

e-smartec

Categorization of engagement and behavior change techniques in sustainable mobility plans steps

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1. Introduction

1.1 Project overview and report positioning

The e-smartec project is a 3-year project started in August 2019, funded under the Interreg Europe Programme 2014-2020 and addressing the thematic area of Low Carbon Economy. It aims at reinforcing existing policy instruments by enhancing each step of mobility planning with the deployment of targeted marketing techniques for linking bottom-up and top-down decision making (participatory dimension of mobility plans). The overall goal is to develop action plans that provide tailored guidelines to authorities for increasing citizens' and stakeholders engagement levels by applying effective marketing techniques.

Three different types of activities are foreseen by the project:

- A. Exchange of experience.** This activity includes all the actions that will ensure the exchange of experience and policy learning among the actors of regional relevance. It incorporates the sharing of practices and the integration and deployment of the lessons learnt into the regional policy instruments. The activity includes the following tasks:
- T1.1: Collection of marketing techniques already used in the participated Regions for engaging and motivating citizens-led urban planning
 - T1.2: Analysis of marketing techniques and selection of the most appropriate while developing effective and acceptable SUMP
 - T1.3: Capacity building for effective “marketing approach in mobility planning”
 - T1.4: Action Plans (APs) definition and preparation
 - T1.5: Monitoring plan for Aps
 - T1.6: Transferability analysis
- B. Communication and dissemination.** This activity focuses on the awareness raising on the project's developments and outputs, the implementation of targeted dissemination activities and the establishment of communication channels with relevant organizations and projects. The activity is developed under the following tasks:
- T2.1: Advanced communication strategy incorporating marketing principles
 - T2.2: Advanced communication and dissemination actions
- C. Project management.** This activity incorporates the administrative, financial, legal, scientific and quality management of the project, concerning all the necessary processes related to the planning, monitoring and controlling the progress and performance of the project and the involved partners.

In particular, the **Task 1.2 (T1.2) aims at analysing the marketing techniques identified and collected in Task 1.1 (T1.1) in order to investigate which ones can be used in different regions** according to: local needs, experience in sustainable planning, maturity in development and implementation in sustainable mobility plans. The main objectives of Task 1.2 are:

- identify the need to intervene and open a dialogue with travellers – identify gaps
- enhance the value of interacting with users at early stages
- select marketing techniques able to tackle the identified needs
- develop a first approach on how to apply the techniques

- identify potential barriers
- develop a methodology to support the evaluation and implementation of sustainable initiatives.

Two reports are delivered by Task 1.2:

- 1 "Categorization of engagement and behavior change techniques in sustainable mobility plans steps"
- 2 "Internal transferability report for marketing techniques adoption in sustainable mobility plans"

A Guide of "E-library smart marketed sustainable mobility plans" (database with further information on best marketing practices per planning step) will be also developed for incorporating it in the Policy Platform. The Guide will have both a print and e-library format and will be also uploaded at the project's website.

The present document is the first deliverable of the Task 1.2, elaborated starting from the main results achieved during the Task 1.1 by **analysing the marketing techniques implemented in the practices that were collected, and matching their expected results with the sustainable mobility plans steps**. As concerns the latter, in this document we refer to the structure of the cycle of Sustainable Urban Mobility Planning depicted in the second edition of the European Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan¹.

1.2 Document concept

The aim of this document is to categorize the marketing techniques towards the sustainable mobility plans steps. The main approach is an inductive one, consisting in some systemic (Systems Thinking) as well as mixed multi-criteria (Group Concept mapping) analytic techniques applied to the knowledge base of good practices (GPs) built by the Task 1.1. The practices, either coming from the regions participating in the e-smartec project or regions outside the project, are really valuable for the categorization analysis because represent concrete outcomes of the implementation of marketing techniques, and related methods, in specific context. Thus, through a categorization and a deeper investigation of the practices and the techniques, some insights have been revealed that could be helpful for the policy makers to enhance the participatory approach of sustainable mobility plans in their regions.

The structure of this document is as follows:

- Chapter 2 outlines the categorization process applied for the classification, evaluation and explanation of the impacts of the diverse marketing techniques
- Chapter 3 provides a systemic understanding of the dynamics underpinning the successful implementation of technique in different contexts
- Chapter 4 presents further results obtained by using a mixed multi-criteria approach to analyse practices and marketing techniques.

¹ Rupprecht Consult - Forschung & Beratung GmbH (editor), Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan, Second Edition, 2019.

- Chapter 5 outlines the overall conclusions.

2. The categorization process

2.1 Approach and methodology

The general objective of the categorization approach is to **classify the marketing techniques according to several relevant attributes and classes per step of the SUMP cycle** (European Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan²).

In particular, it aims to identify which marketing technique(s) best copes with the regional needs, as for example the need for fostering the cooperation and co-planning, or the need to achieve the greatest citizens awareness (of the SUMP relevance and effectiveness), participation and engagement, taking into account several contextual characteristics, as: the phase of the their sustainable urban mobility plan development or implementation (existing phase in the SUMP cycle); the experience/maturity in sustainable planning and implementation; the maturity in terms of technical and administrative capability, and/or in terms of development and implementation of sustainable mobility plans.



Figure 1: The SUMP cycle 2.0, Rupprecht Consult 2019

² Rupprecht Consult - Forschung & Beratung GmbH (editor), Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan, Second Edition, 2019.

The categorization approach of e-smartec good practices was developed in order to classify, cluster and rank the marketing techniques, starting from a systemic understanding of the data and information retrieved and analysed in the Task 1.1 through the combination with relevant results collected from the scientific literature, and a further classification of the good practices and the inherent adopted techniques.



- *The results of the analysis presented in the current report are based on the experience of marketing techniques already used and well evaluated in e-smartec regions.*
- *The assignment of attributes to each GP (objectives, SUMP cycle phase and step, other practice main attributes and relevant features, results evaluation etc) was made having and covering an angle of view wider than the case-specific experience (wide-angle evaluation of practices from the*

The reader is suggested to interpret the final remarks and key takeaways taking into account both the area specific character/experience characteristic and the already applied effort to open the knowledge gained on a wider SUMP cycle perspective for engagement and increase awareness.

The main assumption beside this approach is that a **good practice (essentially the data and information retrieved in the Task 1.1.) synthesizes the concrete successful outcomes of the adoption of the right mix of marketing techniques in a specific context**, thus if we combine this with relevant studies and match the results with a **classification based on both the contextual attributes** (those specifically defining the practice and context in which this was experienced) **and the methodological ones** (those defining the techniques and the different methods applied), we could **help to understand which techniques best apply in the different contexts defined by specified attributes.**

This inductive analysis is therefore guided by a systemic approach. In fact, to have a deeper understanding of how to effectively handle the engagement and co-planning challenges of Sustainable Urban Mobility Planning, and, more specifically, how to **design acceptable policies for improving the adoption of more sustainable mobility modes**, it is imperative

to understand which dynamics characterize together the contexts and the techniques' application and which are the key success factors for those policies already in place (represented by the collected good practices). Rather than pinpointing the single causal chains leading to a favourable condition, **our approach finally aims to identify the dynamics enhancing the adoption of a sustainable mobility in a specific context by addressing the plausible interrelationships between underlying factors.**

The categorization process has been articulated in two phases: (1) systemic analysis; (2) systems factors concept mapping. In particular, the methodologies adopted to perform those analyses envisaged by these two phases, i.e. Systems Thinking evaluation approach and Group Concept Mapping, are briefly described in the next two sections.

2.2 Systems Thinking (ST) evaluation approach

The analysis was performed by elaborating a qualitative model able to support decision makers in understanding the effects of their choices when determining the best marketing technique to adopt (with reference to the desired characteristics of their context). The model has been developed by means of a Systems Thinking approach and in particular it took the form of a causal loop diagram.

The Systems Thinking is an intellectual approach to reality that is intended to look at occurrences from a systemic perspective. This holistic viewpoint involves the analysis of not only the elements the entity in object is composed of, but also of the relationships between those elements.

In fact, a system is an interconnected set of elements that is coherently organized in a way that achieves something. As it emerges from the previous definition, the components of a system are three³:

- **Elements:** the entities which make up the system, they represent its fundamental constituents.
- **Interconnections:** the relationships that link elements between each other. The structure of relationships defines a system as well as its elements: for example, the nature of the system football team doesn't vary even if all the members are changed. If instead interconnections are modified (for example rules are distorted), the nature of the football team changes.
- **Purpose:** the goal which associates all the elements. Without a purpose, a system loses its identity.

All systems are part of bigger systems, that in turn are part of even bigger systems and so on, and in turn, are made up of sub-systems, that in turn are made up of sub-sub-systems and so on. A system is more than the sum of its components: this means that for understanding it, knowing the components is not sufficient, but a complete mapping of interconnections is

³ Meadows, D. H. (2008). Thinking in systems: A primer. Chelsea green publishing.

needed. To do that, it's useful to notice that many of the interconnections in systems operate through flows of information^{4 5}.

Most of the times, system complex behaviour originates because of the interaction of different feedback processes, and, of course, also because of the presence of differential relations, non-linearity and delays. In general, all the dynamics arise from two different feedback loop, namely the reinforcing feedback loop (positive feedback) and the balancing feedback loop (negative feedback). But what is a feedback loop? It is defined as a close sequence of causes and effects, that is to say a close path made of actions and information. Think for instance of the causal relation between eggs and chickens. More eggs bring to more chickens, which leads to have more eggs and so on and vice versa, that is to say less chickens equals less eggs and so on. This relation is always true without other causal relations that limit the chicken population growth. If, for instance, wolves were introduced into the system, they would generate a balancing feedback loop. With the increasing of the chickens there would be an increasing of the wolves. However, if wolves raise the chicken will then decrease. This is a balancing feedback loop.

Therefore, it is very important to understand and learn the structure and the dynamics of the behaviour of systems we are part of, and that, day by day, rapidly become complex systems. To do so, in our mental models (our mental representations of the systems we are dealing with) we need to switch from a linear thinking pattern to a circular thinking pattern (Figure 1).

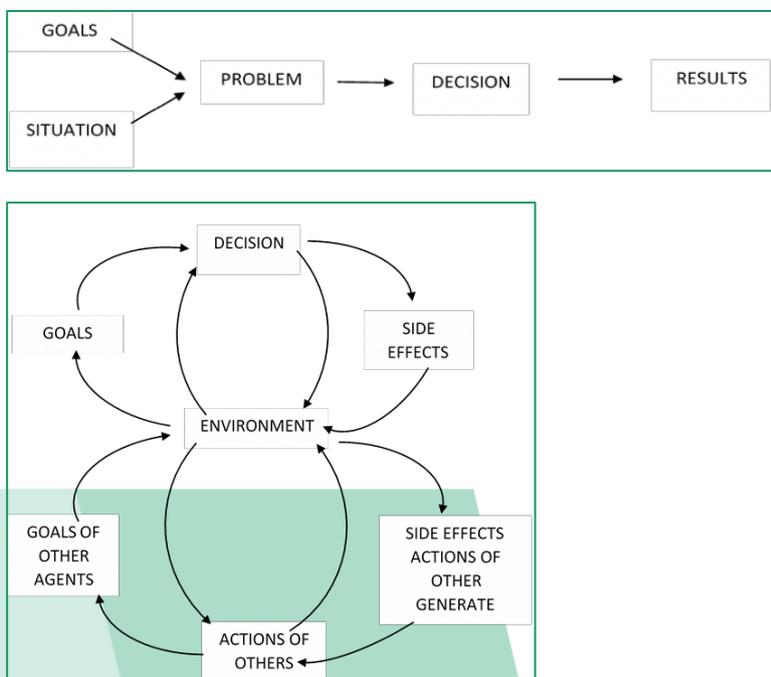


Figure 2 : Linear vs circular (systemic) thinking pattern

⁴ Forrester, J. W. (1994). System dynamics, systems thinking, and soft OR. System Dynamics Review, 10(4), 245–256.

⁵ Sterman, J. D. (2000). Business Dynamics: Systems Thinking and Modeling for a Complex World. Boston: Irwin/McGraw-Hill.

In a context of dynamic complexity, learning is crucial. In this line of thought, learning itself is a process that requires time and is composed of a feedback: following the formulation of an hypothesis, through the observation of an experiment, the hypothesis can be confirmed or needs to be modified (Figure 2).

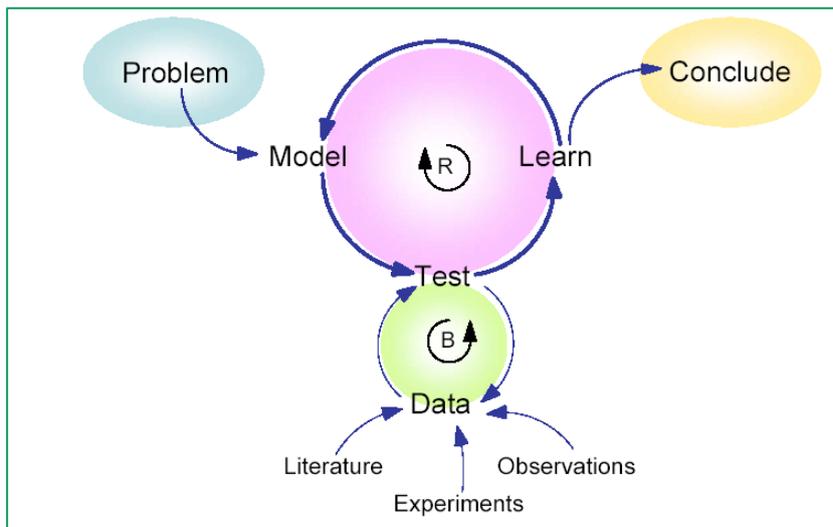


Figure 3 : Learning loop

Accordingly, for a fruitful learning, it is necessary to employ a systemic vision of reality: when hypotheses are tested and modelled, aspects that might seem irrelevant should not be overlooked. The relevance or irrelevance of an aspect will subsequently be evaluated according to the results and according to the impact it has on the behaviour of the system.

Finally, system thinking practitioners highlights the strong similarities between the concept of organization and of system, and how it can be integrated with other organisational approaches to promote change in organisation. In this respect, system thinking can guide organisations in this complex world. Moreover, such a discipline, along with other four, characterizes the so-called Learning Organizations, namely the organizations that learn. The other disciplines are Self-dominance, Mental models, Shared vision and Group learning, and they make it possible to fully achieve also the “fifth discipline”⁶, namely the systemic thought itself. In particular, these disciplines allow us to set aside all the incorrect mental models that cause us a distorted and prejudicial vision of reality raising in this way a barrier to the learning process, which can instead develop when there is a common commitment.

In fact, many of us tend to use, in a more or less conscious way, now consolidated rules and attitudes. System thinking and the other learning organisation disciplines are particularly useful in order to modify one’s vision of reality, because they create a model that can catch its dynamic complexity.

⁶ Senge, P. (1990) The Fifth Discipline, Doubleday/Currency, New York, NY.

The Systems Thinking approach employs various tools for extrapolating information about complex systems and discovering hidden and counter-intuitive behaviour. In this sense, the Causal Loop Diagram (CLD) instrument^{7 8}, as said typical of the Systems Thinking approach, is heavily qualitative but is the starting point for the production of a quantitative model. Notwithstanding its qualitative value, the analysis of CLDs can introduce several important results⁹. The main advantage in using this type of analysis is that it provides with a vision that considers many themes inside a system as interconnected with each other, contrary to those past approaches where systems are analysed individually and on a sectoral basis.

2.2.1 How to read Causal Loop Diagrams (CLDs)

A Causal Loop Diagram (CLD) is a combination of causal links between variables, a diagram that visualizes the elements of a system and how they are interrelated among them. The diagram consists of nodes and edges, where the nodes represent the variables/elements of the system and the edges their causal connections.

A causal link represents a causal relationship between two variables (one, independent, which represents the cause, and another one, dependent, which represents the effect) and can be graphically represented as a directed connection on a graph, an arrow linking the cause “towards” the effect ($A \rightarrow B$), all else being equal.

A causal connection (“directed link”) can be of two types:

- Positive. It is marked as S (or +) and it means that the two linked variables change in the same direction; meaning that when one increases (decreases) the other also increases (decreases). when the independent variable (arrow tail) changes, then the dependent variable (arrowhead) changes in the same direction. (if A grows then B grows, if A decreases then B decreases).
- Negative. It is marked as O (or –) and it means that the two linked variables change in opposite directions; meaning that when one increases (decreases) the other decreases (increases). when the independent variable (arrow tail) changes, then the dependent variable (arrowhead) changes in the opposite direction. (if A grows then B decreases, if A decreases then B grows)

Following these definitions, closed cycles in a CLD are named feedback loops and they are essential parts of the system. A causal loop diagram is defined as a “directed di-graph”, a graph whose arcs - connecting two variables - have a direction (of causality, as explained) and a polarity: such causal relationships may determine some loops between the various variables taken into account in the analysis.

