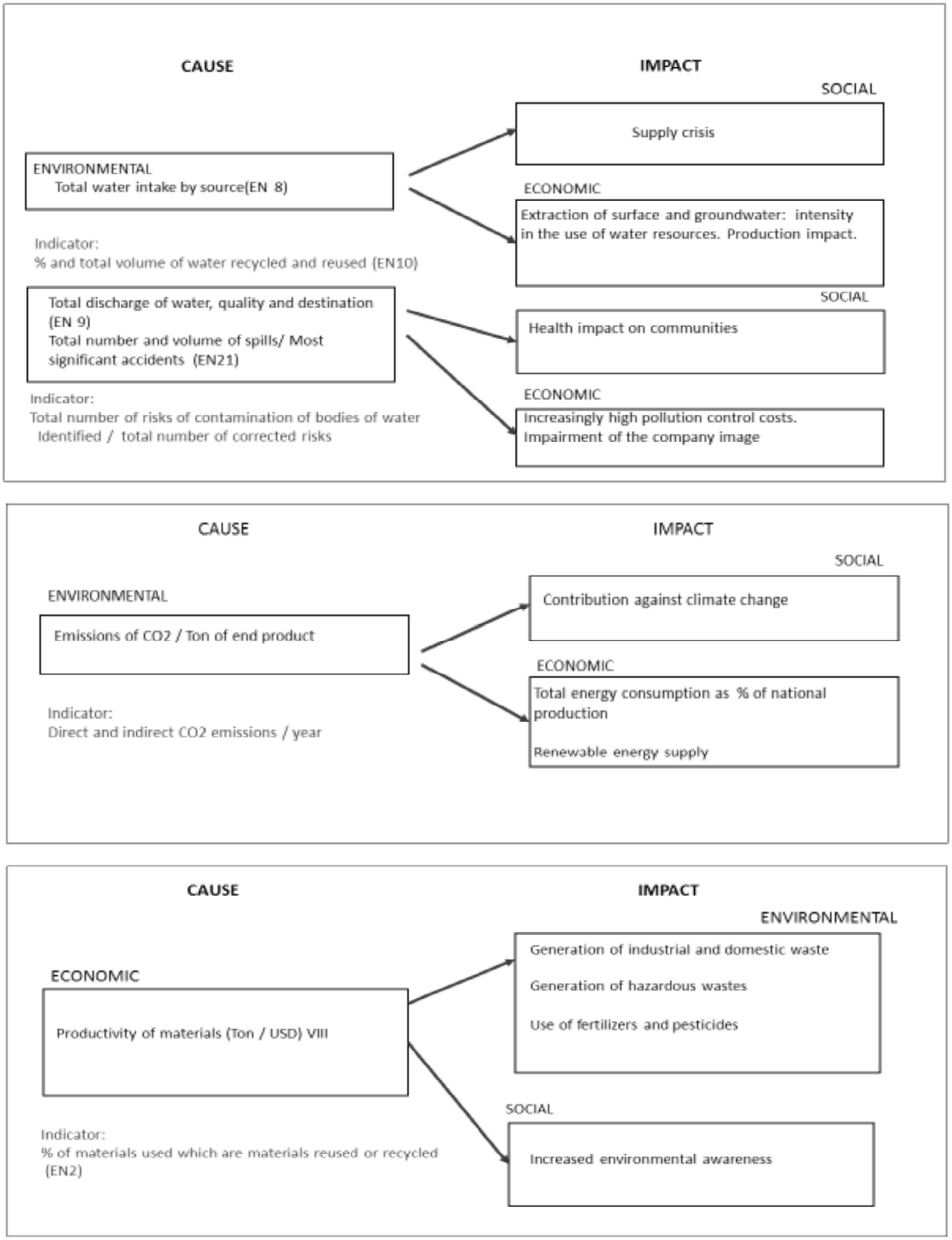
Table 3.2
Syndrome of an industrial operation - Impact aggravating factors

Aggravating Factor	*Impact*
Health problems	Water pollution Climate change
Economical risks	Loose of the habitat caused by a drastic hydrological regime
Water supply crisis	Poor water management

Reference: Ferat, 2016

Figure 3.10: Sustainable indicators – Interrelation analysis diagrams

The second level indicators as a whole were analyzed. The next diagrams only include the results.



Reference: Ferat, 2016

IV. RESULTS

4.1. Sustainable indicators

The sustainable indicators are included in Table 4.1

Table 4.1
Sustainable indicators for industrial chemical operations

The information obtained from a specific polymer manufacture company in Mexico was important for this level.

Indicator
Percentage and total recycled water and reused water (EN10)
Corrected risks/ Total polluted water risks sources identified
CO_2 emissions, direct and indirect
Percentage of raw materials valued for reuse or recycling (EN2)

The use of each one of the indicators group from each level is the following:

Individual indicators: environmental, economic and social

Environmental authorities regulate these indicators. They are also reported in the Social Responsibility Reports. After the implementation of eco-efficiency practices, these indicators are usually monitored to assess their continuous improvement.

