



Providing operational economic appraisal methods
and practices for decision-making on climate and
environmental policies

Social side of policy impact

Deliverable 2.3



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Author(s)	Fatemeh Jouzi, Laura Lakanen, Chipo Peveling, Gianfranco Pomatto, Alessandro Sciallo, Per Erik Sørås, Lucia Zwart
Primary Contact and Email	davide.grasso@unito.it
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Davide Grasso contributed to chapters 1, 2, 8, overviewed the document and supervised its completion; Alessandro Sciallo supervised the document completion; Lysander Fockaert contributed to chapter 3; Petri Kero, Fatemeh Jouzi and Laura Lakanen contributed to chapter 4; Cristina Bargerò and Giafranco Pomatto contributed to Chapter 5; Chipò Peveling and Per Erik Sørås contributed to chapter 6; Lucia Zwart contributed to chapter 7.

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1. EXECUTIVE SUMMARY

The following text aims at presenting the results of Task 2.3 of the research undertaken by the PATTERN Consortium. The Task we pursued consists of circumscribing the social side of the impact of the policies under study. As such, Task 2.3 entails a connection with Task 2.2, during which practitioners and academics were engaged in extracting a Theory of Change from assumptions and rationales held by the actors involved (Rogers 2014; De Silva et al. 2015; Anderson 2017). This link subsists for two reasons. First, the impact category is crucial to a ToC architecture. Secondly, the PATTERN project is defined by a focus on Stakeholders (SHs) involvement in analyzing and evaluating policies and measures (PAMs). It is a participatory process aiming at providing a representation of the policies themselves: their impact on reality based on experience and perceptions of a relevant number of actors. The expected result is a description not merely expression of an institutional and academic gathering and interpretation of data.

Despite these basic methodological similarities between T2.2 and T2.3, the work accomplished displayed significant differences. The notion of impact was further elaborated and unpacked in multiple directions while analyzing on the social side. ToC models produced by PATTERN Case Studies (CS) define impact as peculiar element of a logical chain, as opposed to outputs and outcomes. The study conducted by UNITO, shared with the Consortium during the General Assembly in Turin (October 2022), insisted on the notion of Accountability Ceiling (AC) in relation to the PAMs' causal chain (Taplin et al. 2013). An AC is a line beyond which the effects of the policy cannot be assessed and circumscribed to a precise extent. The effects that the policy has below the AC are certainly due to the intervention: without it they would not have taken place. The policies may contribute to effects above the AC, but they large and complex enough to be likely, or certainly, the product of other factors as well.

We considered the AC to be fundamental, at least in the theoretical elaboration and methodological understanding of the work. This in order to avoid abstract ToCs, expression of wishful thinking and volitions, or expectations, of practitioners and SHs. We supported a critical reflection on the expected change. What are the effects of the policies, if any, to be rigorously attributed to the interventions? This question served to distinguish different outcomes from one another as well (Mayne 2008). The causal function of the intervention varies throughout the process. Not all outcomes are attributable to policy to the same extent and in the same way. Research must take into account epistemic limitations when it comes to measuring the effect of policies on systems. All this spills over into the notion of impact. Its conception and function varies in the context of a ToC or of a Social Impact Assessment (SIA).

In a ToC impact is the last link in the causal chain (Jackson 2013). It lies by definition beyond the AC. Outcomes, in the theoretical model adopted by PATTERN (see D2.2), are defined negatively with respect to impact. They must be circumscribed. ToC

impact is by definition a vague phenomenon. The construction of city infrastructures for fueling low greenhouse gas emission vehicles is the output of a certain policy intervention. The increase of environmentally friendly vehicles is an outcome of the intervention. It has a determinable causal connection to the output. The decrease of greenhouse gases emitted contributes to the impact of the policy. The latter is not only more difficult to measure, however, but is identified with a state of affairs likely to be produced by a number of factors. The very contribution of policy outcome to impact is difficult to measure. Distinguishing outcome and impact is decisive for the development of a ToC based on realistic and utilization-focused evaluation (Tilley 2000; Astbury 2011; Patton 2012).

It is evident, then, that it is different to analyze policies by considering the impact as a specific element of a causal chain, or to assess a side of the policy focusing exclusively on the notion of impact. In this case, as the literature shows, impact is conceived differently, i.e. in a much broader sense (Morgan 2012; Dendena et al. 2015; Aledo-Tur et al. 2017) . This is why we attempted to process available data by placing SIA dimensions within the ToC framework previously produced. Qualifying the social impact of a policy means selecting a number of indicators. These indicators prepare the demarcation of properties, and in some cases the numerical quantification of the impact. A dimension measurable through a quantitative indicator would sometimes be consistent with the notion of outcome, or outputs, in the ToC frame. This semantic slippage stems from the literature historically produced on ToC, on one side, and SIA on the other. We made sure that all researchers involved be aware of this slippage. This, hopefully, neutralized the related, potential distorting effects (Rossouw et al. 2007).

A further introductory clarification concerns the qualification of policy impact. T2.2 considered impact in general terms. T2.3 considers the social side of impact. The ToC models produced by the CS include environmental consequences in the impact factors. The evaluation prodromes (see methodological section) of social impact that we present here mostly select effects on social relations specifically (Taylor et al. 2004; Olsen et al. 1976). Generally speaking, environmental impact is excluded from the investigation. On the other hand, however, the analysis of social side cannot exclude environment-related phenomena entirely. Society and the environment are neither watertight compartments nor unrelated monads (Esteves et al. 2012; Lamb et al. 2020). Every social relationship, in complex socio-ecological systems, is linked to natural and environmental phenomena, at least to some extent (Slootweg et al. 2001; Wong et al. 2021). The selected impact dimensions include, therefore, definitions referable also to environmental impact. This does not detract from the distinction between environmental impact and social impact. Rather, we needed to focus on the margins between these sociological categories. Theoretical awareness enable their use considering their differences, their mutual implications, their richness and their limitations.

2. METHODOLOGY

T2.3 is about definition of the social side of impact. The work done by UNITO, RVO and other partners has been a matter of defining a grid for future evaluation. PATTERN envisages, in subsequent work packages, an economic modeling endeavor to provide data to measure this type of impact. Our work consisted in producing a categorical criterion for the production and selection of indicators (Burdge et al. 2004). In addition, in probing their adaptability to a participatory process to collect a limited amount of data on all five CS. The definition of the grid was followed by two further steps: internal selection and evaluation of indicators relevant to the CS; further assessment by a number of SHs involved in the process.

Social impact was divided into five domains. Domains are here understood as intensional devices serving as criteria to carve out abstract regions from social reality. These regions are to be conceived as subsets of the general set of current or possible social-historical relations. They are defined by specific properties. Each domain is thus defined by an intension. We started with the exploration of the literature (IC-GPSIA 1994; Barrow 2000; Becker et al. 2003; MVEIRB 2007; Vanclay 2020; IAIA 2023). We proceeded to assess the historical-empirical legitimation of categories in pre-existing social impact assessments of public policies (e.g. Franks 2012; Liverpool City Council 2020 and considering insights provided by VITO in D1.4.