⁷ Morecroft, J. (1982). A critical review of diagramming tools for conceptualizing feedback system models. *Dynamica*, 8(1), 20–29.

⁸ Richardson, George P. (1986). Problems with causal-loop diagrams. *System Dynamics Review*, 2(2), 158-170.

⁹ Coyle, R. G. (2000). Qualitative and Quantitative Modelling in System Dynamics: Some Research Questions. *System Dynamics Review*, 16(3), 225–244.

There can be two types of feedback loops: reinforcing feedback loop and balancing feedback loop (indicated by + and – inside the loop). Also, it is possible to indicate a time delay between the two variables (Figure 3) by crossing with two short perpendicular lines the delayed causal link.

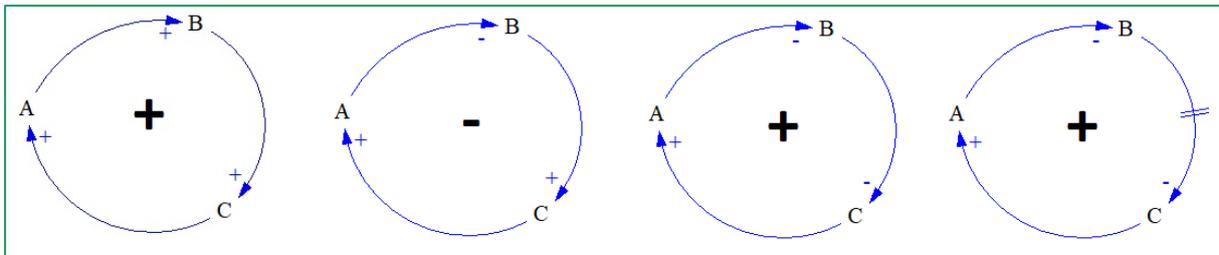


Figure 4 : Starting from the left: Reinforcing (positive) loop, Balancing (negative) loop, positive loop due to even number of negative links and delayed loop

As known, a graph of this type can be described by an inference matrix in which the relationships between elements are described by the presence of a 1, with a positive or negative sign depending on the sign of the corresponding arc, if there is an arc that connects two elements, or an 0 if there is no relationship between them. It will thus be possible to visually locate such feedback loops on the graph. Note that also these feedback cycles can be called as “positive” (or self-reinforcing) or “negative” (or “balancing”), depending on the number of “minus” signs that are present in cycle¹⁰.

A Positive Feedback (“+”, R, self-reinforcing): has an even or zero number of minus signs in the feedback cycle; it is a self-reinforcing behavior in the sense that each change in the starting variable corresponds to a bigger change in the very same variable at the end of the loop. This behavior corresponds to exponential growth.

Positive/reinforcing loop (Figure 4). The effect of one variable propagates through the loop and returns to the initial variable further reinforcing it.

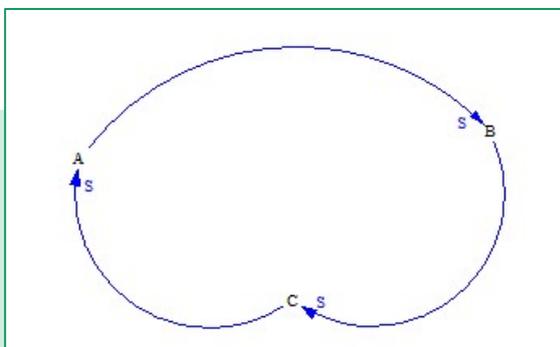


Figure 5 : Reinforcing loop

¹⁰ Sterman, J. D. (2000). Business Dynamics: Systems Thinking and Modeling for a Complex World. Boston: Irwin/McGraw-Hill.

For example, in the figure above an increase (decrease) in variable A will result in an increase (decrease) in variable B, which increases (decreases) variable C. Finally, an increase (decrease) in variable C will ultimately result in a further increase (decrease) of variable A.

While, a Negative Feedback (“-”, N, balancing): has an odd number of minus signs in the cycle; it has a balancing behaviour meaning that a change in the starting variable in a direction is followed, at the end of the next loop, by a change in the opposite direction. Such structure generates goal-seeking behaviours.

Negative/balancing loop (Figure 5). The effect of one variable propagates through the loops and returns to the initial variable decreasing its initial effect.

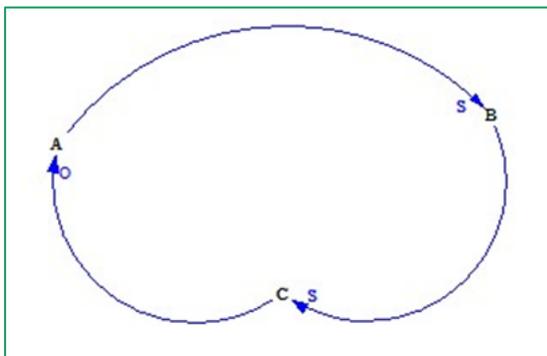


Figure 6 : Balancing loop

For example, in the figure above, an increase (decrease) in variable A will result in an increase (decrease) in variable B, which increases (decreases) variable C. Finally, an increase (decrease) in variable C will ultimately result in a decrease (increase) of variable A.

Some real examples are “Arm race” for reinforcing loop (a) and “Carpools and gasoline consumption dynamic” for balancing loop (b).

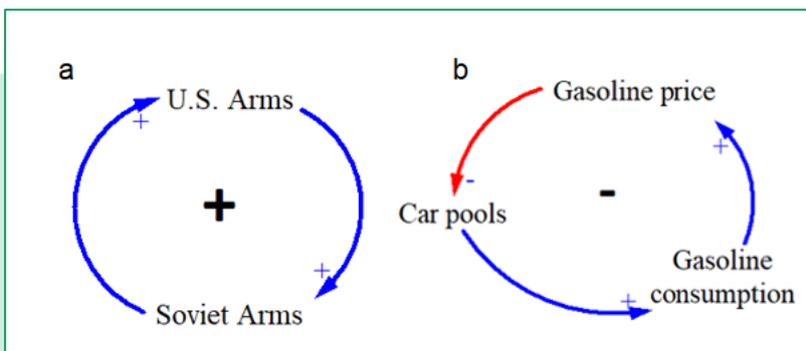


Figure 7: Examples of positive and negative loops

Positive, negative, and delayed loops can give birth to a variety of systemic structures, named system archetypes, which can assist in taking a closer look at the problem displayed by a certain system and diagnosing the optimal solution

Systemic archetypes are modular structures that highlight a particular behavioural pattern. They can be used, individually or together with others, to infer a set of behaviours that can be found in the evolving observable variables of a system. The Fifth Discipline by Senge¹¹ states that “If reinforcing and balancing feedback and delays are like the nouns and verbs of systems thinking, then the systems archetypes are analogous to basic sentences or simple stories that get retold again and again.” Therefore, founding these types of patterns inside a system, it is possible to give a deeper explanation about its dynamics and performance. Thanks to this, the following actions for fixing systemic problems will be more accurate and thorough.

Another step of System Dynamics methodology is represented by the translation of Causal Loop Diagram in a Stock and Flow model, which is another important tool of SD. The S&F model is a simulation model that represent the system under study from a quantitative point of view, allowing user for policy experimentation in free-consequence environment.

S&F symbolism consists of:

- the **stock** (represents things in the model that can accumulate, the stock will rise and drop depending on its flows and will remain constant while in equilibrium),
- the **flow** (is the rate of change of a stock. Inflows add to a stock, outflows take away from the stock. Equilibrium occurs when inflows to all stocks are equal to the outflows),
- and the **information link** (blue arrow in the model represent the direct influence of the current value on another).

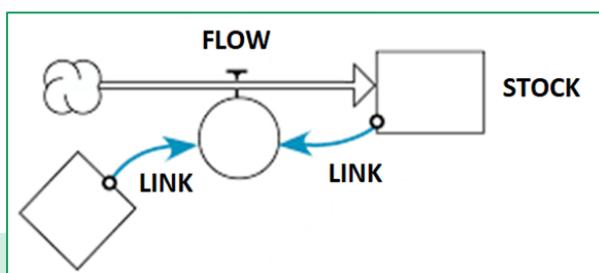


Figure 8: Stock and flow basic elements

For the aim of this study, we will use the symbolism of Stock and Flow method to describe the final version of the model in section 4.1, without defining the data and the equations inside that (this could be done in future with more quantitative data about SUMP adoption process). This is useful because it allows for a better description of citizens development process by the use of “accumulation” concept (different citizens in different clusters of development degree).

¹¹ Senge, P. (1990) *The Fifth Discipline*, Doubleday/Currency, New York, NY.

2.2.2 The former CLD developed during the Task 1.1

Based on the insights provided by the GPs, especially the international ones, a first draft of causal loop diagram was initially developed in order to capture the citizens' behaviour dynamics. In a first phase of the analysis, the model is initially focused on citizens' psychological dynamics and tries to explain how these may affect the performance of the system. In a subsequent phase (section 4.1), the model will also address the marketing techniques and how they push/pull citizens through the SUMP adoption process.

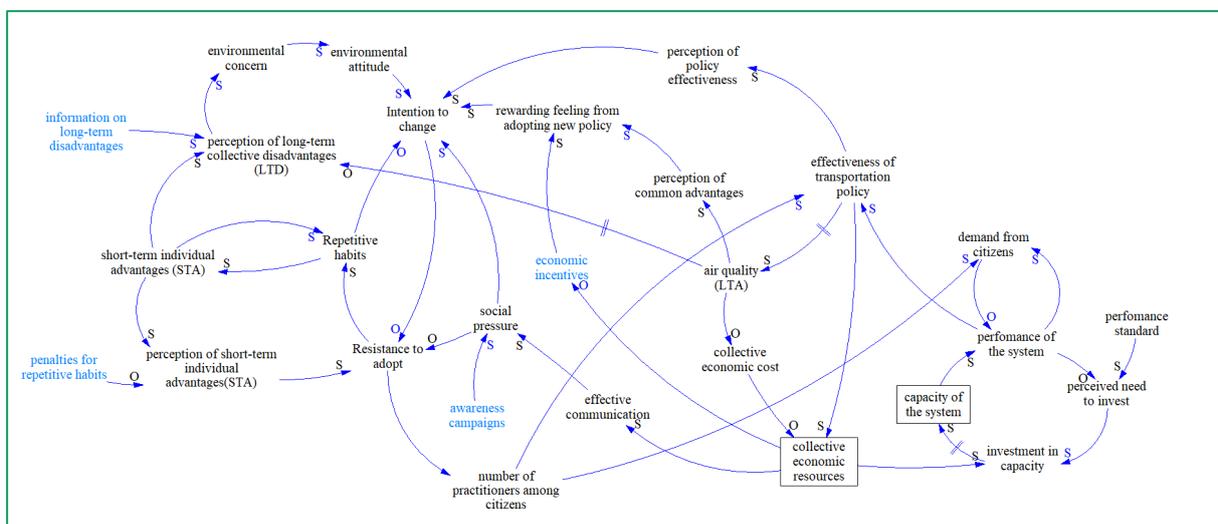


Figure 9: e-smartec first CLD capturing the interaction between the practices' variables

This first draft, which focuses on citizens behavior, was based mainly on a theory widely used to examine the motivation of individuals through the analysis of their intention and behavior, that is the theory of planned behavior¹² (TPB) by Ajzen (1991). This is probably the most relevant theoretical framework to explain determinants and antecedents of purchase and adoption intention. Intention, as explained by the framework, is a conscious plan of action, which specifically requires a behavior and motivation to actuate it. Many studies describe the intentions and generally think they are the best predictors of behavior and fully mediate the impact of:

- attitude,
- subjective norm,
- perceived behavioral control

These three will be indicated in the following as “antecedent factors”. In our CLD model these three factors were translated and adapted to the context, in order to depict their different role inside the SUMP adoption process.

¹² Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, 50(2), 179-211.

The core variable inside the model is the “Intention to change”, which according to the TPM can be considered the best available predictor of human behavior. The other core variables in this first Causal Loop Diagram are named “Repetitive habits” and “Resistance to adopt”

Following the division on antecedents factors described above:

Attitude was translated into “Environmental Attitude”, that has an important role in the decision to accept a new specific behavior regarding transportation habits. The environmental attitude refers to the degree to which a person has a favorable or unfavorable evaluation of the ecofriendly behaviors.

Subjective Norms refer to the belief related to whether most people approve or disapprove some specific behavior. It relates to a person's beliefs about whether peers think he or she should engage in that behavior. Therefore, inside the model, this factor was translated as “Social Pressure”.

Perceived behavioral control refers to a person's perception of the ease or difficulty of pursuing a certain behavior of interest. In the model, this factor can be easily translated into the “perception of policy effectiveness”. When a policy is successful, it is easier for citizens to enter in its mechanism and benefit from it.

Besides these three factors, that are the main drivers that positively affect the intention to shift to a sustainable mobility adoption, we included also another factor, i.e. “rewarding feeling” from adopting new policy, which models the strengthening of the sustainable behavior due to short-term (incentives) and long-term (air quality) benefits.

The inclusion of the variable named “Repetitive Behavior” comes from the fact that when an action has been performed repeatedly in a stable context, which is obviously the case for most travel mode choices, only minimal thought is required in order to initiate, implement, and terminate the action¹³. Thus, it is often argued that travel mode choices are usually performed in a habitual rather than a reasoned or planned way¹⁴. In light of this, it is clear that Repetitive behavior has a critical role in the transportation mode dynamics. While on one hand this dangerous tendency is worsened by the “Resistance to adopt new behavior”, on the other hand the Intention to change, if well-developed by acting on the antecedents factors explained before, can tackle the tendency.

So, in summary, Resistance to adopt affects Repetitive habits positively: the larger the resistance to adopt the larger the level of Repetitive habits. On the contrary Intention to change affects the Repetitive habits negatively, as well as the resistance to adopt: the larger the willingness to change the smaller the level of repetitive habits.

The notion of repetitive habits acts on both the long and short-term disadvantages to the environment. As a result, the CLD illustrates the friction between immediate advantages that

¹³ Wood, W., Quinn, J. M., & Kashy, D. A. (2002). Habits in everyday life: Thought, emotion, and action. *Journal of personality and social psychology*, 83(6), 1281.

¹⁴ Verplanken, B., Aarts, H., Van Knippenberg, A., & van Knippenberg, C. (1994). Attitude Versus General Habit: Antecedents of Travel Mode Choice 1. *Journal of applied social psychology*, 24(4), 285-300.

characterize everyday moves, and the longer-term (difficult to see) disadvantages that will emerge from such unsustainable behavior.

At the same time, Repetitive habits affect positively the long-term, collective disadvantages (more repetitive behavior more disadvantages) after a delay. The long-term collective disadvantages (noted as Air quality (LTA)) affect negatively the perception of long-term collective disadvantages which affects positively environmental concern and attitude, and then the intention to change.

Apart from those aspects that are related to the differences between collective-individual and short-term vs. long-term, there is a part of the model that is focused on the financial/economic aspects of transportation policies. Again, the economic variables – the most important of which is the “collective economic resources” interact with pre-existing loops, which affect the Intention to change and the Resistance to adopt respectively through the economic incentives for citizens who take part in sustainable transport transition and through effective communication and awareness campaign. The rationale behind those variables is that the more effective a policy is the better the level of collective economic resources, which has a positive impact on the personal finances and individual awareness, which ultimately affect the overall attitude towards the new policies.

Finally, there is a small cluster of variables that are focused on the performance of the system itself, based on a well-known archetype called “Growth and underinvestment”¹⁵.

As it was mentioned before, the various loops that were described interact also with each other forming bigger loops. However, it is revealed that there are two types of feedback loops: there are the reinforcing ones that increase the resistance to adopt and therefore the repetitive behavior. Moreover, there are the negative (or balancing loops) that act on the willingness to change with the aim of reducing (counter-balance) the repetitive behavior.

As a result, two interesting policy insights are highlighted. Firstly, with the appropriate measures in the positive loops of the Resistance to adopt, the reinforcing behavior can act in favor of the policy, since the nature of a reinforcing loop is not always in the form of “the higher the resistance to adopt the higher the repetitive behavior”, but it can also act as “the lower the resistance to adopt the lower the repetitive habits”. This fact means that these policies (i.e. penalties for repetitive habits and awareness campaigns) could force a more environment-friendly behavior from the part of commuters that break the negative effects of repetitive, unsustainable behavior.

The second sets of policies (i.e. information on long-term disadvantages and economic incentives) act on the Intention to change. In this part, the higher the effect on the Intention to change, the lower the level of repetitive behavior and thus the lower the level of long-term disadvantages.

¹⁵ Senge, P. M. (2006). *The fifth discipline: The art and practice of the learning organization*. Currency.

