

GREEN TRANSFORMATION! A POLICY TOOL FOR REGIONAL SMART SPECIALIZATION

GUIDELINES FOR REGIONAL DPSIR MODEL (03.1.)

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DPSIR framework is planned as one of the activities in WP3 (Activity 3.1) which is based on the gap analysis (O2.2.2), **as biggest gaps can be seen as drivers for change**. The main aim of the DPSIR is to provide **at least one environmental issue** and the **possible solutions** to this.

Another goal of DPSIR model is to reveal causal links of DPSIR elements where **local context is expected to have regional aspects in long and short terms**.

DPSIR model has been developed by the European Environmental Agency (EEA) and is especially designed to show the relation between societal changes and their impact on environment, as well as actions to help the situation, which makes it ideal tool for addressing the regional environmental challenges.

DPSIR framework is seen as giving a structure within which to present the indicators needed to enable feedback to policy makers on environmental quality and the resulting impact of the political choices made, or to be made in the future. According to the DPSIR framework there is **a chain of causal links** starting with 'driving forces' or drivers (economic sectors, human activities) through 'pressures' (emissions, waste) to 'states' (physical, chemical and biological) and 'impacts' on ecosystems, human health and functions, eventually leading to political 'responses' (prioritisation, target setting, indicators). Describing the causal chain from driving forces to impacts and responses is a complex task, and tends to be broken down into sub-tasks, e.g. by considering the pressure-state relationship (Kristensen, 2004).

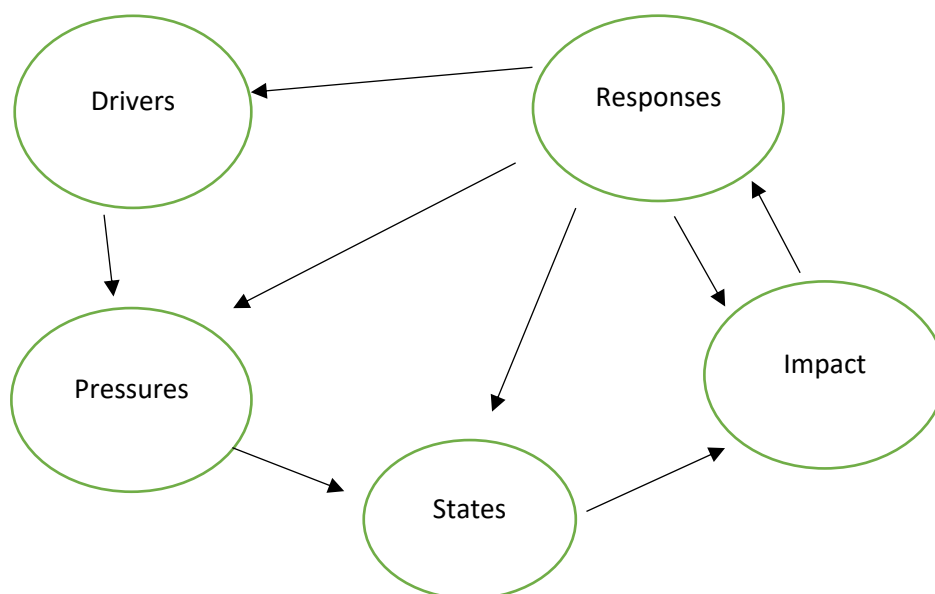


Figure 1. The DPSIR assessment framework

Driving Forces / Drivers

A 'driving force' is a **need**. Driving Forces are the changes in the social, economic and institutional system that directly and indirectly trigger pressures on the environmental state. The European Environmental Agency (EEA) defines them as 'the social, demographic and economic developments in societies and the corresponding changes in lifestyles, overall levels of consumption and production patterns' (EEA, 2007). A classification of four non-hierarchical but interacting levels of driving forces influencing the structure and relation between the social, economic, political and environmental systems has been proposed (Rodríguez-Labajos et al., 2009). From this approach, the 'primary driving forces' are the socio-economic activities directly linked with pressures (e.g. industry, tourism) at the economic management level. 'Secondary driving forces' are found at the policy level (e.g. waste policy, laws). In the long term and with a broader spatial sphere of influence, there is the level of 'tertiary driving forces', ideology and lifestyle (e.g. media, consumption patterns). Finally, the 'base driving forces' include fundamental trends (demographic or cultural), which are only influenced by social decisions in the long term (e.g. climate change, demography) (EJO).

For an industrial sector a driving force could be the need to be profitable and to produce at low costs, while for a nation a driving force could be the need to keep unemployment levels low. In a macroeconomic context, production or consumption processes are structured according to economic sectors (e.g. agriculture, energy, industry, transport, households) (Kristensen, 2004).

- Industry
- Energy
- Agriculture
- Economy
- Aquaculture
- Households
- Tourism
- Climate
- Geology
- Energy use (energy factors per type of activity, fuel types, technology)
- Power plants (types of plants, age structure, fuel types)
- Refineries/Mining (types of plant/minings, age structure)
- Landfills (type, age)
- Sewage systems (types)
- Non-industrial sectors
- Land use, etc.

Pressures

Driving forces lead to human activities such as transportation or food production, i.e. result in meeting a need. These human activities exert 'pressures' on the environment, as a result of production or consumption processes, which can be divided into three main types: (i) excessive use of environmental resources, (ii) changes in land use, and (iii) emissions (of chemicals, waste, radiation, noise) to air, water and soil (Kristensen, 2004).