We then outlined our original proposal. These are the six domains we selected to guide the understanding of impact dimensions:

- (1) Capability
- (2) Community
- (3) Inclusiveness
- (4) Labor
- (5) Political Participation and Civil Rights
- (6) Way of Life

For each of these domains, dimensions were proposed. The latter can be seen as the actual core of the preliminary work. An impact evaluation without indicators is impossible, but so is a selection of indicators without dimensions. We need to break down the real into categories to prevent rhapsodicity and incompleteness. No consideration of social reality relevant to impact studies might be exhaustive once and for all, but that is why it is essential to identify realms based on explicit distinctions. It is a matter of concentric circles in abstraction: from dimensions to domains, and then reassessing the completeness of one and the other. What is left out of our investigation? What is relevant, what is compatible with our assessment ambitions?

These are the results:

Domain	DIMENSION
1-Capability	1.1- Education, knowledge and skills
1-Capability	1.2- Perception of future (fears and aspirations)
1-Capability	1.3- Environmental education and awareness
1-Capability	1.4- Income
2-Community	2.1- Accessibility to services and places
2-Community	2.2- Accessibility to transport and mobility services
2-Community	2.3- Public health services
2-Community	2.4- Population change (permanently)
2-Community	2.5- Community and recreation services / facilities
2-Community	2.6- Items/places of cultural and community significance
2-Community	2.7- Community identity and sense of belonging
2-Community	2.8- Crime and safety
2-Community	2.9- Economic development and employment
2-Community	2.10- Shared beliefs and values
2-Community	2.11- Social interactions and integration
2-Community	2.12- Social cohesion (identity and sense of belonging)
2-Community	2.13- Environmental impact: air quality, water quality
2-Community	2.14- Environmental impact: aesthetic value (Visual, other)
2-Community	2.15- Accessibility to services and transport
2-Community	2.16- Labor market (employment rate and opportunities)
2-Community	2.17- Conflicts and contrasts
2-Community	2.18- Cooperation and collective action (e.g. energy)
2-Community	2.19- Private properties value (houses, lands)
3-Inclusiveness	3.1- Income and economic support
3-Inclusiveness	3.2- Jobs seeking
3-Inclusiveness	3.3- Relational opportunities
3-Inclusiveness	3.4- Educational opportunities
3-Inclusiveness	3.5- Recreational opportunities

3-Inclusiveness	3.6- Accessibility to services and places
3-Inclusiveness	3.7- Accessibility to transport and mobility services
4-Labor	4.1- Employment opportunities (quantity, quality)
4-Labor	4.2- Salary
4-Labor	4.3- Respect of legal standards
4-Labor	4.4- Working hours
4-Labor	4.5- Accessibility to workplace
4-Labor	4.6- Occupational health
4-Labor	4.7- Excess work
4-Labor	4.8- Union rights
4-Labor	4.9- Workplace stress
5-Political participation and civil rights	5.1- Civil liberties
5-Political participation and civil rights	5.2- Access to justice mechanisms (complaints, remedies)
5-Political participation and civil rights	5.3- Political participation and engagement in decision making
5-Political participation and civil rights	5.4- Women rights (parental leave, harassment)
5-Political participation and civil rights	5.5- Corruption
5-Political participation and civil rights	5.6- Political involvement of communities (participatory processes)
5-Political participation and civil rights	5.7- Gender equality (social, juridical and labor related)
6-Way of Life	6.1- Pensions and social security
6-Way of Life	6.2- Access to health care
6-Way of Life	6.3- Housing (quality, affordability)
6-Way of Life	6.4- Access to clean and affordable energy
6-Way of Life	6.5- Capability to heat/cool the house
6-Way of Life	6.6- Health and well being

6-Way of Life	6.7- Habits and practices (mobility, consumption)
6-Way of Life	6.8- Quality of food and nutrition
6-Way of Life	6.9- Daily scheduling balance

Table 2.1

This grid proved capable of producing outstanding exercises and explorations in relation to the policies under consideration, also through SHs involvement. This exploration of the social side of impact was conducted by listing domains and dimensions into an Excel file, where researchers (in a first phase) and SHs involved (in a second phase) were asked to evaluate three different components. First, the relevance of each dimension to the policy, with a quantified gradation from '0' to '5'. Secondly, the timeframe for possible relevance of impact: Short, Medium and Long Term. (Since the CS are very different, the definition of these time windows was delegated to CSLs). Thirdly, the type of expected impact: Positive, Negative, Uncertain.

These engaged CSLs in the compilation of the first sheet of the Excel tool. It enabled us to circumscribe the social sphere of impact for the five different PAMs. Next to different columns for relevance assessment of the dimensions, and temporal limitations, some space was left for discursive notes at the discretion of CSLs. This expresses a methodological concern reflected in the Survey conducted on SHs as well. Defining social impact is properly and strictly measuring it. Wherever we can collect or produce quantitative data, this must be done. However, informations about context and evaluation criteria cannot always be quantified and measured in the proper sense. Both researchers, practitioners and SHs involved must have the opportunity to add (not substitute) discursive formulations to responses framed in structured grids. This enriched the potential for capturing and interpreting the overall research data.

The second step was the proposition of indicators by the CSLs. For each CS, researchers and practitioners proposed one or more indicators for each of the dimensions found to be most relevant. For some CS, indicators were also proposed for dimensions of lesser relevance, since no limit was initially placed on the production of indicators. This allowed an open minded and comprehensive exploration of the five policies. We like to stress that, as for ToC development, the SIA output lies as much in the product (the evaluation or its instruments) as in the process (the transformative engagement around the definition of the policy impact). It was just later on that UNITO proposed an indicators selection related to the dimensions. For each of the indicators selected, CSLs were asked to define (1) availability and (2) data description. Limited to some of the CS, for several indicators no data are currently available. Many unavailable data are expected to be extracted from existing models at a later stage or, in other cases, from models produced in the course of PATTERN subsequent WPs.

The final step was the connection between social impact and ToC. To avoid the semantic slippage of the term "impact" adopted to guide T2.2 and T2.3 being overshadowed, each CS was asked to place the indicators on a grid tracing the ToC model related to that CS. "Distance to nearest charging station" refers to the dimension "access to clean and affordable energy", thus to the "way of life" domain. Although it is in this sense a social impact indicator, it was placed by the CSLs in the "output" category as far as the ToC elaborated in T2.2 is concerned. This is quite intuitive, as is that of the indicator "Percentage of residents using EV" (related to the same dimension) put among the outcomes. The indicator related to "NOx concentration" (dimension "environmental impact: air quality", domain: "community") relates to what in the ToC was literally defined as impact instead.

After this preparatory phase came the involvement of the SHs. We prepared two additional sheets for an enhanced evaluation tool, always in Excel format. Each SH had full access to sheets 1-3, and full awareness of the work done by the CSLs. Nothing was left to opacity. The SHs had the opportunity to critically retrace and understand the work done by our institutions. They were asked to provide their own angle giving different assessments for each selected indicator. The three evaluation scores were related to (1) Short Term; (2) Medium Term; and (3) Long Term. The extent of these windows, as said, varies between the CS. The evaluation of each SH for every timeframe was quantified numerically from a minimum negative (- 5) to a maximum positive (+ 5) with '0' as an intermediate value.

It was suggested to the SHs to write a short discursive evaluation of the social impact as well. The discursive window was left open in order to partially free each actor from the interpretative and classificatory grid, at least at a circumscribed phase of the survey process. This allowed SHs to better motivate or hint at the criteria and reasons for their judgements. It allowed PATTERN to acquire more data and improve their interpretation.