Thus, following this first description of the CLD, and reflecting also the insights gained through the GPs analysis, a reference to the adoption process and marketing techniques has been introduced in the CLD, and a new version of this diagram was developed and is discussed in the following Sections.

2.3 Group Concept Mapping (GCM)

The second part of the document follows a bottom up approach to the analysis i.e. inductive reasoning. Thus, the analysis begins from the specific, then patterns are detected using the data collected and finally ends with general observations. This inductive analysis has the methodology of Group Concept Mapping¹⁶ (GCM) at its core. GCM is a mixed-methods strategy that captures the rich conceptual data from communities of interest on a particular question or topic and organizes and analyses it statistically using multidimensional scaling and cluster analysis. It involves a structured multi-step process¹⁷, including data gathering, sorting and rating, multidimensional scaling and cluster analysis, and the generation and interpretation of multiple maps. The process typically requires the identification of a large set of statements (or performance judgements) relevant to the topic of interest, individually sort these statements into piles of similar ones, rate each statement on one or more dimensions, and interpret the maps that result from the data analyses. The analyses typically include multidimensional scaling (MDS) of the sort data, hierarchical cluster analysis of the MDS coordinates, and computation of average ratings for each statement and cluster of statements. The maps that result show the individual statements in two-dimensional (x, y) space with more similar statements located nearer each other and grouped into clusters. Concept mapping has been used effectively to address substantive issues across a wide range of fields^{18 19 20 21}. This process generates a conceptual framework for evaluation that has several benefits compared with less sophisticated conceptualization approaches such as focus groups:

- It represents a systematic process that integrates structured group processes such as unstructured idea sorting and rating tasks with sophisticated multivariate statistical methods to produce a well-defined, quantitative set of results.
- It graphically represents a domain of ideas in a framework that can be utilized directly for developing specific evaluation metrics.

¹⁶ Kane M, Trochim WM (2007). Concept mapping for planning and evaluation. Thousand Oaks, CA: Sage Publications.

¹⁷ Greene, J. C., & Caracelli, V. J. (1997). Advances in mixed-method evaluation: The challenges and benefits of integrating diverse paradigms. *New Directions for Evaluation*, 74.

¹⁸ McLinden, D. J., & Trochim, W. M. K. (1998). Getting to parallel: Assessing the return on expectations of training. *Performance Improvement*, 37(8), 21-26.

¹⁹ Shern, D. L., Trochim, W., & LaComb, C. A. (1995). The use of concept mapping for assessing fidelity of model transfer: An example from psychiatric rehabilitation. *Evaluation and Program Planning*, 18, 2.

²⁰ Trochim, W., Cook, J., & Setze, R. (1994). Using concept mapping to develop a conceptual framework of staff's views of a supported employment program for persons with severe mental illness. *Consulting and Clinical Psychology*, 62, 766-775.

²¹ Witkin, B., & Trochim, W. (1997). Toward a synthesis of listening constructs: A concept map analysis of the construct of listening. *International Journal of Listening*, 11, 69-87.

- It facilitates the collection of input from a broad and diverse array of data sources, in virtually any setting in which a group issue or need requires definition and evaluation, and it enables feedback on these data to participants in a timely manner.

Above all, concept mapping has been proved to be a valuable strategy to evaluate the result of practice-based research, as the Task 1.2 of the e-smartec project actually is²². Using the concept map as a foundation, one can measure any number of variables of interest and display them as patterns on the map. Two or more patterns can be compared, both in the aggregate and in their details, using pattern matching to look at consensus and consistency over time, along with bivariate displays known as “go zones” to identify the potential courses of action or types of measurement. Therefore, to perform such an analysis, we adopted the following procedure, which is an authors’ modification of some of the techniques recently surveyed and described by Rosas in 2017²³.

2.3.1 Step 1. Systems factors elicitation

The analysis started by working on the data of the practices collected by Task 1.1. First, each of those practices has been **categorized by defining its objectives**: the main one plus, if any, a secondary one. To improve the categorization effectiveness, and the opportunity to perform some comparisons, objectives were also standardized and the good practices were separated into two general groups: those that aim at **behavioral change towards sustainable mobility** and those that aim at increasing **co-planning levels**.

Then, within each group, **each practice has been matched with the SUMP cycle phases and steps** (where the practice can be applied) defined by the European Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan²⁴:

- **PHASE 1: Preparation and Analysis.**
 - Step 1: Set up working structures
 - Step 2: Determine planning framework
 - Step 3: Analyze mobility situation
- **PHASE 2: Strategy Development**
 - Step 4: Build and jointly assess scenarios
 - Step 5: Develop vision and objectives with stakeholders
 - Step 6: Set indicators and targets
- **PHASE 3: Measure Planning**
 - Step 7: Select measure packages with stakeholders
 - Step 8: Agree actions and responsibilities
 - Step 9: Prepare for adoption and financing
- **PHASE 4: Implementation and Monitoring**
 - Step 10: Manage implementation

²² Petrucci, C. J., & Quinlan, K. M. (2007). Bridging the research-practice gap: Concept mapping as a mixed-methods strategy in practice-based research and evaluation. *Journal of Social Service Research*, 34(2), 25-42.

²³ Rosas, S. R. (2017). Group concept mapping methodology: toward an epistemology of group conceptualization, complexity, and emergence. *Quality & Quantity*, 51(3), 1403-1416.

²⁴ Rupprecht Consult (editor), *Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan*, Second Edition, 2019.

- *Step 11:* Monitor, adapt and communicate
- *Step 12:* Review and learn lessons

Furthermore, **each good practice was matched with the wider marketing technique category**. In particular, the marketing already identified and discussed in Task 1.1 were used:

- **Dialogue Marketing.** The generic term for all marketing activities in which media is used with the intention of establishing an interactive relationship with individuals. Dialogue marketing uses technological advancements such as personalized websites, social media apps and blog platforms to promote a message focusing on those individuals who are already open to engagement and creates opportunities for them to connect and relate.
- **Relationship marketing.** Form of marketing that emphasizes in specific target groups with the intention of building long lasting relations. Communication is extended beyond informing. It can be interpreted as commodity exchange that instrumentalize features of partnership.
- **Digital Marketing.** The component of marketing that utilizes internet and online based digital technologies such as desktop and mobile media, digital apps and other platforms to promote services and products. The same policies can be applied to participatory projects for citizens' engagement. Types of Digital marketing, basing on the primary means of communication that each campaign uses:
 - Social Media. A technique that primarily uses blogs or communicative platforms such as Twitter, Facebook, Instagram, YouTube, Snapchat.
 - Internet Marketing. A technique that primarily uses mobile and desktop media with platforms or Web based apps
- **Word of mouth.** A process of storytelling and knowledge spread from one person to another based on reputation. It is the most straight-forward technique since it is based on personal communication and recommendation. Its objective is to generate "buzz" over specific issues which in return will generate awareness and further participation in future initiatives.
- **Undercover marketing.** Form of marketing that uses sublime messaging to promote a concept. The audience is exposed favorably to a topic or issue without being aware of the promotion strategy. It bears many similarities with the Word of Mouth technique as its objective is to create a "buzz" over specific issue. What differentiate it is the use of alternative engaging methods.
- **Guerrilla Marketing.** An advertisement strategy which uses surprise and unconventional interactions in order to promote a concept.
- **Wheel of persuasion.** The technique where scientific insights on the psychology of conversion (insights from behavioral economics, consumer psychology, neuromarketing, sociology) are used for persuading the targeted audience.
- **Cause marketing.** The marketing technique that focuses on social or charitable causes promoting social responsibility. It is designed to raise attention around the topic, while linking relevant activities or ideas that can benefit the explored topic.

On the other hand, the methods adopted to implement the techniques, used to further classify the practices, were:

- **Surveys.** Reaching audience through dedicated surveys and via personal interviews
- **Focus groups.** A combo method of focused interviews and a discussion group. It is designed to obtain information about (various) people's preferences and values on a defined topic.
- **Public Consultation.** It is a public enquiry targeted to a group of randomly selected citizens.
- **Experts Panels.** A specialized discussion where a variety of experts is engaged; based on various fields of expertise; to debate and discuss various courses of action and make recommendations.
- **Public Events.** Events intended to raise awareness, by creating opportunities to inform the public about issues and projects that are being explored.
- **Raising Awareness Campaign.** A promotional campaign which uses several tools in order to reach as many individuals as possible.
- **Workshop.** An intensive planning session where citizens, designers and others collaborate on a vision for development.
- **Participatory Mapping.** A general term used to define a set of approaches and techniques that combines the tools of modern cartography with participatory methods to represent the spatial knowledge of local communities.
- **e-Participation – crowdsourcing.** E-participation is the utilization of information and communication technology in order to motivate and engage wider citizens through diverse modes of technical and communicative skills. An online tool which enables involvement in decision co-creation process, in various extent.
- **e-Engagement – campaigning.** Uses information technology (IT) and digital tools to facilitate the process of engagement.
- **Gaming.** A game is a simulation of a real situation, allowing participants to act out and experience interactions of community activities. It is a participatory approach to problem solving that engages a real-life situation compressed in time so that the essential characteristics of the problem are open to examination.
- **Gamification.** The use of game-elements in non-game contexts. It refers to an instructional strategy with the aim to increase engagement, motivation, and participation by integrating game strategies such as point scoring, competition features, rules of play, etc., to an online platform or community, or mobile application.
- **Pilot Interventions.** Is an approach where interventions of a temporary character are implemented on trial base, leading towards a more permanent transformation in the future.
- **Capacity building.** A method that develops further a certain range of skills and competencies of the participants.
- **Popular Events.** A method where well established events and happenings are “side” used.
- **Ambassador campaign.** Indirect promotion by collaborating important public figures (celebrities, opinion-leaders, trendsetters).
- **Public Cause Events.** Events that are dedicated to social or charitable causes.
- **Raising Awareness campaign (Cause related).** Awareness campaign that focuses on social and charitable causes.

In order to provide a better understanding of those impacts produced by the implementation of techniques/methods, also **the combination of more than a single technique/method has been considered and evaluated if observed in a good practice.**

The obtained classification is then furtherly improved by **defining a set of relevant attributes and features of the practices**, to investigate both the commonalities of them and those factors that could reveal determinant to understand their success. These features were:

- the **Duration of the campaign**: expressed as Continuous, Periodic or One-time
- the **Locus of the events**: expressed as Local, Regional or National
- the **Cost implications**: expressed as Low, Medium and High
- the **Easiness to transfer**: expressed as Low, Medium and High

Finally, **the success of a practice (thus, of a combined techniques/methods implemented in a specific context) is measured against some Key Performance Indicators (KPIs).** Such indicators are either explicitly mentioned in the description of the good practices collected by Task 1.1 or are inferred from their characteristics. A list of such KPIs follows for each group of good practices:

1. GPs aimed at behavioral change:
 - a. **People/stakeholders engaged/informed**
 - b. **Citizens/stakeholders using (more) sustainable or energy efficient modes of transport**
 - c. **People registered in new mobility schemes**
2. GPs aimed at co-planning:
 - a. **People engaged/participating**
 - b. **New mobility solutions/ideas co-created**
 - c. **Level of people registered in new mobility scheme**

2.3.2 The Step 1 resulted in the systems factors organized in a knowledge base through which the practices as well as the techniques/methods can be categorized, to gain some former insights on the conditions by which successful outcomes can be achieved in a specific context. Step 2. Cluster analysis

For each combination of practice/techniques/methods/SUMP steps, 6 specific **fitness indicators** were developed, as follows:

1. **Duration of the campaign.** A value to the duration of the campaign was attributed, with the purpose of facilitating the numerical calculations of the clustering process. The indicator takes one of the following values: 1 for One time; 2 for Periodic; 3 for Continuous.
2. **Marketing communication technique/s.** indicator related to marketing technique mostly implemented in the practice. It takes the following values: Dialogue marketing, 1; Wheel of persuasion, 2; Relationship marketing, 3; Digital marketing, 4; Guerilla marketing, 5; Word of mouth, 6; Undercover marketing, 7; Cause marketing, 8; Other, 9; Combined (if the identification of a single main technique), 10.

3. Means of communication. An indicator to attribute a value to the methods associated with a combination of practice/techniques:

- a. No information, 0
- b. Public cause event, 1
- c. Combined, 2
- d. Other, 3
- e. Awareness campaign, 4
- f. Pilot intervention, 5
- g. Public event, 6
- h. Capacity building, 7
- i. Popular event, 8
- j. E-engagement-campaigning, 9
- k. E-participation/crowdsourcing, 10
- l. Gaming, 11
- m. Ambassador campaign, 12

4. Cost implications:

- a. low, 1
- b. medium 2
- c. high 3

5. Easiness to transfer:

- a. Low, 1
- b. Medium, 2
- c. High, 3

6. Impact on KPIs:

- a. If all three attributes have values, 5
- b. If two of the attributes have values, 4
- c. With one attribute:
 - i. <1000 persons/stakeholders etc., value 1
 - ii. >1000 persons/stakeholders etc., value 2
 - iii. Any number of organizations, municipalities etc., value 3

- d. No values, 0

Then, the K-Means²⁵ clustering technique was used. It is the most adopted in GCM approach. In more detail, the algorithm was performed with 4 clusters, using the Euclidean distance and a random initial state. Finally, it should be stated that the technique was applied when 5 or more good practices were present in a specific SUMP step; any less would not provide meaningful calculations²⁶.

2.3.3 Step 3. Multi-criteria rating

To improve the understanding provided by the clustering step, first an unstructured sorting²⁷ was applied to the practices by grouping them into piles, then both the practices and the techniques were rated according to a multi-criteria evaluation approach. In particular, 3 criteria were defined according the indicators built in the previous step:

1. Cost implications: The criterion requires minimization (the lower the value the better) and it can take the following values:
 - a. low, 1
 - b. medium 2
 - c. high 3
2. Easiness to transfer: The criterion requires maximization (the higher the value the better) and it can take the following values:
 - a. Low, 1
 - b. Medium, 2
 - c. High, 3
3. Impact on KPIs: The criterion requires maximization and it can take the following values:
 - a. If all three attributes have values, 5
 - b. If two of the attributes have values, 4
 - c. With one attribute:
 - i. <1000 persons/stakeholders etc., value 1
 - ii. >1000 persons/stakeholders etc., value 2

²⁵ Krishna, K., & Murty, M. (1999). Genetic K-means algorithm. *IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics)*, 29(3), 433-439.

²⁶ Dolnicar, S. (2002). A review of unquestioned standards in using cluster analysis for data-driven market segmentation. *Faculty of Commerce-Papers*, 273

²⁷ Coxon, A. P. M. (1999). *Sorting data: Collection and analysis* (Sage University Papers on Quantitative Applications in the Social Sciences, 07-127). Thousand Oaks, CA: Sage.

iii. Any number of organizations, municipalities etc., value 3

d. No values, 0

The rating was established by performing the TOPSIS (“Technique of Order Preference Similarity to the Ideal Solution”)²⁸ Multi-Criteria Decision Analysis method. TOPSIS is considered as one of the most versatile and easy to use MCDA method²⁹ and provided many valuable insights on the practices and the marketing techniques (and related methods).

3. A systemic understanding of techniques’ effectiveness

3.1 SUMP adoption process, a causal loop diagram

In order to motivate citizens to accept one or more sustainable mobility solutions implemented in the city, it is necessary to understand that the adoption of particular technology, product, service pass through different stages. Each stage represents the current state of mind of the person who will use the technology, product, service.

Citizens are, de facto, consumers of city’s services. Therefore, the process with which a citizen approaches the new sustainable mobility solution, an unusual mean of transportation for him/her, can be analyzed as the process through which a consumer recognizes his/her need for that specific technology, product, service; develops the willingness to adopt it by collecting information about it and, finally, embrace totally the new technology, product, service.

Unlike the first CLD draft showed in chapter 2.3.1, the CLD proposed in this section attempts to explain how this adoption process can be influenced by marketing tools and what are the endogenous main variables that play a crucial role inside the process. Furthermore, to facilitate the understanding of elements inside the model, the CLD has some graphic elements from Stock and Flow methodology (quantitative formulation of system dynamics modelling): there are stocks (variable inside box), that represents things in the model that can accumulate, the stock will rise and drop depending on its flows and will remain constant while in equilibrium; there are flows (arrow with hourglass), that represents the rate of change of a stock, inflows add to a stock, outflows take away from the stock.

In other words, this model aims to:

- study the effectiveness of exploiting marketing tools for promoting sustainable mobility interventions among the population and for enhancing the participatory approach of SUMP;
- investigate how marketing tools influence the adoption of new sustainable mobility interventions and whether specific characteristics of citizens should be taken into account when applying a marketing technique;

²⁸ Lai, Y., Liu, T., & Hwang, C. (1994). Topsis for MODM. European journal of operational research, 76(3), 486-500.