Sustainable development indicators

These indicators allow the industry to be aware of their stakeholders and their needs. Their improvement will reflect their commitment to their social responsibilities.

For the government, these indicators are an important input for statistical studies and the drafting of public policies.

Sustainable indicators

For private companies:

Enterprises have to keep a continuous monitoring of these indicators and make effort to improve them. These indicators will reflect the level of sustainable commitment of the company.

For government:

They are important as input for statistical studies, environmental impact analysis and cost estimates for the use of natural resources. Table 4.1 includes the sustainable indicators.

4.2. Social responsibility model

It is important that private companies include sustainable indicators in their strategic plan, in order to have a significant influence in the stakeholders' concerns. The benefit that a social responsibility company may receive from their sustainability performance can be represented in Figure 4.1.

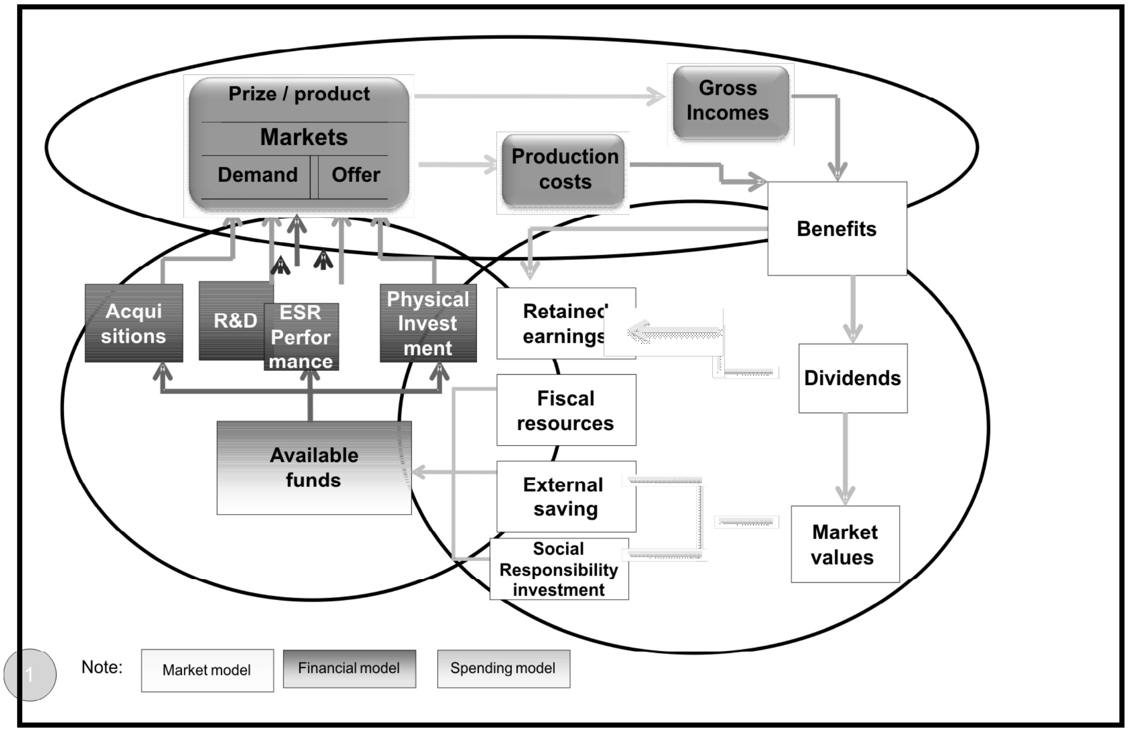


Figure 4.1. Social Responsibility Model proposed for an operational manufacture industry

Reference: Adapted from Hay & Momis, 1991.

Market Model

The interest from the society for a cleaner environment without risks give companies the opportunity to mention their sustainable practices in their marketing practices to achieve a competitive advantage.

Spending Model

Even if economic results decline, it is necessary to consider that plant operations still pollute the environment. It is necessary at all times to secure an economic fund for expenses and avoid considering that there will be a return of those investments; it may and may not.

Financial Model

At present, there are financial instruments worldwide to support industries in their technological investments in order to avoid environmental pollution. These are funds for projects that will have a social benefit.

V. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The only way to measure sustainability is through indicators. The investigation performed gives the opportunity to the industrial people to identify their sustainable indicators and contribute for a better environment and social welfare.

Social Responsibility reports are important documents to know about the company performance, but not necessarily reflect their sustainability.

Recommendations

Some investigation trends were identified:

Businesspersons

Socially responsible obligations must be included in the companies' Vision and Mission, and aligned with the ethics of the heads of the company and its shareholders. All of them must commit for the improvement of the sustainable indicators.

Government

Governments must promote research task groups to define the scope of the environmental impact studies and include sustainable indicators in these studies. The improvement of the latter should be mandatory throughout the plant operation.

Academy

Be aware of the needs of the industry and prepare research studies for new technologies.

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