The selection of the SHs is part of a process started in T2.1. Their selection and participatory involvement was first implemented during the extraction of the five ToC from the policies under consideration (T2.2). At this stage, many of the SHs (though not all) coincide with those involved in T2.2. Variations may be due to the availability of them: they were contacted twice in a short period of time. In more limited cases it was due to an assessment of the specific relevance of their views on the social impact. The first reason entails an objective limitation of the research. The second emerges from the analysis of the definition of the social side of the impact for each CS, which we will now consider individually.

3. AGRICULTURAL CASE STUDY: BELGIUM

3.1 Introduction

The policy evaluated in the Belgian case study comprises governmental contracts for agri-environment -climate measures (5-year commitments). Farmers can voluntarily implement these measures to enhance the environmental quality of the rural landscape or to reduce the negative impact of food production on the natural ecosystem. Examples are sowing and maintaining flower strips or planting and maintenance of hedgerows. Farmers who implement such measures can sign in to an agreement with the government (Vlaamse Landmaatschappij, VLM). These contracts specify the conditions for the implementation and the subsidies that the participating farmer can receive in compensation for their efforts and income foregone. VLM is also responsible for contracting, advising and monitoring farmers who implement the agri-environmental measures.

3.2 Selection of indicators

A list of dimensions was provided by UNITO. A first evaluation of their relevance was made by the administrative officers of the VLM. This preliminary selection was then discussed with UA and adjusted when necessary. The selection of relevant dimensions started by distinguishing between the most and the least relevant dimensions of social impact. Dimensions that were related to the policy in a more distal manner were assigned a relevance score through discussion and unanimous agreement.

The most relevant dimensions (relevance score = 5) have direct links to the core aspects of the policy, i.e., the subsidies and the implemented measures. Through the subsidies, compensating for any implementation costs and for the loss of income due to non-productive use of agricultural land, the policy is relevant to the farmer's income, which is also closely linked to the salary of the farmer. The agri-environmental measures themselves have multiple environmental impacts, which also result in social impacts through the concept of ecosystem (dis)services. The implemented landscape elements contribute to the aesthetic quality of landscapes. They also aim to improve the biotic (biodiversity) and abiotic conditions (air, water, and soil quality) in the agricultural ecosystems and in the natural ecosystems surrounding those. By motivating farmers to take care of the natural elements in the landscape, for which they also receive advise and coordination, the measures enhance the farmers' environmental awareness. The limitations on the use of harmful substances (e.g. herbicides and pesticides) could provide several health benefits to the farmers and other relevant stakeholders. The personal satisfaction and social recognition of, and praise for, taking care for the natural landscape can provide additional benefits to the mental health of the farmers.

Other dimensions of high relevance (relevance score = 4), but more indirectly linked to the policy, were those related to the farm management (working hours, excess work, workplace stress, habits and practices, daily scheduling balance and perception of the future), since the agri-environmental measures are likely to affect the decision-making on the farm to some extent. In addition, they may contribute to educational opportunities and development of knowledge and skills, with an emphasis on environmental knowledge, but also related to technical skills due to the introduction of new practices in the farm. The policy also has an impact on inclusivity, as voluntarily participating farmers may feel included in decision-making on landscape management and feel like they contribute to societal wellbeing. On the other hand, not all farmers are eligible for the contracting of each type of agri-environmental scheme, so even though they might want to contribute, they are not allowed. By promoting non-productive practices on productive agricultural land (of high quality in the case of Flanders), the measures affect the overall quantity and availability of food. This is rather limited due to the small areas on which the measures are implemented.

Dimensions of medium relevance (relevance score = 3) were those related to impact to the broader community, which are affected in less obvious, indirect ways. This complicates estimation of the impact from the policy. For example, the agri-environmental measures contribute to the structure and functioning of the general landscape, which is often part of the cultural identity of the local community. As such, the policy can influence community and recreation services and opportunities, places of cultural and community significance, community identity and sense of belonging, and shared beliefs and values (e.g. on how to take care of the biophysical landscape and the natural ecosystem). Farmers implementing the agri-environmental measures act as landscape stewards and provide collective benefits to society. This can enhance relational opportunities, social cohesion, interactions and integration of the farmer community in the wider society, since they signal their willingness for cooperation and collective action. As such, they can alleviate conflicts between farmers and other SHs, although new conflicts may arise, for example when citizens damage the vegetation on grass or flower strips, for which the farmer can receive a sanction.

In addition, strong restrictions on practical interventions can reduce the farmer's accessibility to the workplace, i.e., the fields they have to manage, e.g. because they are not allowed to drive across the contracted grass or flower strips with their machinery. This subsequently gives rise to conflicts between the farmer and governmental actors. However, the personal relationship and recurrent interactions between the farmers and the governmental advisors involved in the contracting could prevent escalation and might enhance access to justice mechanisms and political participation and engagement in decision making, since the advisors act as mediators between farmers and policy makers. This, in combination with the fact that the agri-environmental measures are implemented on a voluntary basis, can enhance political involvement of (farmer) communities. Quality of food and nutrition was also categorized as of medium importance, since the measures are likely to have only limited impact on this dimension.

Low importance (relevance score = 1 or 2) was assigned to the dimension of economic development and employment, since the policy is aimed at a very specific economic sector (i.e., agriculture). The measures might also affect the value of (agricultural) land, although this is likely rather marginal. Participating in agri-environmental contracts and implementing the measures can influence occupational health (of the farmers), although this likely varies substantially between farmers and depends on the influence on the factors discussed above. The voluntary nature of the measures also relates to the civil liberties of free choice, i.e., the measures are not imposed on the farmers.

Irrelevant dimensions (relevant score = 0) related to built infrastructure and public social services since they have few links with agriculture, such as accessibility to public services and places, transport and mobility services, access to health care and public health services, housing and building infrastructure, and access to clean and affordable energy. Other rather irrelevant dimensions for the evaluated policy related to social and societal structure and qualities, such as (permanent) population change, pensions and social security, corruption, crime and safety, respect for legal standards, union rights, women rights and gender equality, labor market, employment opportunities and job seeking.

An extensive set of potential indicators for the dimensions was proposed by VLM and subsequently reduced during discussion with UA. Indicators that could not be obtained from available data, through surveys or interviews, or from existing models were excluded from the list. Examples of indicators for which data is available are the amount of paid subsidies (an indicator for the impact on income and salary of the farmer), or the number, location and geographical configuration of landscape features (which provide indications for the potential for ecosystem services and the impact on the landscape structure and aesthetics). Survey methodologies are often applied in policy evaluations and are planned for the ex post and ex ante evaluations of the agri-environmental measures in this case study of the project. Examples of indicators that could be obtained through this data collection method are the technical and environmental knowledge of the farmers, trust in the government, farm income, place attachment, perceived subjective norms, perceived behavioral control, and so on. The impact of the agri-environmental measures on the biophysical landscape (air, water, and soil quality), biodiversity and (monetized) ecosystem services, could be assessed through existing models, such as the Nature value explorer, ECOPLAN or InVEST models.

3.3 Stakeholders engagement

For the impact assessment, we opted to consult a select number of experts, i.e. governmental actors directly involved in the policy and agricultural economists. They were asked to score the expected impact of the agri-environmental measures on each of the dimensions selected above and considering three different time scales (short term = immediate impact within 1 year, medium term = impact within 5 years, long term = impact beyond a 5 year time horizon). To simplify the procedure, only the

dimensions with high relevance (scores 5 or 4) were considered in this task. The scale for the impact ranged from -5 (very negative impact) to 5 (very positive impact). The dimensions were weighted by their relevance scores assigned by the case study leaders and confirmed by the experts. As such, weighted averages were obtained for the overall set of dimensions and for each domain separately (also on a scale from -5 to 5). The results are provided in Table 3.1.