²⁹ Papathanasiou, J., & Ploskas, N. (2018). Multiple Criteria Decision Aid. Springer International Publishing

- give evidence of how the adoption process, if well managed by policy makers, heavily affects the performance of the transportation system, as well as the health status of city's environment (with obvious benefits for the city system in general) – serving sustainable mobility vision
- provide a causal relationship rationale for the future development of a quantitative model, based on a stock & flows approach (typical of the System Dynamics methodology) that will constitute a fundamental building block towards the development of new generation decision support-systems according to the Smart Model-based Governance framework³⁰

Figure 10 shows the model. Variables in **green** indicate marketing techniques which enter the adoption process in different phases. Variables in **red** indicate the Key Performance Indicators which give relevant measures for SUMP effectiveness.

³⁰ Armenia, S. (2020) "The value of Systems Thinking and System Dynamics in the management of complex organizations. A selection of case studies". Napoli, Editoriale Scientifica, ISBN: 978-88-9391-859-6

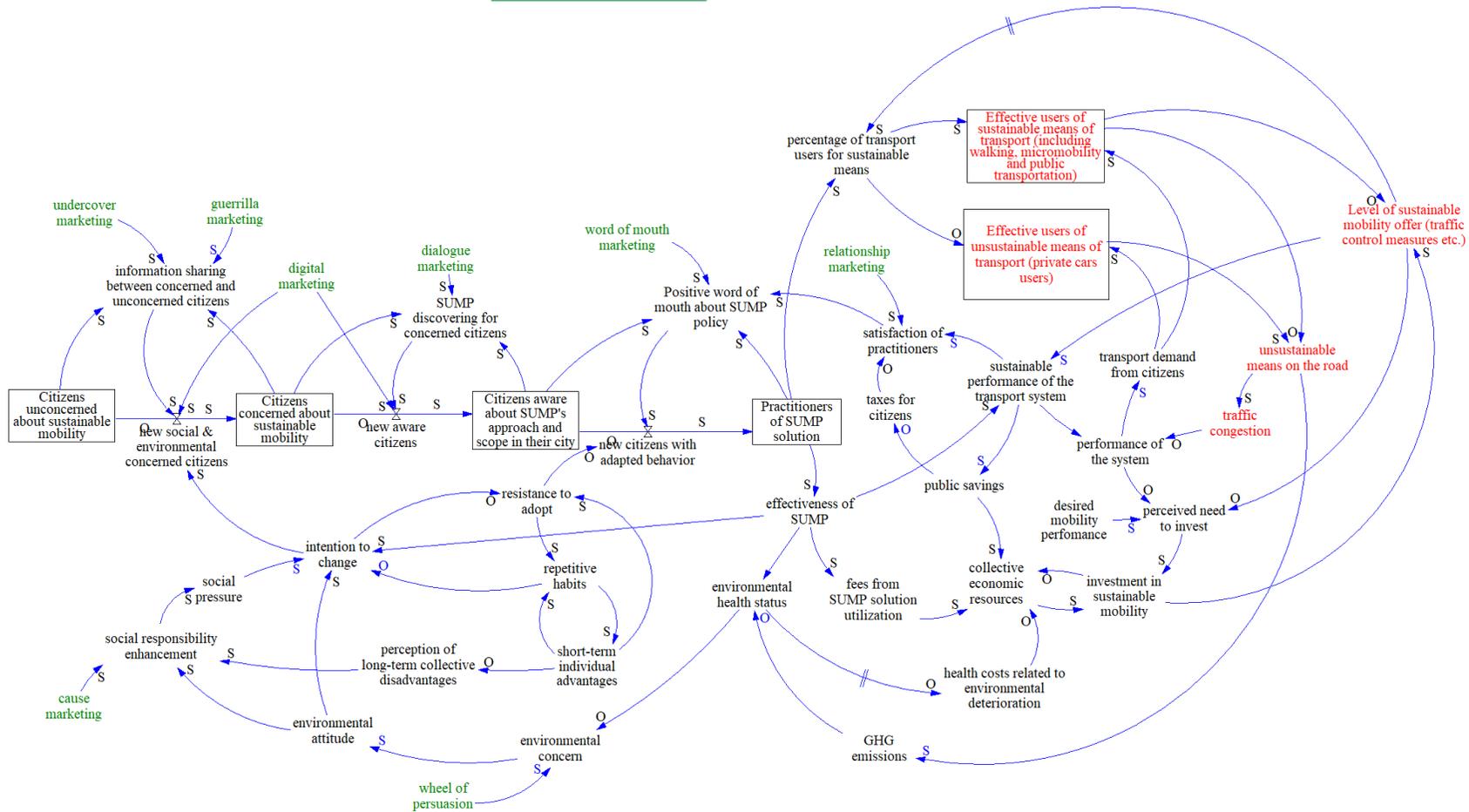


Figure 10 : e-smartec causal loop diagram

3.1.1 Explanation of the variables

The following table provides an overview of the main variables that were included in the Causal Loop Diagram, our qualitative model. The basic structure of the model was partially retrieved and adapted for our specific context from a model developed by Babader et al. on 2016.³¹ In particular, the part transposed and adapted for our purposes is the backbone made by stocks and flows (uninformed -> informed -> aware -> practitioners).

The aim of this model is to clarify where and when the four relevant predictors previously identified, and namely: (a) the attitude towards environment; (b) social pressure; (c) perception of policy effectiveness; (d) perceived benefits of the provided service, fit in the adoption process by citizens. To do so, as suggested by Babader et al., we have first divided the urban population into different clusters (stocks) and then factored in the predictors so to be influencing the rates that determine the flows among such stocks. The set of stocks and flows in this case create the so-called “aging chain”, i.e. disaggregating the total population stock into multiple categories (referred to as cohorts) and each cohort “graduates” to the next cohort over time (and can only move in one direction). So, the development of adoption of SUMP solutions by citizens can be described by this dynamic over time: unconcerned about sustainable mobility -> concerned about sustainable mobility -> aware about SUMP policy in their city -> practitioners of SUMP solution.

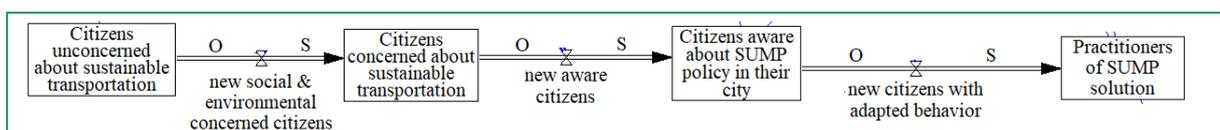


Figure 11: Aging chain of adoption

Table 1: CLD's variables description

Variable	Type	Explanation
Citizens unconcerned about sustainable mobility	General (Stock)	In this stock there is the part of population that is not concerned about environment in its city and do not believe that sustainable mobility could address the issue
Citizens concerned about sustainable mobility	General (Stock)	In this stock there is the part of population that is concerned about environment in its city, but they are not aware of sustainable mobility measures presented in the city

³¹ Babader, A., Ren, J., Jones, K. O., & Wang, J. (2016). A system dynamics approach for enhancing social behaviours regarding the reuse of packaging. *Expert Systems with Applications*, 46, 417-425.

Citizens aware about SUMP's approach and scope in their city	General (Stock)	In this stock there is the part of population that is concerned about environment, know about SUMP in the city, but they do not trust solution's utility
Practitioners of SUMP solution	General (Stock)	In this final stock there are all the citizens that regularly use sustainable mobility options
New social & environmental concerned citizens	General (Flow)	Rate with which citizens become aware of their social role in environmental protection
New aware citizens	General (Flow)	Rate with which citizens become aware of sustainable mobility options and SUMP inside their city
New citizens with adapted behavior	General (Flow)	Rate with which citizens adapt their behavior in favor of the sustainable mobility solutions
Information sharing between concerned and unconcerned citizens	General	Variable that indicate the amount of information shared between concerned citizens and those who are not concerned about sustainable mobility
SUMP discovering for concerned citizens	General	Variable that indicate the amount of information shared between concerned citizens and citizens who are aware of SUMP scopes and sustainable mobility measures in their city
Positive word of mouth about SUMP policy	General	Variable that indicates the size of word of mouth phenomenon, in its positive sense
Intention to change	General	General psychological status characterized by the tendency to change the status-quo
Resistance to adopt	General	Variable that indicates the unwillingness of citizens to be part of the transition to sustainable mobility era
Repetitive habits	General	General state of mind in which the individual finds comfort and advantages in its habits
Short-term individual advantages	General	Variable that identifies the short-term advantages that arise from repetitive behavior
Perception of long-term collective disadvantages	General	Variable that identifies the citizens' perception of collective disadvantages coming from irresponsible behavior
Social responsibility enhancement	General	Improving process of the citizens' collective sense and responsible behavior
Environmental concern	General	General state of mind regarding the environmental issues

Environmental attitude	General	Evolution of environmental concern that becomes everyday practice
Percentage of transport users for sustainable means	General	Percentage of the total commuters that uses sustainable means of transportation
Effective users of sustainable means of transport (including walking, micromobility and public transportation)	KPI (Stock)	Absolute number of people that use sustainable means of transport for a specific period
Effective users of unsustainable means of transport (private car users)	KPI (Stock)	Absolute number of people that use private cars for a specific period
Level of sustainable mobility offer (including traffic control measures, walking and cycling lanes etc.)	General	A general variable that signifies the sustainable mobility solutions in a city
Unsustainable means on the road	General	Number of vehicles on the transportation network that are less sustainable due to their intrinsic polluting level (e.g. private cars)
Performance of the system	General	The state of the whole system that makes its use attractive (fair prices for transit, transport options, service quality)
Sustainable performance of the transport system	General	A measure of the effectiveness and sustainability of the transportation system
Desired mobility performance	General	A measure of the desired performance of the transportation system
Perceived need to invest	General	A variable signifying the need to provide resources to the transportation system to increase its sustainable performance
Investment in capacity	General	Invested resources in sustainable mobility solutions
Environmental health status	General	Measure of the effects of pollution/environmental degradation to health
Health costs related to environmental deterioration	General	Indication of the economic effects of environmental-related health problems

Collective resources	economic	General	An indication of the public budget available to fund sustainable mobility solutions and/or to improve overall system capacity
Fees from SUMP solution utilization		General	Part of the budget that is directed from the applied policy. It also represents revenues from congestion tools.
Effectiveness of SUMP		General	Measure of the adoption level of the applied policy, due to acceptance from people and adherence to sustainability goals
Public savings		General	Amount saved/gained by the adoption of sustainable mobility solutions
Taxes for citizens		General	Level of taxation
Satisfaction of practitioners	of	General	Satisfaction of people that adopt the sustainable mobility solutions

3.1.2 Description of the adoption process

As illustrated in Figure 10, **the model concentrates on three main flows that define the rate with which the citizens change attitude (in favor of) towards SUMP process and towards sustainable mobility measures: (1) social and environmental concern, (2) SUMP solutions awareness, and (3) behavioral adaptation to SUMP solutions.**

About the first mentioned flow, the model identifies the variables that affect unconcerned citizens about sustainable mobility, making them interested in the topic and willing to learn more about what their city has to offer. This change can be achieved by two main activities: on the one hand by **enhancing general social and environmental concerns**, on the other by **pushing peer information sharing between citizens who are not concerned with the ones who do**. Marketing techniques, in this sense, are valid tools to influence a target group to accept, reject, modify or abandon voluntary behavior, with the purpose of obtaining an advantage for individuals, groups or society as a whole. Therefore, we included the marketing techniques, arising from the GPs analysis in the previous project activities, inside the model and we linked their action to specific dynamics in a logical manner, relying on the marketing techniques' descriptions developed previously during the project.

The activity related to enhancing general social and environmental concerns is related to psychological factors that arise from the repetitive behavior held by citizens. In other words, **citizens generally have a certain resistance to adopt new solutions because they are stuck in habits that maximize their own individual short-term benefit, making perception of long-term collective disadvantages even lower**, the repetitive habits has a negative effect on the intention to change, slowing down the social and environmental concerning process. **The intention to change can be enhanced by increasing the social pressure regarding new sustainable thinking; to do so, working on social responsibility enhancement of population through the cause marketing, being a marketing technique that focuses on social or charitable causes promoting social responsibility, seems to be a good solution; but also by highlighting environmental health status and problems**

to raise environmental concern among population, in this sense the **wheel of persuasion can be a valid tool**, as it is effective for persuading the targeted audience to embrace a new point of view through the psychology of conversion (insights from behavioral economics, consumer psychology, neuromarketing, sociology).

The **other activity, i.e. to increase the flow from unconcerned to concerned citizens, is related to the information exchange between citizens who are not concerned with the ones who do**. This can happen both in real life when citizens meet each other, and virtually, through social medias and digital platforms (enhanced by an “ad hoc” digital marketing, eventually). In order to boost the information sharing and to give talking points to citizens, the **policy makers can leverage on two other marketing tools: (i) undercover marketing**, a form of marketing that uses ‘sublime’ messaging to promote a concept. It **bears many similarities with the Word of Mouth** technique as its objective is to create a “buzz” over specific issue, (ii) **guerilla marketing**, an advertisement strategy which uses surprise and unconventional interactions in order to promote a concept.

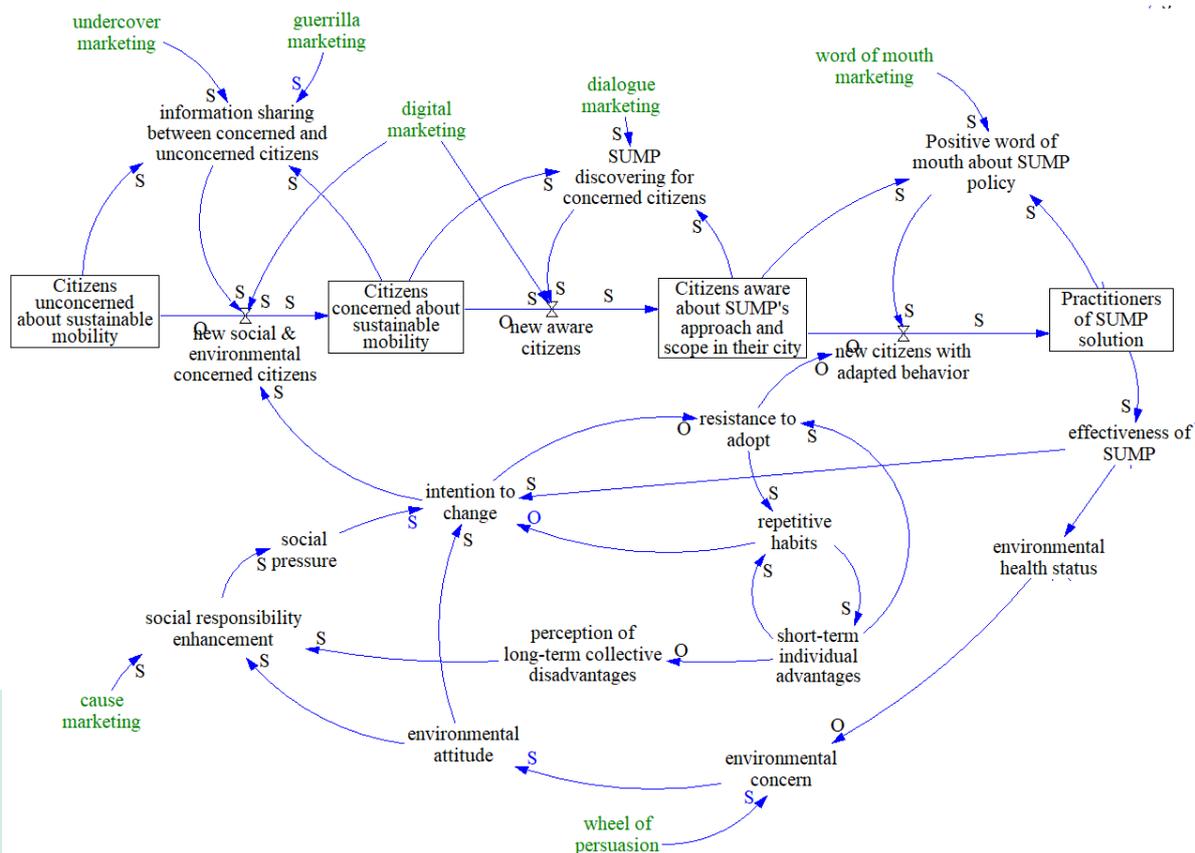


Figure 12: Citizens' social and environmental concern and SUMP awareness development process

After that, the model continues the investigation of what makes citizens become aware of a SUMP policy in their city. The model identifies that, similarly with the previous case, **the information sharing process between citizens is one of the ways through which uninformed citizens become aware of SUMP scopes currently underway inside the city**. In this specific case, **the most suitable marketing tools to enhance the SUMP policy**

discovering process is the dialogue marketing, which uses technological advancements such as personalized websites, social media apps and blog platforms to promote a message focusing on those individuals who are already interested and open to engagement and creates opportunities for them to connect and relate. Anyway, there is **also the digital marketing that can help this flow**, as for the previous one, because it utilizes internet and online based digital technologies such as desktop and mobile media, digital apps and other platforms to promote services and products. In this way, citizens who want to search for information independently from others can consult the material uploaded by SUMP marketing operators directly on web.