Pressures are the anthropogenic factors inducing environmental change (Impacts). They are defined by the EEA as 'developments in release of substances (emissions), physical and biological agents, the use of resources and the use of land by human activities', although different approaches to its definition can be found in the literature (EJO). In GT **pressures** should be seen as **long term** and **more general** aspects of DPSIR.

- Expansion of environmental footprint
- Climate change
- Use of resources
- Emissions (per driving force for numerous compounds)
 - direct emissions to air, water and soil
 - indirect emissions to air, water and soil
- Production of waste
- Production of noise
- Radiation
- Hazards (risks)
- Consumption
- Application of technology
- Sectoral energy use: agriculture, industry, etc.

States

As a result of pressures, **the 'state' of the environment is affected**; that is, the quality of the various environmental compartments (air, water, soil, etc.) in relation to the functions that these compartments fulfil. The 'state of the environment' is thus the combination of the physical, chemical and biological conditions (Kristensen, 2004).

State may refer to a natural system alone or to both a natural and socioeconomic system. According to the focus, indicators of State can be very different. State can refer to a wide range of features, from the qualitative and the quantitative characteristics of ecosystems, the quantity and quality of resources, living conditions for humans, exposure to the effects of Pressures on humans, to even larger socio-economic issues. The combination of the current State and the existing Pressures explains Impacts (EJO). In GT **states** should be seen as **short term** and **more specific** aspects of DPSIR.

- Environment
- Air quality (national, regional, local, urban, etc.)
- Water quality (rivers, lakes, seas, coastal zones, groundwater)
- Soil quality (national, local, natural areas, agricultural areas)
- Ecosystems (biodiversity, vegetation, soil organisms, water organisms)
- Ecological status (chemical, physical, biological)
- Humans (health)
- Soil use
- Linear economy
- Air pollution and global warming (CO2 emissions)
- Increased generation of all waste types flows, etc.

Impacts

The changes in the physical, chemical or biological state of the environment determine the quality of ecosystems and the welfare of human beings, human health and functions. In other words, changes in the state may have environmental or economic ‘impacts’ on the functioning of ecosystems, their life supporting abilities, and ultimately on human health and on the economic and social performance of society (Kristensen, 2004).

Impacts are changes in environmental functions affecting social, economic and environmental dimensions, which are caused by changes in the State of the system. Impacts can include changes in environmental functions such as resource access, water and air quality, soil fertility, health or social cohesion (Maxim et al., 2009). These Impacts trigger Responses (EJO).

- Resource consumption
- Deteriorated water, air, soil quality
- Deteriorated public health
- Increased amount of waste
- CO2 emissions
- Decreasing natural resources
- Loss of biodiversity
- Loss of non-renewable mineral resources
- Energy shortages
- Decomposition of biowaste and landfill gas generation, etc.

Responses

A ‘response’ by society or policy makers is the result of an undesired impact and can affect any part of the chain between driving forces and impacts. An example of a response related to driving forces is a policy to change

mode of transportation, e.g., from private (cars) to public (trains), while an example of a response related to pressures is a regulation concerning permissible SO₂ levels in flue gases (Kristensen, 2004).

Responses are the policy actions which are directly or indirectly triggered by the perception of Impacts and which attempt to prevent, eliminate, compensate or reduce their consequences. Responses can come from different levels of the society, such as groups of individuals, governments or non-governmental sectors. These Responses can in turn influence trends in the Driving Forces, Pressures, State and Impacts.

- Setting of targets
- Prioritising
- Environmental policies
- Energy policies
- Sector specific policies
- Macroeconomic policy measures
- Subsidised (energy) prices
- Improved information
- Voluntary agreements
- Alternative supplies
- Demand side management
- Use restrictions
- Public awareness, etc.

Responses affect all elements of DPSIR framework. That is why it is important to assess all types of responses:

- Driving forces-based responses
- Pressure-based responses
- State-based responses
- Impact-based responses

Linking DPSIR elements

The DPSIR framework is useful in describing the relationships between the **origins** and **consequences** of environmental problems, but in order to understand their dynamics it is also useful to focus on **the links** between DPSIR elements (see Figure 3). For instance, the relationship between the 'Drivers' and the 'Pressures' by economic activities is a function of the ecoefficiency of the technology and related systems in use, with less 'Pressures' coming from more 'Drivers' if eco-efficiency is improving. Similarly, the relationship between the Impacts on humans or eco-systems and the 'States' depends on the carrying capacities and thresholds for these systems. Whether society 'Responds' to impacts depends on how these impacts are perceived and evaluated; and the results of 'Responds' on the 'Drivers' depends on the effectiveness of the Response (Kristensen, 2004).

Driving Force - Pressure Relationships

The environmental pressures resulting from human activities (emissions, resource use and land use) are a function of two types of variable: (i) the level of these activities, and (ii) the technology applied in these activities. For example, an emission of a given compound from an economic activity is the product of the level of activity and an emission factor, which reflects the technology of the process under scrutiny. Discharge of waste water from domestic sources, for instance, depends on the size of the population and their consumption (activity) and on the proportion of population connected to sewers and different kinds of waste water treatment (technology). The technology variables will be reflected by emissions factors, resource use factors or land use factors. The variables accounting for the level of activities are of an economic nature, because they reflect the level of production and consumption (Kristensen, 2004).

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