	Total	Capability	Community	Inclusiveness	Labor	Way of Life
Short term	0.76	1.87	1.19	1.00	-0.88	-0.26
Medium term	1.24	1.72	2.07	0.74	-0.20	0.21
Long term	1.69	1.65	2.84	0.49	0.55	0.62

Table 3.1: Weighted averages for the total set of social dimensions and for each grouping of dimensions into larger domains.

The results show that the expected impact of the policy becomes more positive over a longer time period. This is also true for the impact on the dimensions specific to the community (which included most of the environmental impact dimensions), labor (through salary, excess work and workplace stress) and way of life (health and wellbeing, habits and daily scheduling balance). The environmental benefits of the policy were emphasized by all stakeholders. Community appreciation was acknowledged, but considered as an underdeveloped or less targeted part of the policy, although with the additional comment that this is not (and does not need to be) a core goal of the policy.

The most relevant impact in the labor domain was on the income dimension, with the subsidies and the contract assuring a fixed income source in short to medium terms. The impact on capability (skills, knowledge, income and perceptions of the future, specifically for the farmers) is most substantial in the short term, but remains rather high (and positive) in longer time spans. Farmers implementing the agri-environmental measures for longer times can build-up relevant experience and understanding of ecological processes, benefits and costs. Dimensions relating to inclusiveness (income support, educational opportunities and inclusivity of stakeholders) are more impacted in the short term, likely because these are influenced by the contracting procedure, the aspect of income support, and eligibility of potentially interested farmers.

4. TRAFFIC CASE STUDY: FINLAND

4.1 Introduction

As a necessary step for supporting the already completed steps for designing the ToC model, we conducted a SIA outline of the proposed pathways for implementation of the defined policy package. The latter is aimed at a transition to net zero transportation and at achieving the final impact of GHG reductions, better air quality (less PM and NOx emissions) and increase in well-being of residents in Lappeenranta. After a primary selection of the most relevant dimension and defining the indicators, we conducted a survey for refining the selection with participation of the local stakeholders. These stakeholders are chosen during the process of stakeholder analysis in the earlier steps.

4.2 Selection of indicators

For defining a proper set of indicators and assessing various social impacts the proposed PAM, we went first through the list of domains and dimensions provided by UNITO and score them based on their relevance. To score the relevance of the dimensions we considered the whole pathways in ToC from primary interventions to intermediate outcomes and final impact. The range of relevance is from “0” to “5”. The dimensions with Score 4 and 5 were selected.

After reviewing some literature in social assessment focusing on transportation policies, we added two more dimensions to the original list, one in Capability domain, dimension 1.5 transportation cost, and one in Community domain namely 2.20 Opportunities for local businesses. After proposing various indicators for each dimension, we decided about the final indicator to be measured based on availability or potential possibility of data to be gathered via defined sources of data. In this case study, in addition to open databases we are in the process of gathering local data from citizen surveys and expert interviews. The primary list of selected domains, dimensions and suggested indicators are shown in Table 4.1. This list was shared with stakeholders and the results are presented in the following sections.

Domain	Dimension	Relevance	Suggested indicators	Justification
1.Capability	1.5- transportation cost	5	a- transportation costs, euro/month	Directly is affected by transportation policies
2.Community	2.7- community identity and sense of belonging	4	a-qualitative description of identity and belonging	An emission free city can affect sense of belonging, actively be part of in transition to the environmental choices
	2.13- environmental impact: air quality	5	a-fine particles b-NOx concentration	Directly is affected by transportation policies
	2.19- Private properties value (houses, lands....)	5	a-EV charging infra effect on the property value	Accessing to charging infrastructures can affect property price and rental value
	2.20- Opportunities for local businesses	5	a-Fair opportunity for local businesses qualitative	There are uncertain opportunities in transportation transition according to ToC
6.Way of life	6.4- access to clean and affordable energy	5	a-Percentage of residents using EVs b-Distance to closest charging station	Directly relevant to equity which is a concern in the policy package in ToC
	6.6- health and well-being	5	a-Health cost of fine particles b-Residents satisfaction	Included in the final expected impact in ToC
	6.7- habits and practices (mobility, consumption...)	4	a-Qualitative Effect of refueling frequency on city routine (public transport; ...)	EV refueling differs from normal combustion cars so it can affect the daily or travel routine or public transportation routines
	6.9- daily scheduling balance	4	Effect of private EV car on routines of life	EV refueling differs from normal combustion cars so it can affect the daily or travel routine or public transportation routines

Table 4.1

4.3 Stakeholders engagement

Invitations to take part in the survey were sent by email to 33 recipients representing 13 stakeholder organizations. Initially, only four stakeholders responded to the survey, and after the reminder email there were two more. Stakeholders were asked to rate the effect of the selected policies on ten selected dimensions. For the rating we used the following scale: 1 = highly negative effect, 10 = highly positive effect. Additionally, we asked stakeholders to estimate what other social impacts chosen policies and measures might have on different domains. Chosen domains were *Way of life, Community, Labor, Inclusiveness and Capability*. Lastly there was an open field question for any additional feedback regarding policy measures for the zero-emission transportation.

2.13- environmental impact: air quality	0-3 years	6,3	4	9
2.13- environmental impact: air quality	4-10 years	7,3	4	9
2.13- environmental impact: air quality	over 10 years	8,3	4	9
6.6- health and well-being	0-3 years	5,5	4	8
6.6- health and well-being	4-10 years	6,3	3	8
6.6- health and well-being	over 10 years	7,2	6	8
1.5 travel cost	0-3 years	5,2	5	6
1.5 travel cost	4-10 years	6,2	6	7
1.5 travel cost	over 10 years	7,0	5	9
2.16- labor market (employment rate and opportunities)	0-3 years	5,4	5	6
2.16- labor market (employment rate and opportunities)	4-10 years	6,0	5	7
2.16- labor market (employment rate and opportunities)	over 10 years	6,4	5	8
6.4- access to clean and affordable energy	0-3 years	6,0	5	7
6.4- access to clean and affordable energy	4-10 years	7,5	7	9
6.4- access to clean and affordable energy	over 10 years	8,0	7	10
2.20- Opportunities for local businesses	0-3 years	5,8	5	7
2.20- Opportunities for local businesses	4-10 years	6,7	5	8
2.20- Opportunities for local businesses	over 10 years	7,0	5	8
6.7- habits and practices (mobility, consumption...)	0-3 years	5,4	4	6
6.7- habits and practices (mobility, consumption...)	4-10 years	6,4	5	7
6.7- habits and practices (mobility, consumption...)	over 10 years	7,0	5	8
6.9- daily scheduling balance	0-3 years	5,0	4	6
6.9- daily scheduling balance	4-10 years	5,4	5	6
6.9- daily scheduling balance	over 10 years	5,4	5	6
2.7- community identity and sense of belonging	0-3 years	5,4	5	6
2.7- community identity and sense of belonging	4-10 years	5,2	5	6
2.7- community identity and sense of belonging	over 10 years	5,2	5	6
2.19- Private properties value (houses, lands....)	0-3 years	5,8	5	6
2.19- Private properties value (houses, lands....)	4-10 years	6,8	5	9
2.19- Private properties value (houses, lands....)	over 10 years	6,8	5	8

Table 4.2

This is a summary for the open field questions:

Inclusiveness: Respondents estimated that transport sector disruption and electrification can decrease income and social equality

Labor: No effect or slight increase in job and employment opportunities in a long-time frame

Capability: No effect or only small effect.