The last stage in the model is to investigate **people's behavioral adaptation to become practitioners of SUMP solutions**. This is the hardest state to be reached, because, **although a citizen can be concerned about the environment and be informed about solutions, he/she could not want to enjoy or adopt the solution because of insecurities about the benefits he/she can get from it, in line with the “resistance to adopt” factor**, of which we have spoken before. The **resistance can be tackled by a positive word of mouth about the SUMP policy**. In fact, the most effective way citizens could be persuaded to use a SUMP solution is when they are pushed by someone that they know and whose opinion they trust. The policy maker can boost the word of mouth phenomenon by investing in public events, as well as public relation activities. There is however a critical aspect to consider in this dynamic, **the opinion about the policy of who is spreading the message must be positive, because otherwise, the effect would be diametrically opposed**. In order to improve the opinion about the solution, for it to be effective, the more the practitioners of solution the more the effectiveness and success of solution. The effectiveness has two beneficial effects, on the one hand it could convince someone to make a try of that solution just because he/she sees that there are many citizens that already did; on the other hand **the effectiveness involves in the long term a benefit for public savings, that involves savings on citizen taxes and at the same time causes satisfaction on practitioners about policy makers' work as they see its virtuosity, stimulating positive word of mouth about SUMP**. It is worth mentioning that the satisfaction of practitioners can also be enhanced by using relationship marketing activities, as it emphasizes in specific target groups with the intention of building long lasting relations through a form of communication that is extended beyond just informing.

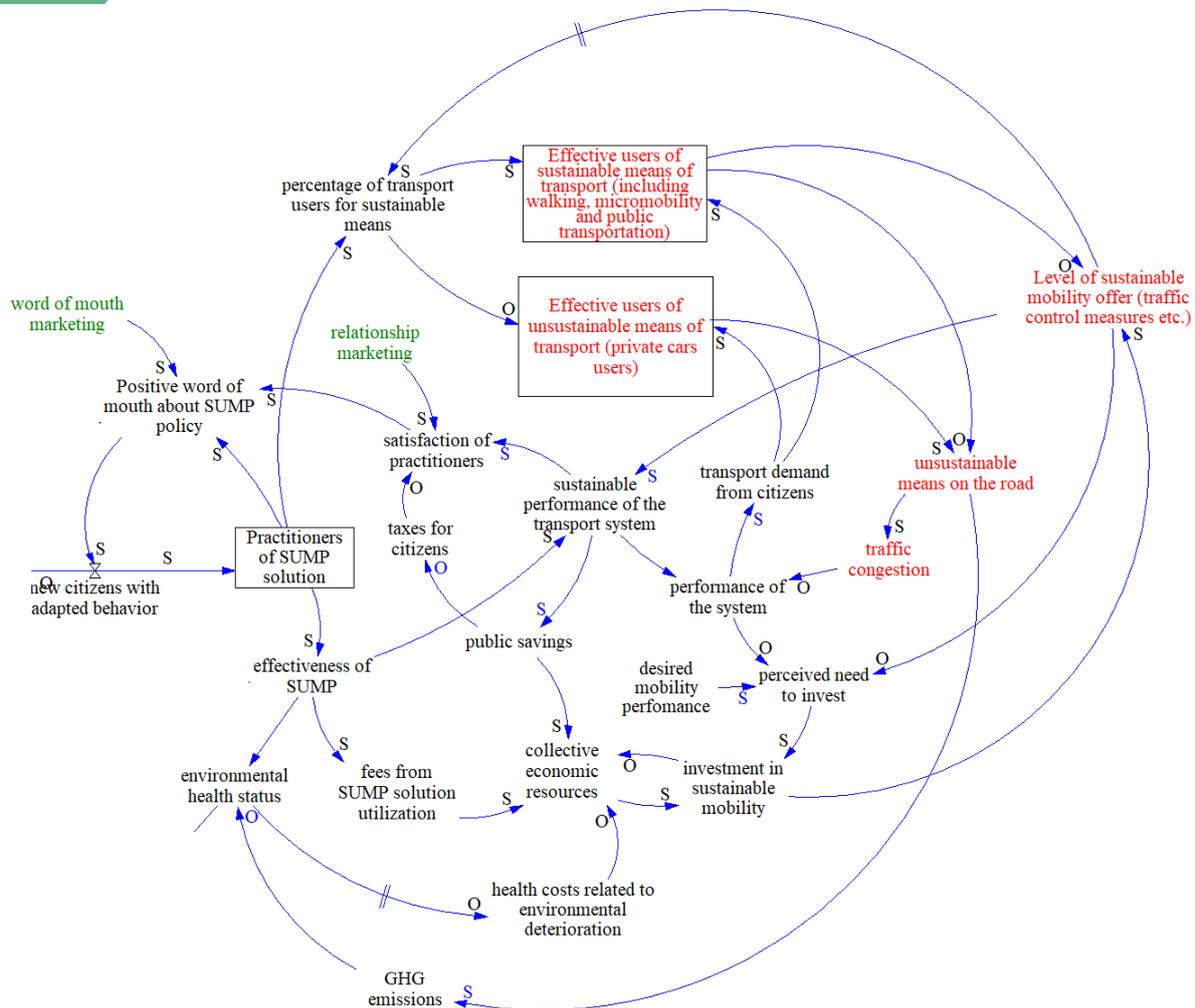


Figure 13: Increasing practitioners and system's performance dynamic

3.1.3 Main Feedback Loops

As explained before, links and nodes create causal relationships, and causal relationships create feedback loops. In this section the main feedback loops that emerge from the analysis of the Causal Loop Diagram will be described.

Ageing chain of adoption

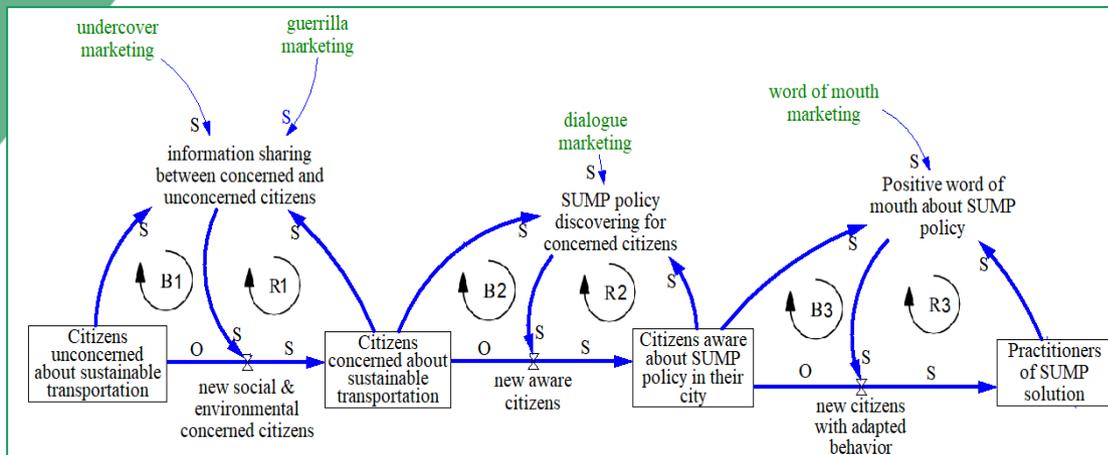


Figure 14 : Feedback loops through adoption process

As depicted in Figure 13, during each phase in which citizens develop new features towards the reach of “practitioner” status, there are several feedback loops that are presented in pairs (B1 and R1, B2 and R2, B3 and R3). They represent the same dynamic, that is saturation, in different phases. In fact, taking as example the first combination, while there is a reinforcing loop R1 that increases eventually the number of citizens concerned about sustainable mobility, on the other hand the balancing loop B1 prevents this growth from being excessive because as the citizens concerned raise in number, the opportunity for them to encounter unconcerned citizens becomes lower, until reaching the saturation, thus the equilibrium. This is true for all the three dynamics showed.

Policy Recommendation: The loops highlighted so far give important indications about how and especially when it is better to use a particular type of marketing technique. Undercover marketing and guerrilla marketing fit better with SUMP strategy when there is still the need to develop a common ground of social and environmental responsibility among citizens. These two kinds of tools act like kick-starters for information sharing about transport and environmental issues, pushing citizens to take care of such topics. Once almost all citizens have received this “education” about the topics it seems that it would be more convenient to invest in other marketing types, for example dialogue marketing if there are many citizens who do not know SUMP’s scopes and role is undertaken by their city; or word of mouth marketing when the SUMP solutions need a catalyst to spread among population.

Resistance to adopt and social responsibility

Policy Recommendation: Resistance to adopt is a crucial variable inside the presented process, through which all the loops, directly or indirectly, pass, but there is something that policy makers could do to control it. First of all, policy makers could act on citizens' social responsibility, when the sense of community is lacking, through cause marketing. By doing this, the R5 loop (which we remind being very dangerous) can be brought under control with evident benefits on resistance to adopt (avoiding at the same time the negative consequences of R4 loop). Another means to tackle the citizens' resistance to adopt is to work on the flow named "new citizens with adapted behavior" through enhancing word of mouth marketing, in this way, the practitioners will increase naturally and simultaneously they will give evidence that the SUMP solutions are effectively working and this will push undecided citizens to take a try. Last action that can be taken is about the loop B4. Generally, this loop is slow to occur because there is a certain delay between the environmental health status and the negative consequences on people, so the awareness and the concern about the problem come after some time. In order to speed up the process, policy makers could make use of wheel of persuasion to effectively persuading the targeted audience to focus on environmental issues before the potential consequences come out.

Feedback Loops on the system's operations

Let's consider the total population of the environment under analysis (i.e.: a city): this consists in the number of relevant people that might be considered as potential target of the SUMP scope (so, in terms of SD modeling, they are those who will be "moving" through the various SUMP states, in other words flowing through the various stocks of the SUMP chain). The higher this initial total population, the higher the number of people that will be involved in the whole systems and in the various stocks, hence also the higher the Effective users of sustainable means of transportation (this entails a positive causal relationship between total population and effective users). Being effective in moving people along the SUMP chains means that there will thus be more effective users, which in turn reduce the capacity of the system (all things being equal – hence at fixed resources – an increase in effective users leads to a decrease in the available/residual capacity of sustainable means. For example, as more people use bike lanes, the more crowded these lanes become, which means that they eventually would need further resources in order to be expanded so to accommodate such an increased number of cyclists). Such a decrease in available sustainable means capacity has also a balancing effect (negative/balancing loop (B6) in Figure 15) on the overall system as it leads to a smaller percentage of sustainable transport users: in fact, as the capacity decreases, due to scarce service availability and/or quality, users may decide resort to other means in order to increase their personal utility functions).

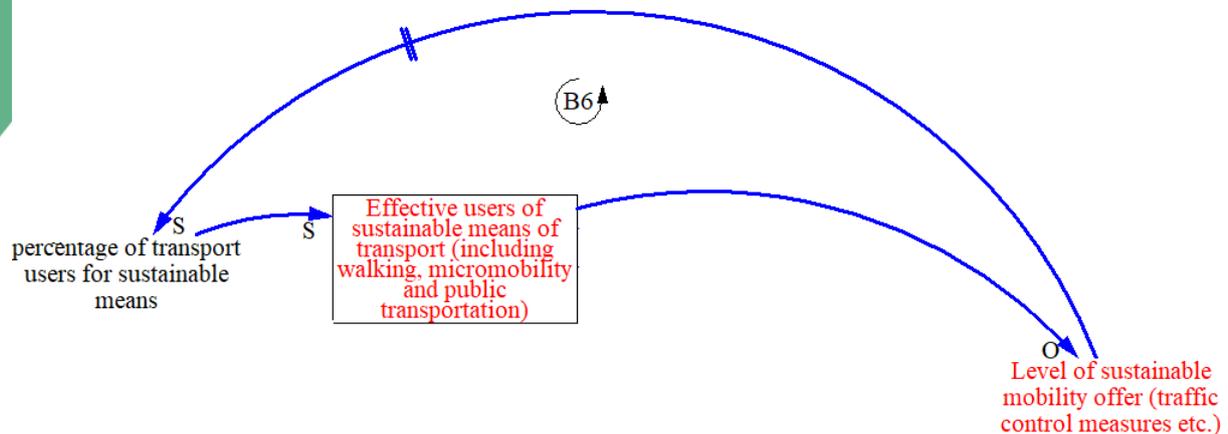


Figure 16 : Balancing loop B6

Both the effective users of sustainable and unsustainable means of transport affect the variable called “unsustainable means on the road”, i.e. less unsustainable means due to their intrinsic polluting level (e.g. private cars). The larger number of effective users of sustainable means of transportation (effective users of unsustainable means of transportation) the smaller (larger) the unsustainable means on the road; for example, the more (less) users prefer public transportation the less (more) private cars circulate on the roads. The number of sustainable means on the road affect positively the traffic congestion; less (more) unsustainable means on the road results in a reduced (increased) traffic congestion. The latter variable affects negatively the performance of the system; the smaller (larger) the traffic, the better (worse) the performance. The performance of the system affects the transport demand, meaning that the better (worse) the performance of the transportation system itself, the larger (smaller) the travel demand. This link can be considered as the utility of transportation in general, which drives the number of effective users of both sustainable and unsustainable means in a positive way. Consequently, the feedback loop that contains the effective users of sustainable means of transportation is a positive/reinforcing one (R7), while the one containing the users of unsustainable means is a negative/balancing loop (B7) as it can be seen in Figure 16. In conclusion, the number of commuters that use sustainable means will ultimately reinforce itself (either positively or negatively), while the number of commuters of unsustainable means will balance itself (either upwards or downwards).

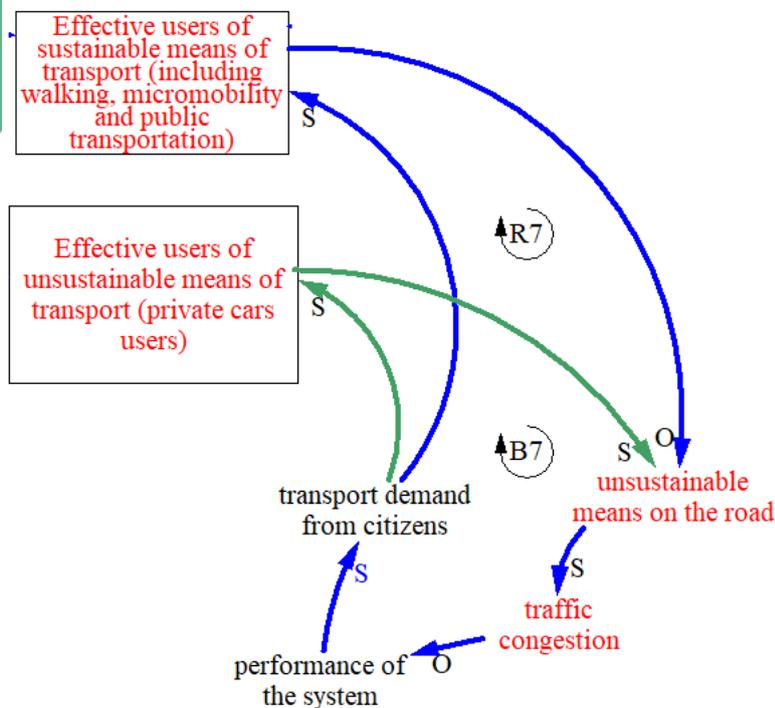


Figure 17 : Reinforcing loop R7 (blue) and Balancing loop B7 (green)

Another loop contains the variables Unsustainable means on the road, traffic congestion, performance of the system, perceived need to invest, investment in sustainable mobility and level of sustainable mobility offer. As was mentioned in the previous feedback loop, the larger the number of unsustainable means on the road, the larger the traffic congestion, which in turn decreases the performance of the system. As soon as the system's performance decreases, on one hand there's the perception from users of such a decreased capacity, which leads the very same users to use less the system as it is perceived as not fully functional and effective towards their utility functions. The perception of such a dynamics, on the other hand, leads the administration to an increased perception about the need to invest in new infrastructures and hence in new system's capacity. This will result in an increased capacity of the transportation system, which ultimately leads to a smaller percentage of unsustainable means on the roads, in a sort of phasing out dynamics. Hence, these are negative/balancing feedback loops (B8) and (B9).