Way of life: Two respondents estimated increase on Well-being, others that there is no effect.

Community: One respondent estimated that policies could potentially alter community's norms and speed up the electrification of the vehicles.

More time and expert would be needed for a comprehensive analysis of the results of the survey. However, as a rough conclusion following points are highlighted:

- The selected indicators have got average score of 5 and higher for all proposed timelines, short-term, medium and long-term. This shows that stakeholders are optimistic about the impact of the policies on the proposed social dimensions.
- One of the valuable outcomes of this survey is the concerns of the stakeholders about decrease of income and social equity due to electrification. This shows that 'equality and well-being' should be highly credited in practical steps along the defined pathways in ToC model. This factor can affect on assessing the different pathways. For instance, the public transport electrification is much far from inequality in result compared to increasing the number of private EV owners.
- Change in social norms is recognized by stakeholders. It shows that the defined indicators about social habits, daily routines and vacation routines should be included in evaluation.
- Noise pollution as a health and well being indicator is noticed by stakeholders.
- The importance of complementary public educational plans for the efficient use of the electricity for charging electric cars is a highlighted point by some of the stakeholders.

The results of this survey will help us in weighting the social data in future steps of this study.

5. TRANSPORT MOBILITY CASE STUDY: ITALY

5.1 Introduction

The Italian case is focus on triggering the decarbonization of transport sector by the renovation of Local Public Transport (LPT) fleet in Piedmont Region. The policy intervention is being implemented in one of the most polluted areas in Europe (the Po Valley) characterized by a medium-high intensity of commuting both within and among urban areas in the region. The current policy has been launched in 2017. Fostered by the wider EU framework that is clearly supporting sustainable mobility policies and LPT improvement the policy is the most recent step of a series of interventions promoted over the past two decades and aimed at renovating the LPT fleet relying on different funding channels.

The overall goal is to make LPT more sustainable and efficient by contrasting the obsolescence of the fleet (far above the EU average) that might trigger a number of negative impacts such as high emissions from the LPT's fleet and high cost of maintenance, not reliability and low quality of the service, negative perception of the public transport and consequent resistance from the citizens in shifting from the private to the public transport. Given the heterogeneity of the regional territory, the policy must be conceived as site-specific since, e.g., the introduction of reserved lanes is feasible in the city, but in extra-urban areas the LPT vehicles share roads with private means of transport.

In terms of funding, the central government assigned to the regional administration dedicated resources coming primarily from the National Strategic Plan for Sustainable mobility and integrated with resources from the National Cohesion Fund, the National Recovery Plan and the Po Valley regional Fund 2018-2022.

In terms of results, the policy is expected to produce a number of outputs in the short run (by 2 years) and outcomes in the medium (2 to 5 years) and long run (5- to 10 years). As for the outputs, directly connected with policy implementation, are likely to be produced in the next two years a relevant increase in the share of low emission vehicles and in the quality of services and a contemporary decrease in maintenance costs and the whole LPT emissions. As for the outcomes, by five years the policy is expected to trigger sustainable innovation in vehicles manufacture and a Improvement in air quality mostly in the areas directly affected by the policy. Finally, by ten years from the implementation, the changes in the LPT system will result in an increase of public transport reputation and of adoption by the users, in a shift towards the approach of Mobility as a Service (MaaS) and in the reinforcement, via a virtual loop, of the intermediate impact on users adoption and improvement in air quality.

5.2 Selection of indicators

Given the context and ambitions of the policy, the Italian project team composed of researchers from IRES Piemonte and UNITO and supported by the involvement of representatives from the regional administration (Transport department) was able to identify a number of Social Dimensions that are likely to be affected by the renovation of the LPT's fleet.

These Social Dimensions are clustered around four main domains and reported below with a short rationale that justifies their selection:

Capability

Perception of future (fears and aspirations)

The renovation of the fleet will provide the community with better performing service referred to the satisfaction of transport need both in rural and urban environments. In particular in cities, the impact will be also relevant in terms of the aesthetic of the built landscape, as the density of buses in some areas is particularly high and represents not a minor component of the perception of the surrounding space. The joint effect of the increase in efficiency and aesthetics will shift the life experience of the citizens that could result in a more optimistic view of the future.

Environmental education and awareness

Having the opportunity to use sustainable means of transport, that are likely to be enriched with positive and stimulating information panels on environmental issues and the potential of adopting sustainable behaviors, could both increase the knowledge and awareness of citizens about the challenges posed by the environmental crisis and trigger a shift in their attitudes towards more sustainable behaviors beyond the mobility domain.

Community

Accessibility to transport and mobility services

Although not intended as a reorganization of the LPT service, the renovation of the fleet will allow, on the one side, to have more efficient vehicles able to better cover the regional territory (distances and remote areas not easy to be reached, higher speed, more reliability and less accidents).

Crime and safety

The new vehicles are likely to be equipped with security devices (cameras, ...) and direct channel to alert police forces that should guarantee safer trips in every conditions and for every categories of passengers

Economic development and employment

The renovation might trigger a chain of innovation in the manufacture as well as in all the other sectors related with the sustainable LPT service (charging infrastructure if electric, bio and ecofuel...)

New vehicles might also require new and specialized technicians to be properly maintained that might result from the reskilling of the current work force as well as from the creation of new job position

Shared beliefs and values

The PT is in itself a collective experience that favors the sharing of the benefits in terms of shift in environmental awareness and education. In addition, the increased attractiveness of the LPT might trigger a change in mobility habits that can benefit the renewal of common values towards sustainability and, the way around, can be benefitted by the increasing diffusion of sensitivity towards environmental issues

Environmental impact: air quality, water quality

Direct expected effects of the renovation is the decrease in the emissions that might impact with different intensity different areas depending on the density of LPT service.

Inclusiveness

Accessibility to transport and mobility services

The new vehicles are likely to be equipped with tools and devices that make them more comfortable in general and in particular more accessible for specific groups of disadvantaged people (disabled, elderly, parents with kids...)

Way of life

habits and practices (mobility, consumption...)

The increased quality of the service, the increased performance in terms of emissions and the improved aesthetics are likely to increase the attractiveness of the LPT and to decrease the appealing of private means of transport in such a way that citizens will be stimulated in shifting their habits toward new and more sustainable behavior primarily in the mobility domain but potentially in other domains of consumption (e.g. more LPT will trigger as a spillover more biking and as a chain more healthy diet). It could be a specific component contributing to a wider paradigm change.

For each of the above described domain, the research team also identified possible proxies for their measurement as reported in table 5.1.

DIMENSION	INDICATOR
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perception of future (fears and aspirations)	attitude towards utilization sustainable means of transport
environmental education and awareness	concerns about environmental effects of transport
accessibility to transport and mobility services	% of users who are fairly or very satisfied with the service
crime and safety	N. of crimes reported on Public Transport on the N of users
economic development and employment	decrease maintenance cost /10.000 Km
economic development and employment	R&D in TPL firms
shared beliefs and values	improving positive public perception of Public Transport
environmental impact: air quality, water quality	decrease in specific CO2 emission (see https://annuario.isprambiente.it/sys_ind/906)
accessibility to transport and mobility services	share of vehicles accessible to vulnerable groups (elderly, disabled persons...)
habits and practices (mobility, consumption...) -	N users of public transport

5.3 Stakeholders engagement

The research team submitted the survey to validate the impact dimensions and to assess their potential impacts to 12 stakeholders belonging to four categories: mobility agencies, vehicle manufactures, passengers and trade unions.

Table 5.2, based on the feedback from the stakeholders, shows the expected changes to be triggered by the policy in the short (by 2 years), medium (by 5 years) and long (by 10 years) run.

Overall for almost all the dimensions the impacts are expected to be to a certain degree positive with the benefits increasing over time, in particular for what concerns the *Environmental Impact: Air Quality, Water Quality, Accessibility To Transport And Mobility Services and Habits And Practices (Mobility, Consumption...)*. The only exceptions are represented by impact on *Crime and safety, Shared beliefs and values* and *Habits and practices* that, due to a certain resistance to the innovation and time needed to adapt, are expected to be slightly negatively impacted in the short run.

	SHORT
--	-------

	-5	-4	-3	-2	-1	0	1	2	3	4	5
Perception Of Future (Fears And Aspirations)									x		
Environmental Education And Awareness										x	
Accessibility To Transport And Mobility Services											x
Crime And Safety					x						
Economic Development And Employment							x				
Economic Development And Employment							x				
Shared Beliefs And Values					x						
Environmental Impact: Air Quality, Water Quality									x		
Accessibility To Transport And Mobility Services								x			
Habits And Practices (Mobility, Consumption...) -					x						

	MEDIUM										
	-5	-4	-3	-2	-1	0	1	2	3	4	5
Perception Of Future (Fears And Aspirations)								x			
Environmental Education And Awareness								x			
Accessibility To Transport And Mobility Services									x		
Crime And Safety								x			
Economic Development And Employment								x			
Economic Development And Employment								x			
Shared Beliefs And Values							x				
Environmental Impact: Air Quality, Water Quality									x		
Accessibility To Transport And Mobility Services									x		
Habits And Practices (Mobility, Consumption...) -								x			

	LONG										
	-5	-4	-3	-2	-1	0	1	2	3	4	5
Perception Of Future (Fears And Aspirations)						x					
Environmental Education And Awareness							x				
Accessibility To Transport And Mobility Services						x					
Crime And Safety							x				
Economic Development And Employment								x			
Economic Development And Employment								x			
Shared Beliefs And Values								x			
Environmental Impact: Air Quality, Water Quality									x		
Accessibility To Transport And Mobility Services										x	
Habits And Practices (Mobility, Consumption...) -									x		

	SHORT
--	-------

	-5	-4	-3	-2	-1	0	1	2	3	4	5
Perception Of Future (Fears And Aspirations)									x		
Environemntal Education And Awareness										x	
Accessibility To Transport And Mobility Services											x
Crime And Safety					x						
Economic Development And Emploment							x				
Economic Development And Emploment							x				
Shared Beliefs And Values					x						
Environmental Impact: Air Quality, Water Quality									x		
Accessibility To Transport And Mobility Services								x			
Habits And Practices (Mobility, Consumption...) -					x						

	MEDIUM										
	-5	-4	-3	-2	-1	0	1	2	3	4	5
Perception Of Future (Fears And Aspirations)								x			
Environemntal Education And Awareness								x			
Accessibility To Transport And Mobility Services									x		
Crime And Safety								x			
Economic Development And Emploment								x			
Economic Development And Emploment								x			
Shared Beliefs And Values							x				
Environmental Impact: Air Quality, Water Quality									x		
Accessibility To Transport And Mobility Services									x		
Habits And Practices (Mobility, Consumption...) -								x			

	LONG										
	-5	-4	-3	-2	-1	0	1	2	3	4	5
Perception Of Future (Fears And Aspirations)						x					
Environemntal Education And Awareness							x				
Accessibility To Transport And Mobility Services						x					
Crime And Safety							x				
Economic Development And Emploment								x			
Economic Development And Emploment								x			
Shared Beliefs And Values								x			
Environmental Impact: Air Quality, Water Quality									x		
Accessibility To Transport And Mobility Services										x	
Habits And Practices (Mobility, Consumption...) -									x		

Table 5.2

6. AQUACULTURE CASE STUDY: NORWAY

6.1 Introduction

Aquaculture contributes significantly to the economy of the Trøndelag region. The aquaculture sector in Trøndelag has been growing rapidly and has potential for further growth. Trøndelag has ideal environmental conditions for the growth of salmon, and the aquaculture industry has benefited from these natural advantages. Climate mitigation policies in aquaculture aim to improve biodiversity and increase growth by promoting sustainable practices and reducing environmental impacts that affect fish health and welfare. Climate policies, however, have both negative and positive social impacts. To better understand the social implications of these policies, an SIA was carried out through a stakeholders' survey.

6.2 Selection of indicators

Accessibility to services (-)

Trøndelag has many rural communities whose livelihoods depend on traditional farming. Implementing green policies in aquaculture can displace some traditional fishing communities and limit access to natural resources thus affecting their livelihoods.

Economic development and employment, Employment opportunities (+)

Aquaculture is an essential source of revenue and employment in Trøndelag. The implementation of climate mitigation policies in aquaculture can create more employment opportunities and thus promoting sustainable jobs for the local municipalities in which aquaculture is taking place.

Environmental impact: air quality, water quality (+)

The Trøndelag region has taken active measures to protect water quality with strict regulations in place to limit the impact of fish farming on the environment. Implementing climate policies will require aquaculture operations to adopt good waste management practices to promote clean water thus reducing the risk of diseases and lice and improving the growth and health of fish populations.

Conflicts and contrasts (-)

The aquaculture industry in Trøndelag thrives on profits. Implementing climate policies can lead to higher production costs which could affect the profitability of aquaculture and lead to conflicts.

Quality of food nutrition (+)

Implementing climate mitigation policies leads to increase in the production of fish protein, providing food securities to communities in Trøndelag and promoting good nutrition.

6.3 Stakeholders engagement

Stakeholder selection for the survey impact was guided by key functions that drive the operation of salmon production in Trøndelag and is summarized in the figure provided.

As far as Permit/Licenses and application process are concerned, all aquaculture sites require a permit to operate. Municipalities make plans for aquaculture sites. They also make public announcements of new permit applications and collect feedback from the public regarding the permit applications. There are several regulatory bodies involved in the application process (refer to Figure 6.1).