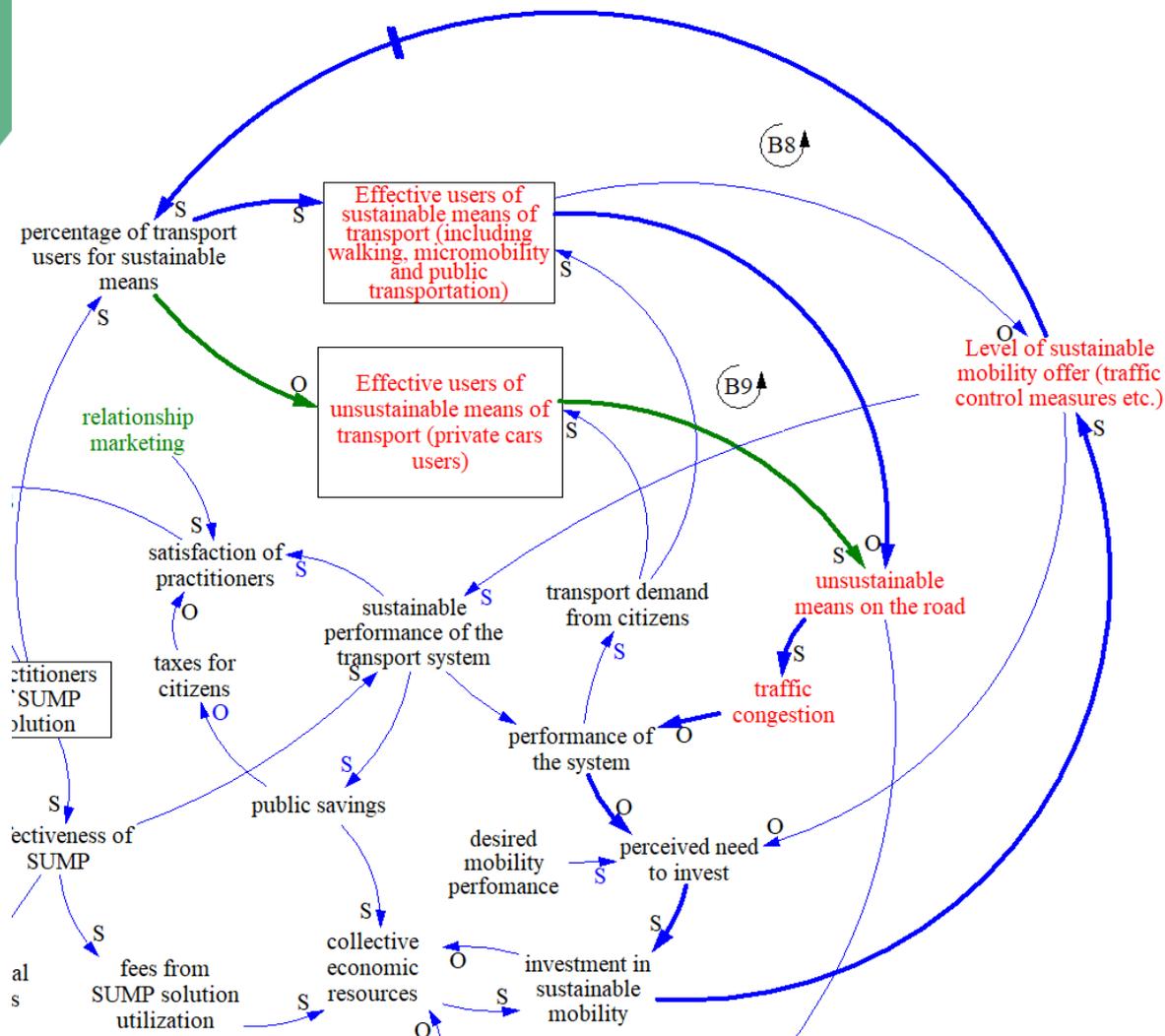


Figure 18 : Balancing loop B8 (blue) and B9 (green)

Policy Recommendation: Thus far, the larger the number of users of sustainable means of transportation will (in general) result in a reinforcing loop that will increase the number of users itself. As a result, any policy maker should bear in mind that increasing the number of commuters that adopt a sustainable mean of transportation, can have positive effects (even if they are small) to the overall sustainability of the urban environment, as the increased number of such users acts in a reinforcing way to itself. However, to increase the probability of success, the increase in those users should be accompanied by an increased provision of sustainable mobility options (quality, coverage, accessibility), otherwise the balancing loop B8 mentioned in a previous paragraph could have the opposite effect and reduce significantly the number of users of sustainable means.

Feedback Loops with a focus on financial/economic variables

Several loops are formed also where the economic/financial variables play an important role. First, there is a negative/balancing loop (B10), where the larger the necessary investment in the overall system capacity, the smaller the remaining amount of total collective economic

resources. In turn, the small number of collective economic resources will result in a decreased investment capacity (Figure 18).

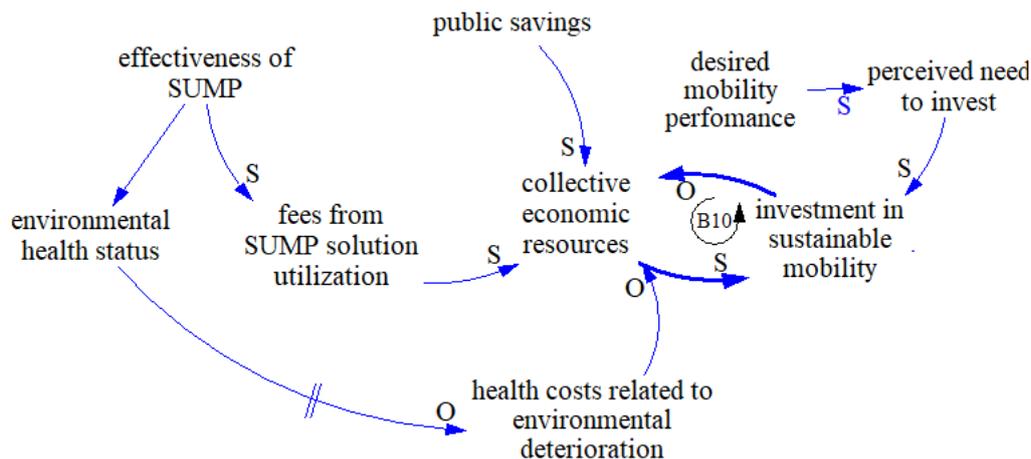


Figure 19 : Balancing loop B8 (green) and Balancing loop B10 (blue)

Policy recommendation: The central economic/financial variables act in general in such a way that restrains the number of users of sustainable means and/or reinforce the number of users of unsustainable means (in other words, when there are budget constraints for promoting the use of sustainable modes of transport – both at practical level i.e. construction of cycling paths as well as at awareness raising efforts –, even if a central strategy is to promote cycling, the effect will be low and the shift from private cars to bicycles will be also limited). Consequently, the shift in a sustainable mean of transportation requires constant resources (i.e. maintenance and enforcement costs other than initial investment costs) by the competent authority. This can be explained by the fact that most of urban transportation systems are traditionally designed posing private car at the centre of their transport system. As a result, this is the default choice that most users resort to. Until some sustainable mean of transportation replaces the private car as the default choice, becoming sustainable will require a continuous stream of resources.

The economic/financial variables are also connected with the SUMP approach. The performance of the system affects in a positive way the level of citizens' satisfaction of the SUMP solutions (the better the performance of the system, the higher the level of satisfaction). An increased level of satisfaction increases the positive word of mouth of the policy which increases in its turn the number of citizens that may adopt it. The higher number of adopters increases the effectiveness of the policy, which increases the fees collected and so the collective economic resources, which increases investment capacity. An increased investment capacity increases the overall capacity of the sustainable mobility system which results in an even better system performance with consequent satisfaction from users. Thus, this is a positive/reinforcing loop (R10) seen in blue arrows on Figure 19.

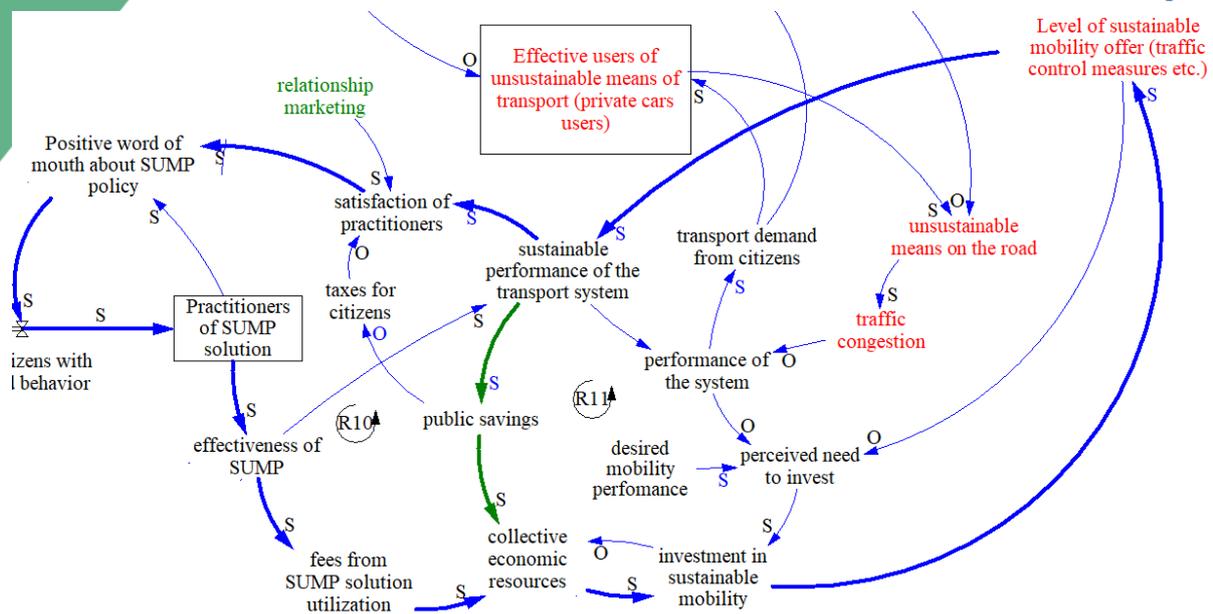


Figure 20 : Reinforcing loop R10 (blue) and R11 (green)

On the other hand, the improved sustainable performance of the transport system after investment causes an increasing in public savings, which results in an increased economic resources and other possibilities to invest again on sustainable mobility (R11).

Policy recommendation: A successful marketing technique (relationship marketing and word of mouth) will act in the feedback loops by increasing the number of adopters. This will result in an increased effectiveness of the policy. Thus, the importance of marketing is that -if successful- it can render the balancing economic loops into reinforcing ones, increasing the probabilities for a sustainable transition without draining the collective economic resources.

Feedback Loops with a focus on environmental variables

Finally, there are variables that represent the effect on the environment of the transportation system in general. The increased number of private cars increase the GHG emissions. Increased emissions result in a deteriorated environmental health status which will increase the overall costs related to health issues. These costs will act in a negative way to the collective economic resources which will decrease the investment capacity for sustainable mobility and the overall level of sustainability of the transport network. By reducing the available space for private cars, the sustainable means of transport share will increase thus forming a positive/reinforcing loop. (R12); see Figure 20.

effects can manifest later in time. This danger could explain why the environmental deterioration may be underrepresented and/or underappreciated in policy making.

4. Classification and evaluation of marketing techniques in sustainable mobility plans steps

4.1 Practices, techniques and methods categorization

According to the first step of the Group Concept Mapping (i.e. Systems factors elicitation), all the practices, the implemented techniques and the related methods have been categorized and matched with the SUMP cycle steps. Furthermore, all the relevant systems factors, such as attributes, features and KPIs have also been identified for each combination of practice/techniques/methods. The categorization table is articulated accounting two different groups of practices (a former categorization): those that aim at **behavioural change** and those that aim at **co-planning**.

4.1.1 Categorization of practices aiming at behavioural change

The following table reports the practices aiming at the behavioural change, and the matching with the related SUMP cycle steps. The practice IDs have been conserved as they are represented in the deliverables provided by the Task 1.1 of the project, so to provide harmonized results and data

Table 2: Classification of practices aiming at behavioural change

ID	PRACTICES	MAIN OBJECTIVE	SECONDARY OBJECTIVE	SUMP phase	SUMP step	SUMP phase	SUMP step	SUMP phase	SUMP step
1	VOLTARO	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport		4	11	3	8; 9		
2	MOBITHESS	exchanging information with citizens and stakeholders	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport	4	11				
3	MOTIVATE	exchanging information with citizens and stakeholders	increase co-creation of new mobility solutions/ ideas (achieving co-creation)	1	3	2	4;5;6	4	11; 12
5	Macedonian Cuisine Food	increase awareness regarding the		4	11	3	8; 9		

7	Truck of the Region of Central Macedonia	benefits deriving from shifting to sustainable or green modes of transport							
7	Cycling against Diabetes Melitus	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport		4	11	3	8; 9		
9	Ecomobility	increase co-creation of new mobility solutions/ ideas (achieving co-creation)	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport	1	3	4	11	3	9
10	Virtual Reality for the promotion of tourism in RCM	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport		4	11	3	8; 9	1	3
11	Coventry University Enterprises Ltd Location Independent Working (LIW)	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport		4	11				
12	Coventry Recycling Club	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport		4	11				
13	Cycle-R services	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport	behavioural change towards sustainable or green modes of transport	4	11				
14	"Go Electric Taxi" Scheme	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport	behavioural change towards sustainable or green modes of transport	4	10	3	8; 9		
15	Greening Your Fleet event	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport		4	10	3	8; 9		
18	Cycle Training in Schools (Bikeability)	increase awareness regarding the benefits deriving from shifting to	behavioural change towards sustainable or	4	11	2	4; 5		

		sustainable or green modes of transport	green modes of transport						
19	Rome's SUMP participatory approach	increase co-creation of new mobility solutions/ ideas (achieving co-creation)	influencing decision making (achieving co-planning)	2	4;5;6	3	7; 8; 9	1	3
20	PEDIBUS	behavioural change towards sustainable or green modes of transport		4	11	2	4		
21	DESIRE	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport	behavioural change towards sustainable or green modes of transport	4	11				
22	VIA LIBERA	behavioural change towards sustainable or green modes of transport		4	11	3	8; 9		
23	FORMULA E ROME E-PRIX	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport		4	11	3	8; 9		
25	BA.cycloportal	behavioural change towards sustainable or green modes of transport		4	11	2	4; 5		
26	eGUTS	behavioural change towards sustainable or green modes of transport	Increase of walking and cycling trips	4	11				
27	Promoting the implementation of a new sustainable mode of transport in city of Bratislava	behavioural change towards sustainable or green modes of transport		4	11				
30	SacraVelo: Combination of two different aspects in one product to attract a broader group of people	behavioural change towards sustainable or green modes of transport	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport	4	11				
31	Promotion of the implementation of new unified tariff system	behavioural change towards sustainable or green modes of transport		4	11				
32	Creation of a unified image of tourist destination	behavioural change towards sustainable or green modes of transport		4	11	2	5		

35	Cargobike Trendsportal – Competition	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport	increase awareness regarding the importance of participating in planning/creation	4	11	1	3	3	8; 9
36	Active Mobility Check for Municipalities in Hessen	behavioural change towards sustainable or green modes of transport	influencing decision making (achieving co-planning)	4	11	2	4;5;6	3	7;8;9
37	School Bike Route Planner	exchanging information with citizens and stakeholders	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport	4	11	2	4;5;6	1	3
38	“Better school” to	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport	behavioural change towards sustainable or green modes of transport	4	11				
39	Active Mobility Marketing Toolbox	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport		4	11	1	1		
41	Mobilfalt	behavioural change towards sustainable or green modes of transport		4	10				
42	“365” Flat rate Ticketing	behavioural change towards sustainable or green modes of transport		4	10; 11				
43	City cycling competition	Increase of walking and cycling trips	Increase of population awareness	4	11	3	8; 9		
44	Frankfurt Green City	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport	exchanging information with citizens and stakeholders	4	12				

4.1.2 Categorization of practices aiming at co-planning

The following table reports the practices aiming at co-planning, and the matching with the related SUMP cycle steps. The practice IDs have been conserved as they are represented in the deliverables provided by the Task 1.1 of the project, so to provide harmonized results and data