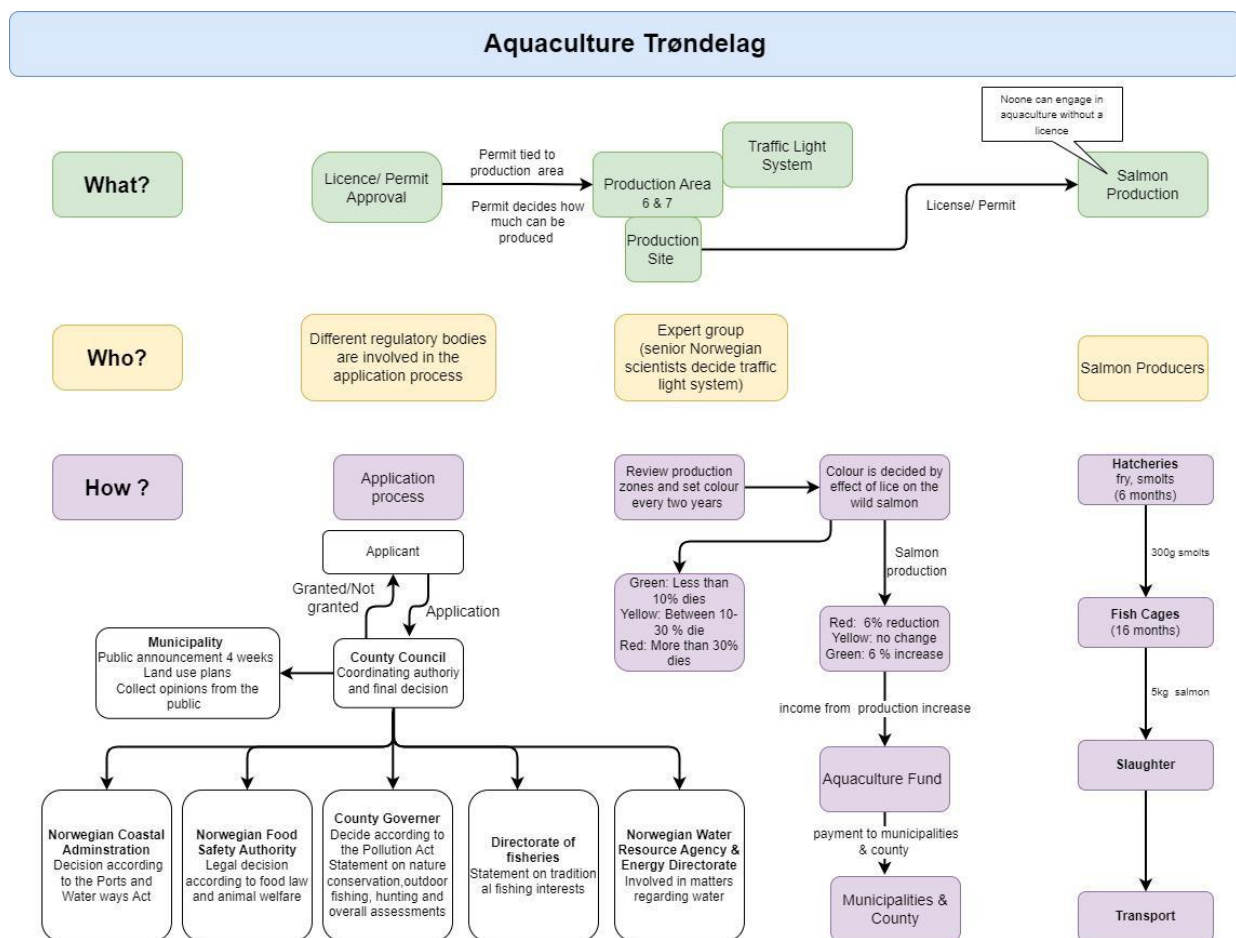


Figure 6.1

In terms of Production Area, permits are tied to production areas. A traffic light system is used to describe the production area. Norway has 13 production areas and the aquaculture sites in Trøndelag are in production areas 6 and 7. A group of experts review the production sites every 2 years and decide the color based on the effect of lice in the production area on wild salmon. Green colored areas allow for 6% increase in production. Municipalities and the county receive payments when there is production increase from the sites in the municipality. The production of salmon is done at different stages (Hatcheries, Cages, Slaughter).

7. BUILDINGS CASE STUDY: THE NETHERLANDS

7.1 Introduction

There is little research on the actual contribution that the ISDE and NHF make to the number of home renovations made by home-owners. According to a market research (RVO, 2022) only 17% of home owners can certainly afford the costs of renovating their home to a natural-gas free home. 56% of home owners say that it depends on the final costs and 25% of home owners indicates not being able to afford to renovate their home to a natural-gas free home. However, from the home owners that are considering to renovate their home, 66% will most likely use their own savings. 72% are considering making use of state subsidies and 13% of the National Heat Fund.

This means there is a large percentage of home-owners that are both considering to use their own savings as well a state subsidy (mainly ISDE). It is unclear if these home-owners would not renovate their home in the absence of the ISDE subsidy (additionality). For the National Heat Fund research (PWC, 2020) shows that most applicants for the NHF loan would be able to get mortgage credit from another financier (bank) than the state funded NHF. However, these credits would be at a higher interest rate and it has not been researched whether this would affect the home-owners decision to renovate.

Due to this absence of data on the additionality of the PAMs we have had to make an assumption for this SIA (and previously for ToC). The assumption is that without the ISDE and NHF less home-owners would take sustainable measures in or around their homes. Therefore, for this SIA we have looked at the impact of home renovation/taking sustainable measures, the assumed result of the PAMs.

7.2 Selection of indicators

According to our analysis there are 13 social dimensions on which the two PAMs have an impact with a relevance of 3 or higher. In order of highest these dimensions are:

- 5 housing (quality, affordability)
- 5 access to clean and affordable energy
- 5 private properties value (houses, lands....)
- 4 capability to heat/cool the house
- 4 environmental impact: air quality, water quality
- 4 environmental impact: aesthetic value
- 3 labor market (employment rate and opportunities)
- 3 economic development and employment
- 3 income and economic support
- 3 cooperation and collective action (e.g. energy)
- 3 health and well-being
- 3 income
- 3 habits and practices

7.3 Stakeholders engagement

For 11 of these domains we have found researches that prove this impact by means of different indicators. We will discuss them per domain. Within the domain of *Way of life* there are three dimensions on which the PAMs have an impact. The first is *access to clean and affordable energy*. All SHs except for one believe the impact of the PAMs on the access to clean and affordable energy to be high. According to a survey (Milieu Centraal, 2021) among home owners with a heat pump (also hybrid) 58% respond that their energy bill is lower in comparison to when they had a (natural) gas boiler. A study from the University of Maastricht (2023) shows that after taking insulation measures the natural gas use for heating decreases on average 20% and remains low(er) in the following years. This study also takes possible rebound effects in behavior into account. Although the PAMs do not actually affect the energy price itself, the home owners are able to heat their homes at a lower price.

The second dimension is *housing (quality, affordability)*. The same survey by Milieu Centraal (2021) found that over 58% of home owners with a heat pump experienced a (strong) increase in living comfort. Therefore, it can be said that for the transition from a natural gas boiler to a heat pump (funded by ISDE of NHF) the housing quality increases. All stakeholders believe the PAMs to impact housing quality in a positive way although the amount of impact differs from slightly to greatly. Two out of four stakeholders expect the positive impact on housing quality to increase over time possibly due to advancements in technology.

The last dimension in this domain affected by the PAMs is health and well-being. CBS have performed a study researching the impact of renovation on health, specifically respiratory problems, sleeping problems and stress. The indicators they have chosen are the use of asthma medication in relation to gas heating or bad ventilation, the use of sleeping pills in relation to bad insulation and experienced stress as a result of energy poverty. The use of asthma medication (respiratory problems) seems unaffected by using a gas heater and only slightly affected by better ventilation. There is however a stronger relation between the insulation level of the house and the use of sleeping pills. An improvement in the insulation status of a home equivalent to a single energy label step (for example from label D to label C) results in a 2% to 6% decrease in the use of sleeping medication.