Table 3: Classification of practices aiming at co-planning

ID	PRACTICES	MAIN OBJECTIVE	SECONDARY OBJECTIVE	SUMP phase	SUMP step	SUMP phase	SUMP step	SUMP phase	SUMP step
3	MOTIVATE	exchanging information with citizens and stakeholders	increase co-creation of new mobility solutions/ ideas (achieving co-creation)	1	3	2	4;5;6	4	11; 12
4	Co-creation of mobile open government services with the substantial participation of senior citizens and other stakeholders	increase co-creation of new mobility solutions/ ideas (achieving co-creation)		2	4;5;6	3	7	1	3
6	REFORM	increase co-creation of new mobility solutions/ ideas (achieving co-creation)	influencing decision making (achieving co-planning)	1	1				
8	4mycity	exchanging information with citizens and stakeholders	influencing decision making (achieving co-planning)	1	3	4	11		
9	Ecomobility	increase co-creation of new mobility solutions/ ideas (achieving co-creation)		1	3	4	11	3	9
16	SUITS	increase co-creation of new mobility solutions/ ideas (achieving co-creation)		1	3	2	4;5;6		
17	CASI project citizen panel meetings	increase co-creation of new mobility solutions/ ideas (achieving co-creation)	influencing decision making (achieving co-planning)	1	3	2	4;5;6		
19	Rome's SUMP participatory approach	increase co-creation of new mobility solutions/ ideas (achieving co-creation)	influencing decision making (achieving co-planning)	2	4;5;6	3	7	1	3
24	Transdanube Pearls	Increase of mobility planning effectiveness	Increase of the public transport modal share	1	1;3	2	4;5;6	3	7;8
28	EdTWINL (Education Twinning): multicultural marketing as a tool for sharing the knowledge and best practises in	exchanging information with citizens and stakeholders		1	3	2	4;5;6		

	international environment								
29	Silver Economy: creation of cross-border cooperation	exchanging information with citizens and stakeholders	influencing decision making (achieving co-planning)	2	4;5	3	7		
33	Energy transition game	exchanging information with citizens and stakeholders		2	4;5	3	7		
34	Trendsportal card game	exchanging information with citizens and stakeholders	influencing decision making (achieving co-planning)	2	4; 5; 6				
35	Cargobike Trendsportal – Competition	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport	increase awareness regarding the importance of participating in planning/ creation	4	11	1	3		
36	Active Mobility Check for Municipalities in Hessen	behavioural change towards sustainable or green modes of transport	influencing decision making (achieving co-planning)	4	11	2	4;5	3	7;8
37	School Bike Route Planner	exchanging information with citizens and stakeholders	increase awareness regarding the benefits deriving from shifting to sustainable or green modes of transport	4	11	2	4;5	1	3
40	Reporting platform for cycle traffic	exchanging information with citizens and stakeholders	increase co-creation of new mobility solutions/ ideas (achieving co-creation)	1	3	4	11		

4.2 Clustering and ranking of practices, techniques and methods aiming at behavioural change

4.2.1 Cluster analysis of the practices aiming at behavioural change

Starting from the categorization provided in the Table 2, there were 25 Good Practices (GPs) that are matched with the SUMP step 11, 4 with the SUMP step 10, 2 with the SUMP step 3, 1 with the SUMP step 4, and 1 with the SUMP step 12. As a result, while we could argue that the techniques applied to enhance a behavioural change in the contextual SUMP steps 10, 3, 4 and 12, are the most effective ones, a further cluster analysis can be performed for those GPs that match with the SUMP step 11. Such an investigative analysis has been performed

using the following practices' main factors (i.e. main features and attributes), with the related value adopted as explained in the Section 2.3.2.

Table 4: Attributes and values to classify the practices matching with the SUMP step 11

ID	Duration of the campaign	Marketing communication techniques	Diversity of communication methods	Locus of events	Cost implications	Easiness to transfer	Impact on KPIs
1	Periodic (2)	Word of Mouth (6)	Public event (6)	Local (1)	Low (1)	High (3)	2
2	Continuous (3)	Digital Marketing (4)	E-engagement campaign (9)	Regional (2)	High (3)	Low (1)	2
5	Continuous (3)	Word of Mouth (6)	Ambassador campaign (12)	Regional (2)	Medium (2)	High (3)	2
7	Periodic (2)	Cause Marketing (8)	Public cause event (1)	Local (1)	Low (1)	High (3)	1
10	No Information (0)	Word of Mouth (6)	Other (3)	Local (1)	High (3)	Low (1)	2
11	No Information (0)	Combined (10)	Awareness campaign (4)	Local (1)	Medium (2)	Medium (2)	5
12	No Information (0)	Combined (10)	Combined (2)	Local (1)	Medium (2)	Medium (2)	4
13	No Information (0)	Wheel of Persuasion (2)	Combined (2)	Local (1)	High (3)	Medium (2)	4
18	Continuous (3)	Wheel of Persuasion (2)	Capacity building (7)	National (3)	Medium (2)	Low (1)	2
20	Continuous (3)	Word of Mouth (6)	Combined (2)	National (3)	Low (1)	High (3)	2
21	Continuous (3)	Combined (10)	Combined (2)	Local (1)	Medium (2)	High (3)	2
22	Periodic (2)	Guerilla Marketing (5)	Pilot intervention (5)	Local (1)	Medium (2)	High (3)	0
23	One time (1)	Undercover Marketing (7)	Popular event (8)	Local (1)	Medium (2)	Medium (2)	0
25	Continuous (3)	Digital Marketing (4)	E-engagement campaign (9)	Regional (2)	Low (1)	High (3)	2
26	Continuous (3)	Combined (10)	Combined (2)	Local (1)	High (3)	Medium (2)	1
27	Continuous (3)	Combined (10)	Combined (2)	Local (1)	Low (1)	High (3)	2
30	Continuous (3)	Undercover Marketing (7)	Other (3)	Regional (2)	Medium (2)	Medium (2)	0
31	Continuous (3)	Digital Marketing (4)	E-engagement campaign (9)	Regional (2)	Low (1)	High (3)	0
32	Continuous (3)	Combined (10)	Combined (2)	Regional (2)	Medium (2)	Medium (2)	0
35	One time (1)	Combined (10)	Combined (2)	Local (1)	Low (1)	High (3)	1
36	Continuous (3)	Combined (10)	Combined (2)	Regional (2)	High (3)	Low (1)	0
37	Continuous (3)	Combined (10)	E-participation/crowdsourcing (10)	Regional (2)	Medium (2)	Medium (2)	0
38	Continuous (3)	Wheel of Persuasion (2)	Combined (2)	Regional (2)	High (3)	Medium (2)	1
39	Continuous (3)	Wheel of Persuasion (2)	Capacity building (7)	National (3)	Medium (2)	Medium (2)	0

43	Continuous (3)	Relationship Marketing (3)	Awareness campaign (4)	National (3)	Medium (2)	Medium (2)	4
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The clustering of practices according to these attributes, by means of the K-Means technique, resulted 4 different clusters.

The 1st cluster contains the practices with the following IDs: 7, 11, 12, 21, 26, 27, 32, 35, 36. As it can be observed by the Table 4, the majority of those practices uses a combination of marketing techniques, while almost half of them are “continuous”. Finally and most important, it appears that practices that belong to this cluster are either “local” (the majority of them) or at most “regional” in location. Consequently, it can be induced that:

From e-smartec experience, when policy makers want to enhance public awareness for sustainable mobility interventions (SUMP step 11) are usually applying a combination of marketing techniques with a combination of diverse communication approaches. This can be explained due to the crucial role of well communicating mobility interventions scopes (and services details, opportunities, coverage, role within the wider city’s vision) when started being provided to citizens.

The 2nd cluster contains the practices with the following IDs: 1, 10, 13, 20, 22, 30, 38 and 43. As it can be observed by the Table 4, these practices do not have many commonalities, thus further analysis is required to extract robust/safe conclusions.

The 3rd cluster contains the practices with the following IDs: 2, 5, 18, 25, 31, 39. As it can be observed by the Table 4, the practices have a “continuous duration” and are either “regional” or national. Within this cluster, “digital marketing” and “wheel of persuasion” are the dominant marketing techniques. Consequently:

It is a common practice to activate digital marketing or Wheel of persuasion as marketing techniques during phase 4 and step 11 of SUMP cycle E-engagement seems to be a strong marketing tool – respecting also COVID-19 social distancing measures

Finally the 4th cluster contains only the practices with the IDs 23 and 37, thus its size prevents a safe extraction of conclusions about the marketing techniques without a further analysis.

4.2.2 Multi-criteria rating of the practices aiming at behavioural change

To gain further insights, a ranking of all the practices was devised adopting the TOPSIS method. In particular, 3 features and attributes related to the practices where adopted to perform such analysis: (1) **cost implications**, (2) **easiness to transfer**, (3) **impact on KPIs**. Finally the ranking was elaborated only for those sets of practices matching with a specific SUMP step with a meaningful size: the practices matching with SUMP cycle step 11 and the ones matching with the SUMP cycle step 10.

As concerns the first set (i.e. practices matching with the SUMP cycle step 11), the TOPSIS rating is represented in the following Figure.

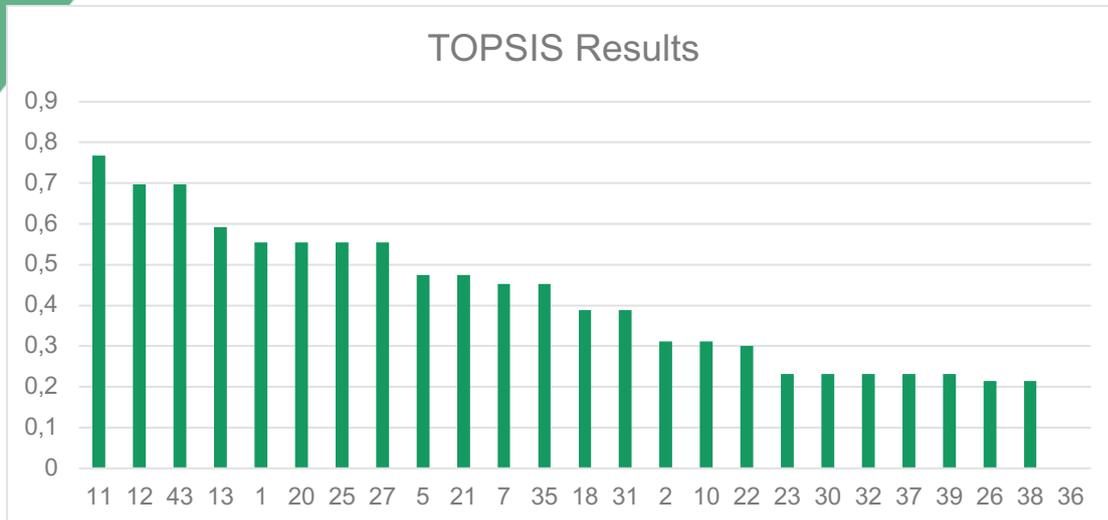


Figure 22 : TOPSIS ranking of the practices matching with the SUMP cycle step 11

The best 8 rated practices (11,12,43,13,1,20,25,27) have a low to medium cost and a medium to high transferability barrier, and their attributes, as reported in the Table 4, suggest that:

policy makers that aim at behavioral change in SUMP step 11 should adopt a combination of several marketing techniques, mostly the “digital marketing” and the “word of mouth” ones.

As concerns the second set (i.e. practices matching with the SUMP cycle step 10), the TOPSIS rating is represented in the following Figure.

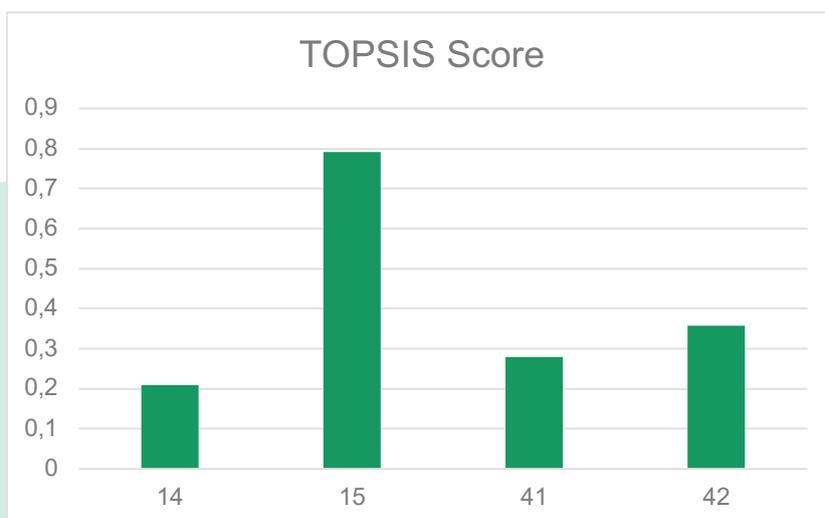


Figure 23 : TOPSIS ranking of the practices matching with the SUMP cycle step 10

This result can be combined with the attributes of the related practices, as reported in the following table.

Table 5: Attributes and values to classify the practices matching with the SUMP step 10

ID	Duration of the campaign	Marketing communication techniques	Diversity of communication methods	Locus of events	Cost implications	Easiness to transfer	Impact on KPIs
14	One time (1)	Combined (10)	Pilot intervention (5)	Local (1)	High (3)	Low (1)	5
15	One time (1)	Word of mouth (6)	Public event (6)	Local (1)	Low (1)	High (3)	3
41	Continuous (3)	Combined (10)	Combined (2)	Regional (2)	High (3)	Medium (2)	5
42	Continuous (3)	Word of mouth (6)	Awareness campaign (4)	Regional (2)	High (3)	High (3)	4

As it can be observed, practice with ID 15 is the only one that scores high. This practice uses “Word of Mouth” for a “one-time” campaign and it has a low cost and a high easiness to transfer. Consequently:

from e-smartec experience, “word of mouth” is highly used in Step 10 of SUMP cycle as a very suitable marketing technique since it appears to be cost effective and easy to transfer to different contexts while generating adequate/satisfying results.

4.3 Clustering and ranking of practices, techniques and methods aiming at co-planning

4.3.1 Cluster analysis of the practices aiming at co-planning

Starting from the categorization provided in the Table 3, there were: 8 Good Practices (GPs) that are matched with the SUMP step 3; 5 with the SUMP step 4, 5 and 6; 3 with the SUMP step 11; 1 with the SUMP step 1. As a result, a meaningful cluster analysis can be performed only for those GPs that match with the SUMP step 3. Such an investigative analysis has been performed using the following practices’ main factors (i.e. main features and attributes), with the related value adopted as explained in the Section 2.3.2.

Table 6: Attributes and values to classify the practices matching with the SUMP step 3

ID	Duration of the campaign	Marketing communication techniques	Diversity of communication methods	Locus of events	Cost implications	Easiness to transfer	Impact on KPIs
3	Continuous (3)	Undercover Marketing (7)	Combined (2)	Local (1)	Medium (2)	Medium (2)	5
8	Continuous (3)	Digital Marketing (4)	E-participation/crowdsourcing (10)	Local (1)	Medium (2)	Low (1)	4

9	Periodic (2)	Combined (10)	Combined (2)	National (3)	High (3)	Low (1)	4
16	One time (1)	Wheel of Persuasion (2)	Capacity building (7)	Regional (2)	High (3)	Medium (2)	4
17	One time (1)	Dialogue marketing (1)	Combined (2)	National (3)	Medium (2)	High (3)	4
24	Continuous (3)	Combined (10)	Combined (2)	Local (1)	High (3)	Low (1)	5
28	Continuous (3)	Combined (10)	Combined (2)	Local (1)	Medium (2)	Medium (2)	0
40	Continuous (3)	Combined (10)	E-participation/crowdsourcing (10)	National (3)	Medium (2)	Medium (2)	5

The clustering of practices according to these attributes, by means of the K-Means technique, resulted 4 different clusters.

The 1st cluster contains the practices with the following IDs: 8 and 16. As it can be observed by the Table 6, no meaningful conclusions can be drawn from the specific cluster since the two practices show differences in all their attributes.

The 2nd cluster contains the practices with the following IDs: 3, 9, 24, 28. As it can be observed by the Table 6, these practices are either period or continuous and a combination of marketing techniques along with a combination of communication methods is used. Furthermore, these practices are in general local in scope while they present a medium to high cost but accompanied by a low to medium easiness to transfer. Consequently:

SUMP step 3 seems that requires the active and strong engagement of both citizens and stakeholders - a combination of marketing techniques is usual during this step while continuous efforts seems to take place for keeping users' interest alive

The 3rd cluster contains the practice with ID 40, while the 4th one contains the practice with ID 17, thus no meaningful analysis can be retrieved from such data.

4.3.2 Multi-criteria rating of the practices aiming at co-planning

To gain further insights, a ranking of all the practices was devised adopting the TOPSIS method. In particular, 3 features and attributes related to the practices were adopted to perform such analysis: (1) **cost implications**, (2) **easiness to transfer**, (3) **impact on KPIs**. Finally the ranking was elaborated only for those sets of practices matching with a specific SUMP step with a meaningful size: the practices matching with SUMP cycle steps 3, 4 and 11.