The last indicator of health researched by CBS is the sense of stress due to energy poverty. We have made the assumption that the use of the ISDE subsidy or taking out a loan at the NHF can lessen energy poverty (lower energy demand for heating). The study shows that the home owners falling into the category of “20% highest energy bill” on average are 14% more likely to experience stress than the home owners in the category “20% lowest energy bill”. Most of the stakeholders expect a (very) limited positive impact on health as a result of the PAMs on the medium and long term. One stakeholder actually expects a negative impact on stress as a result of energy poverty on the short term. Reasons for this can be the (complex) application process and the initial investment costs of the renovation.

Six dimensions within the domain community are impacted by the ISDE and NHF. The first is *private properties value (houses, land, etc.)*. A study conducted by Brainbay commissioned by RVO (2022) looked at the capital gain from houses after renovating (per label step). When renovating from energy label G to C the average capital value of a house will increase 6,1 to 7,8 percent. Most stakeholders expect the PAMs to positively impact (2 tot 5) the value of the private property.

The second dimension is the *labor market (employment rate and opportunities)*. The ISDE subsidy and NHF loan are assumed to increase the number of home renovations. These renovations mean a higher demand for labor and materials. ABN AMRO shared in their ‘Arbeidsmarktindicator’ that the percentage of unfillable vacancies in the energy transition sector was over 36% by the end of 2022 in comparison to 22% for the entire job market. Most stakeholders however, expect the positive impact of the ISDE and NHF on the job market to be limited.

The third dimension is *cooperation and collective action (e.g. energy)*. The ‘Lokale Energie Monitor’ shows an increase in the number of energy cooperatives with sustainable heating initiatives over the last couple of years. The impact of the PAMs on this trend is believed to be medium (3) by the stakeholders with expertise on this subject.

There are several indicators researched with regard to the impact of the PAMs on *economic development and employment*. From 2021 to 2022 approximately 55.000 new

heat pumps (excluding air-air heat pumps) were installed in homes. It is unclear what part was installed in existing homes and what part in newly constructed homes. However in that same period a small 20.000 home owners were granted an ISDE subsidy for a heat pump. As mentioned before, we are left assuming that the ISDE or NHF actually contributed to these numbers and are not (only) additional. The SHs believe the impact of the PAMs on this dimension to be medium to high.

The last two dimensions affected by the PAMs are related to *environmental impact* both *aesthetically* (to which we also added sound) and *air and water quality*. With regards to the first one, the survey conducted by Milieu Centraal (2021) showed that 16% of home owners with a heat pump experience nuisance from the sound coming from their heat pump at night. And 7% indicate that their neighbors experience sound- nuisance from their heat pump. Most stakeholders believe the impact of the PAMs on sound pollution to be small except for one stakeholder, who is an expert on energy poverty and talks to many home owners, who believes the impact of PAMs/renovation on sound pollution to be very high. The subject of sound pollution from heat pumps is also one that has received much attention in the Dutch media.

With regards to air and water quality; Renovation made possible by the ISDE subsidy or the NHF loan will result in a reduction of energy demand. As we have seen on average insulation measures resulted in 20% decrease in gas demand. When transferring from a natural gas boiler to a heat pump the electricity demand in Joules will (on average) be 1/4th of the previous gas demand. These decreases can be translated prevented CO₂ emissions. With the build environment being responsible for 37% of the final energy use of the Netherlands, and most of that energy use coming from heating, heating being done in the people's homes, and this being the location where the CO₂ is emitted, cutting back on this demand can have a significant effect on the air quality. Most stakeholders believe the impact on air quality to be high for the exception on one stakeholder who believes renovation results in a negative impact on air quality in the short term.

The dimension *income and economic support* is of course an important one when we look at an investment subsidy and a loan. In the Netherlands about 5% of home owners were suffering from energy poverty in 2020 and 2021 due to low income in combination with a energetically inefficient home (TNO, 2022). Are these people however aided by the ISDE and NHF? According to the PWC (2021) study only 1% of all NHF loans were granted to home owners with an annual income lower than 18.000 a year. In comparison, the total percentage of home owners with this income in the Netherlands is 4%. For home owners making less than 30.000 a year, the difference in percentage granted loans and total share of all home owners was 16% to 33%.

This means the highest percentages of loans were actually granted to home owner with higher incomes. Part of the reason is that home owners with very low incomes often do not meet the demands for taking out a loan (not BKR registered, reliable income). In this year, 2023, the National Heat Fund has founded a new type of loan at a zero interest rate especially for home owners earning less than minimum income. Three out

of four SHs also confirm this (strong) negative impact of the PAMs on economic support and inclusiveness. They mention that because home owners with very low incomes cannot apply for a loan, the gap between home owners suffering from energy poverty and other home owners widens since the ISDE and NHF do offer financial support to home owners that are financially better off.

8. CONCLUSIONS

A predictive impact evaluation is all the more useful when it manages to combine ex-ante and ex-post evaluations (referring to similar measures or partial implementations of the same intervention) and to involve SHs in the research process. The aim of T2.3 was to develop tools for a SIA of PAMs related to the CS, considering the social side of impact, which does not exclude aspects concerning environmental impact as well. The objective was not to conduct a comprehensive evaluation, at this stage of PATTERN research development, but to specify the domains, dimensions and indicators of an SIA; to build analytical tools capable of qualifying, measuring and quantifying impact dimensions; to involve a number of SHs in different countries to test these tools and obtain both data for the overall evaluation pathway, and explicit or implicit suggestions towards refining evaluation techniques.

In the first section of this deliverable, its structural, theoretical as well as empirical significance were presented, explaining how PATTERN conceives the link between ToC and SIA (T2.2 and T2.3). In the second section, the general methodology followed in setting up the survey instruments, and involving SHs, was presented. In the subsequent sections, the characteristics of the Agricultural CS (Belgium), the Traffic CS (Finland), Transport Mobility CS (Italy), the Aquaculture CS (Norway) and the Buildings CS (Netherlands) were outlined, as well as results of indicators selection and of the surveys conducted with local SHs.

The production of an impact assessment horizon was positively underpinned by an experimental application that allowed for the acquisition of significant amounts of data and the engagement of a number of SHs in policy assessment in the prospect of bridging ex-post and ex-ante evaluations and projections. T2.3 offers to PATTERN new data and tools to be poured into models production, proposed by UNITO and RVO to the Consortium and profitably compared with the suggestions proposed by VITO in the work addressed to D1.4. The tool offered and put to the test with this survey has proven to be effective and adaptable to the the different CS contexts, collecting quantitative and qualitative data on indicators appropriately calibrated. The latter were selected by CSLs in relation to different contexts referred to unitary and consistent dimensions, limited in number and corresponding to an ordered and limited number of social domains.

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The PATTERN project aims to improve practitioners' capacity for decision making on climate and environmental policies by developing a One-Stop Shop for the economic appraisal of policies and measures. With this One-Stop Shop and its different components, PATTERN will provide decision-makers, stakeholders, and the public with more realistic ability to systematically assess the options and their consequences. It will provide a basis for improving (i) methodologies, techniques and models for conducting economic appraisal of climate and environmental policies (ii) the broader policy evaluation framework and practices currently used in European countries and their regions and (iii) tailored analysis and engagement strategies structures for participation and co-creation with relevant stakeholders and key actors to enhance operational capacities of economic appraisal methods and improve the impact of European policies on climate and environment.