As concerns the first set (i.e. practices matching with the SUMP cycle step 3), the TOPSIS rating is represented in the following Figure.

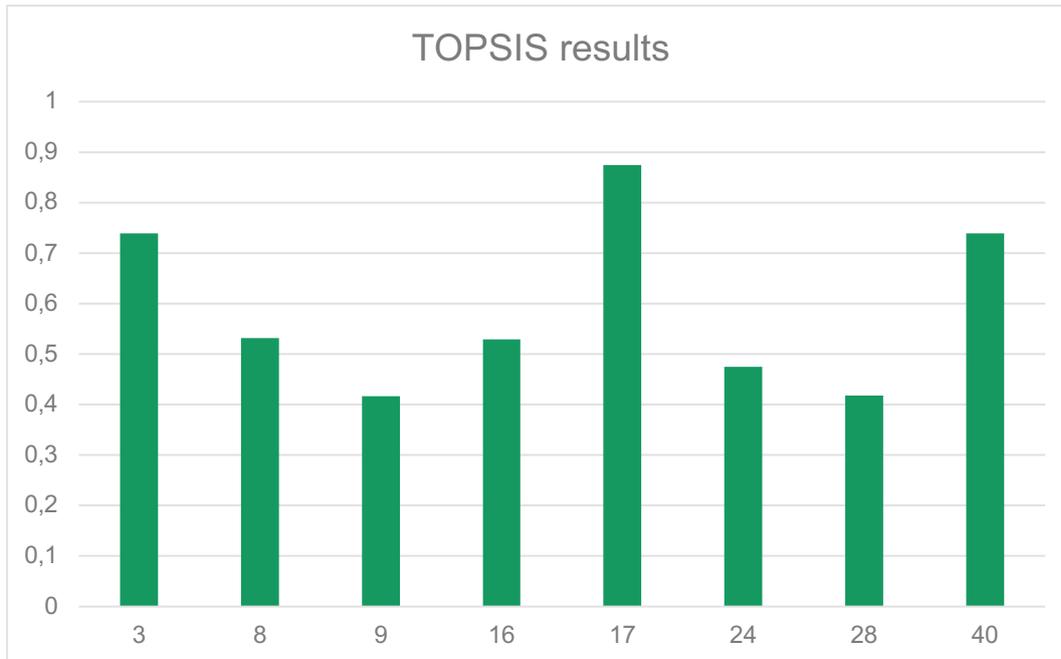


Figure 24 : TOPSIS ranking of the practices matching with the SUMP cycle step 3

The best 5 rated practices (17, 3,40,8,16) have several commonalities as reported by the Table 6. First, we can observe that dialogue marketing with a combination of communication techniques scores the best. Furthermore, a combination of communication techniques along with e-participation and crowdsourcing form the majority of those best-ranked practices. Finally, these practices have medium cost and in general medium easiness to transfer to different contexts. Consequently:

policy makers that aim at co-planning in SUMP step 3 could use various marketing techniques, but they should consider a combination of communication methods or e-participation with those along with a continuous time of implementation.

As concerns the second set (i.e. practices matching with the SUMP cycle step 4), the TOPSIS rating is represented in the following Figure.

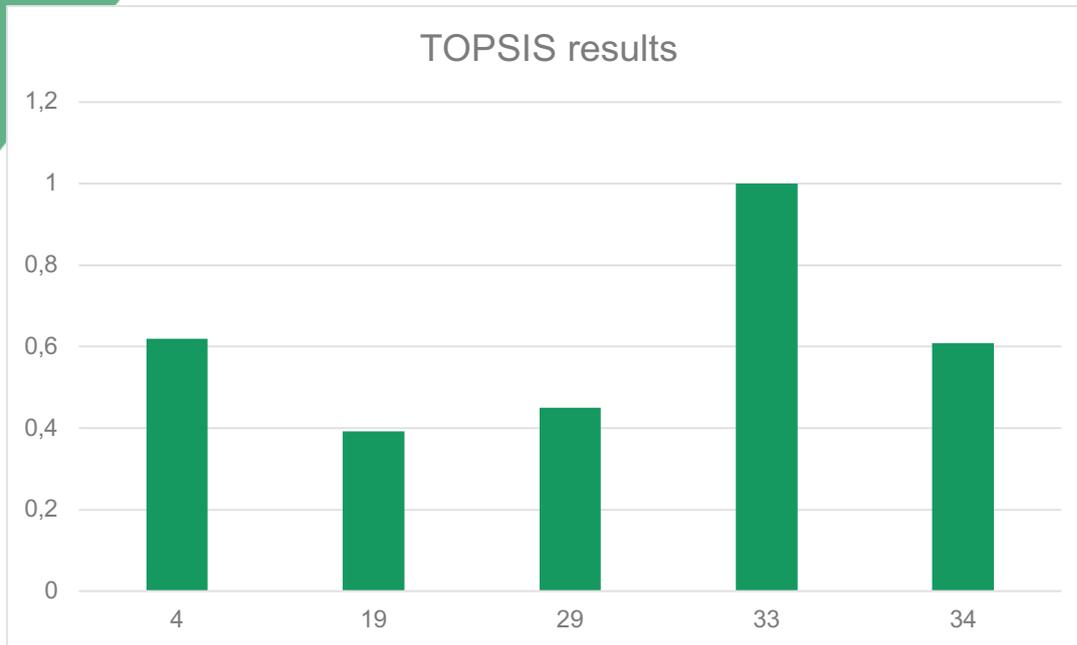


Figure 25 : TOPSIS ranking of the practices matching with the SUMP cycle step 4

This result can be combined with the attributes of the related practices, as reported in the following table.

Table 7: Attributes and values to classify the practices matching with the SUMP step 4

ID	Duration of the campaign	Marketing communication techniques	Diversity of communication methods	Locus of events	Cost implications	Easiness to transfer	Impact on KPIs
4	One time (1)	Relationship marketing (3)	Combined (2)	Regional (2)	Medium (2)	Medium (2)	4
19	Continuous (3)	Combined (10)	Combined (2)	Local (1)	High (3)	Low (1)	4
29	One time (1)	Relationship marketing (3)	Combined (2)	Local (1)	Medium (2)	Medium (2)	2
33	No Information (0)	Guerilla marketing (5)	Gaming (11)	Local (1)	Low (1)	High (3)	4
34	Continuous (3)	Guerilla marketing (5)	Gaming (11)	Local (1)	Low (1)	High (3)	1

As it can be observed, practice with ID 33 performs the best with those of 4 and 34 following behind. It is characteristic that in these practices Guerilla marketing appears with gaming as a means of communication. Furthermore, these practices have a low cost and a high easiness to transfer, nonetheless are limited to a local scope. Consequently:

Guerilla marketing with gaming seems to be an effective channel to increase participatory approach of SUMP at step 4 attractive both in terms of (low cost and easiness to transfer).

As concerns the third set (i.e. practices matching with the SUMP cycle step 11), the TOPSIS rating is represented in the following Figure.

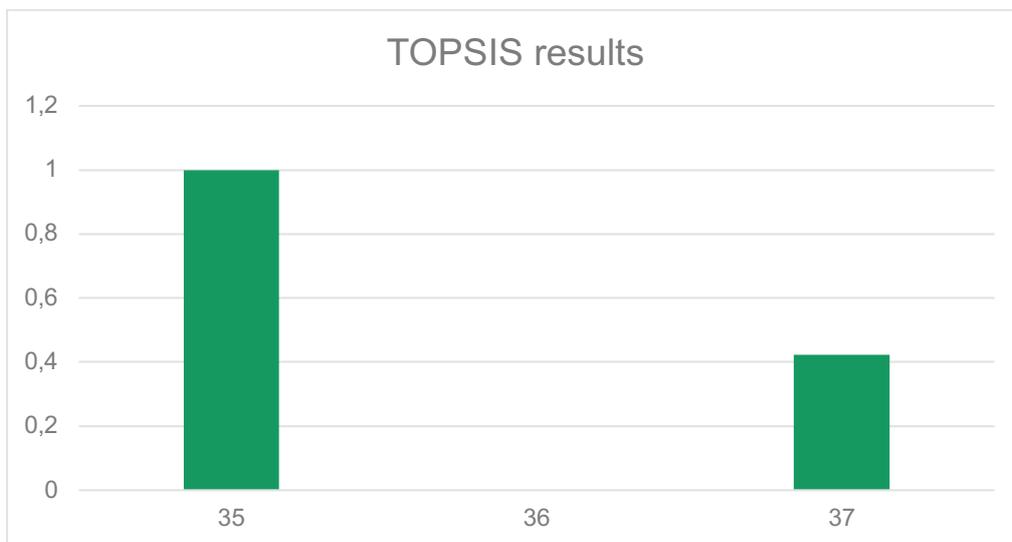


Figure 26 : TOPSIS ranking of the practices matching with the SUMP cycle step 11

This result can be combined with the attributes of the related practices, as reported in the following table.

Table 8: Attributes and values to classify the practices matching with the SUMP step 11

ID	Duration of the campaign	Marketing communication techniques	Diversity of communication methods	Locus of events	Cost implications	Easiness to transfer	Impact on KPIs
35	One time (1)	Combined (10)	Combined (2)	Local (1)	Low (1)	High (3)	4
36	Continuous (3)	Combined (10)	Combined (2)	Regional (2)	High (3)	Low (1)	2
37	Continuous (3)	Combined (10)	E-participation/crowdsourcing (10)	Regional (2)	Medium (2)	Medium (2)	2

As it can be observed, practice with ID 35 score the highest. It uses a combination of marketing techniques with a combination of communication methods. It should be stated that this is the only one that has a low cost and high easiness to transfer to different contexts. Consequently:

also from the e-smartec GPs that serve co-planning purposes, SUMP step 11 seems to be a step that needs citizens to be strongly engaged for monitoring the progress and the effectiveness of mobility interventions - combination of marketing and communication techniques is widely used too

5. Conclusions

In the previous chapters a categorization of the marketing techniques and methods have been produced, providing several insights for application and for understanding the dynamics underpinning the transition to a more sustainable mobility condition starting from a contextual-dependent SUMP cycle step.

The analysis of the main variables and feedback loops of the (part) of the Causal Loop Diagram, revealed several insights that could be helpful to policy makers. In the big view drawn by the CLD model, the marketing techniques were considered as input lever for the policy makers to lead the system towards specific results in terms of performance of the sustainable mobility. In this sense, marketing techniques are catalysts that should be used in line with their specific aims; in other words, each technique has its own role and timing in the adoption process (as clearly described inside the CLD) and this must be clear to policy makers who want to make use of them. Nevertheless, the right positioning of marketing techniques cannot be the only advice from this analysis, as there are also other aspects to be considered in the process which are relevant for the success of the entire decision-making process.

The main insights provided in turn by the systemic analysis are:

- Increasing the number of users that are willing to adopt a sustainable mean of transportation, can have positive effects (even if they are small) to the overall sustainability of the urban environment, as the increased number of such users acts in a reinforcing way to itself. However, to increase the probability of success, the increase in those users should be accompanied by an increase in the capacity of the transportation system to accommodate them, otherwise the balancing loops have the opposite effect and reduce significantly the number of users of sustainable means. Causal, undercover and guerilla marketing can support the start up phase of awareness raising while then, word of mouth can take the reins.
- The available economic/financial resources for investing in sustainable mobility act in general in such a way that restrains the number of users of sustainable means and/or reinforce the number of users of unsustainable means.
- A successful marketing technique will act, by increasing the number of adopters. This will result in an increased effectiveness of the policy. Thus, the importance of marketing is that -if successful- it can render the balancing economic loops into reinforcing ones, increasing the probabilities for a sustainable transition without draining the collective economic resources.
- The environmental variables act in general in a positive/reinforcing way to the other variables and loops of the system. This means that when the environmental status is at satisfying/good levels (there is little or no environmental degradation), then the

overall performance and sustainability of the system becomes even better. However, when the environmental status is not at good/satisfactory levels, then the performance of the system falls rapidly which results in an even bigger environmental degradation. These effects nonetheless are not immediately observed in the system, because these loops contain some significant delays, with the most important being the one connecting the environmental health status with the health costs related to environmental deterioration.

A further clustering and ranking analysis, mainly working on the project good practices and their related attributes, provided more insights. In particular:

- Investigating those practices aimed at behavioral change, we gained that policy makers addressing the SUMP cycle step 11 should apply a combination of marketing techniques with a combination of diverse communication approaches while limit the spatial scope to specific locations whether local or regional. Furthermore, they should use digital marketing or Wheel of persuasion with a focus on e-engagement at a regional or national level and with a big timeframe.
- Furthermore, policy makers addressing the SUMP cycle step 10 should consider word of mouth as the best suitable marketing technique since it appears to be cost effective and easy to transfer to different contexts while generating adequate/satisfying results.
- On the other side, investigating those practices aimed at co-planning, we gained that policy makers addressing the SUMP cycle step 3 could use a combination of marketing techniques, however they should be continuous in time but local.
- Finally, policy makers addressing the SUMP cycle step 4 could use Guerilla marketing with gaming but at a local context.

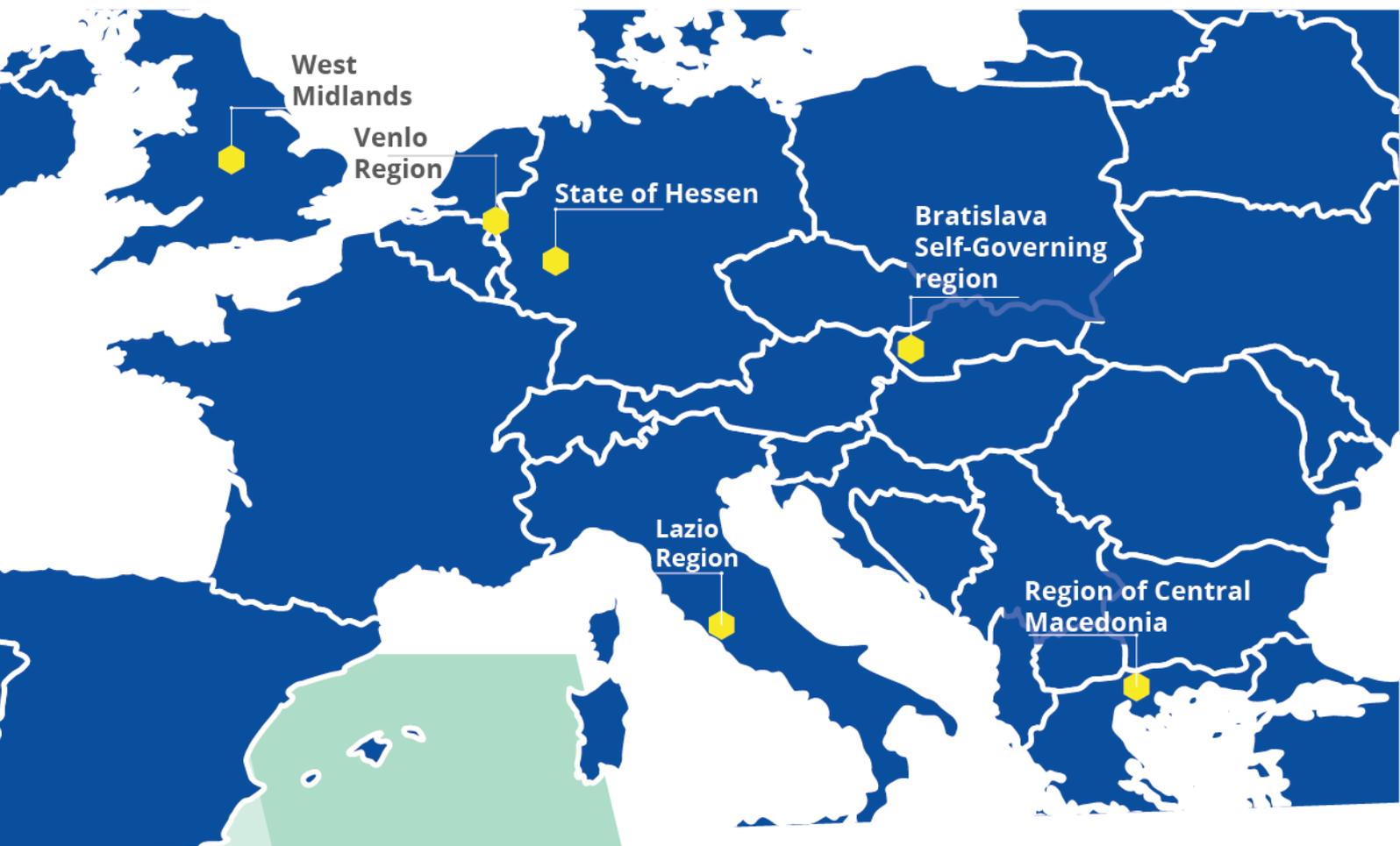
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