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Perception and Evaluation of Regional and Cohesion Policies by Europeans and Identification with the Values of Europe

PERCEIVE

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Deliverable 6.3

'Report with analysis of model behaviour and scenario analysis'

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Executive summary

The scope of the Deliverable 6.3 is to provide a concrete analysis of the behaviour of the System Dynamics (SD) model on the European Cohesion Policy (CP) system, as a part of the Working Package 6 in the context of the PERCEIVE project. The model was already presented in the Deliverables 6.1 (qualitative model) and 6.2 (quantitative model). Focusing on the two subsystems under study, namely the funds' absorption and general public awareness, the behavioural analysis includes both: (i) quantitative sensitivity analyses of the model's parameters on the simulation results, (ii) and qualitative insights based on real data, the model's structure and the outcomes of the quantitative analysis.

More specifically, we articulated this study in two parts according to the model's subsystems. In the funds' absorption subsystem, as a reminder of the problem under study, we first report a concise analysis of EU and regional evidence on absorption rates. Then, the absorption model is presented in brief, followed by an extensive sensitivity analyses of the model's parameters. The analysis provides the major simulation findings, along with indicative policy recommendations. Finally, a comprehensive discussion of the modelling approach, based on real data and the modelling results, is presented. In the general awareness subsystem, initially the available awareness data of the related Eurobarometer's reports are presented for the contextualization of the problem. Thereafter, the awareness model is briefly discussed, while the main sensitivity analyses results are presented along with the related recommendations. Lastly, the model's building process and the quantitative outcomes are discussed.

Overall, this final Deliverable 6.3 contributes towards: (i) identifying the major factors of the CP system that affect the local managing authorities' (LMAs') performance in terms of funds' absorption, as well as the citizens' awareness about the EU role on regional development, (ii) in order to offer meaningful managerial insights for fostering the LMA administrative capacity and increasing the general public awareness about regional CP funding benefits. The analysis of the influencing factors, along with the adoption of efficient policies, is anticipated to improve the state of the CP system and support the regional sustainability of the local communities.

1. Introduction

PERCEIVE Deliverable 6.3 reports the analyses conducted and the insights gained following our efforts of applying System Dynamics (SD) modelling methodologies to address the issue of "efficiency and effectiveness" in Cohesion Policy (CP) funds expenditure and the related question about the citizens awareness of such policy intervention in their area. As deeply discussed in previous deliverables, applying SD to such environment consists in an innovative and original attempt to study CP from a new perspective (Smeriglio *et al.*, 2015). SD approach focuses on understanding the underlying cause-structure, based on feedback, delays, accumulation and decision points, that generates the a system's behaviour over time (Forrester, 1961; Sterman, 2000). First, we built a qualitative system structure based on relevant literature, national and European reports, interviews and workshops. This structure has been accurately described in PERCEIVE deliverable 6.1 (Aivazidou *et al.*, 2018) followed by the technical specification on how the SD methodology was used. Then, such structure has been quantified in a formal mathematical model in PERCEIVE deliverable 6.2 (Aivazidou *et al.*, 2019) in order to simulate and test the reliability of the qualitative construction build and subsequently, when confidence in the model outputs were reached, to explore interesting scenario from organizational and policymaking perspectives.

In the report, they are divided as follow. First, chapter 2 is focused on the CP implementation. We start presenting some ideas we developed on data availability and conceptualization while we were collecting data for building the model. Then, after having showed model quantification, base results in contrast with real data and the most interesting simulations of scenario obtained, we propose systemic qualitative analyses: connections between structure and behaviours, usefulness of potential new indicators, organizational traps, and exploration of principal actors' mental models and decision paths. Second, in chapter 3, we focus on the analysis of how awareness of CP local achievements spread among common citizens. Here, as a first finding of our research, we discuss data unavailability and inconsistency. Then, grounding on theories of attention decay (Candia *et al.*, 2018) and diffusion theory (Bass, 1969), we formalize and, carefully explain, an original SD model. The fact that such formal and transparent construction is able to replicate real data with simple mechanisms provides strength to the model reliability. After presenting the model, we perform tests of the model and we explore a number of different scenarios. Then, the results of our simulation experiments are dissected and their meaning discussed. At the end in chapter 4 a brief conclusion is outlined in order to contextualize our work, discuss its meaning and relevance with

respect of other studies and policy actions, explore future possibilities and provide a wrap up to WP6 effort.

2. Funds' absorption system

The first subsystem under study is the main flow of CP funds from the EU through the LMAs to the beneficiaries, including all factors that affect these procedures. Notably, the analysis is multi-level, including three key players: the EU, the LMAs and the final beneficiaries (and only marginally the nation state). In this section, the real time series regarding CP implementation are provided, the funds' absorption model is presented and analysed to provide meaningful simulation results and finally several insights are provided for enabling discussion in the field of study.

2.1. Funds' absorption data

The process of capturing a system's behaviour over time constitutes the key preliminary step to adopt a systemic approach for mapping a complex environment. Thus, collecting and analysing the available time series data is a crucial phase of our analysis on the Cohesion Policy (CP) funding scheme. To this end, to investigate the robustness of the modelling procedure and the consistency of the related results, comparisons with the available real-world data is necessary.

Plotting available EU and regional data (commitments, payments and absorption) over time enables the investigation of the patterns of the real time series under study. In addition, this graphical representation can allow for meaningful comparisons among different regions (or nations), different programming periods and different EU funds. Based on all available data, it is necessary to analyse deeply the absorption rate of the CP funds, both EU and regional. This absorption rate is calculated as the ratio of refunded expenditure (accumulated payments) to the funds approved (commitments) for a specific program and period. The related scientific publications and news articles refer mainly to the absorption of the EU commitments.

To this end, EU and regional data about commitments and expenditure are collected and analysed in order to investigate the absorption of the European Regional Development Fund (ERDF) at a regional level. This study is performed in nine regions with diverse characteristics in seven EU countries, namely: (1) Burgenland, Austria, (2) Calabria, Italy, (3) Emilia-Romagna, Italy, (4) Dolnośląskie, Poland, (5) Warmińsko-mazurskie, Poland, (6) Sud-Est, Romania, (7) Extremadura, Spain, (8) Norra Mellansverige, Sweden, and (9)

Essex, United Kingdom. In the following subsections, all collected data are presented in time series graphs.

2.1.1. EU absorption data

The regional operational plan (ROP) data were retrieved from the official European Union (EU) annual reports for the CP funds in each period (2000-2006, 2007-2013, 2014-2020) (Equey, 2003-2017)[1]. In addition, the regionalized national operation plan (r-NOP) data, for the regions without a ROP, during the two programming periods (not available for 2014-2020) were retrieved from the European Commission (2018) database. Although these later funds might be partially or totally managed by national authorities and not just by LMAs, these data were used as an approximation for a comprehensive analysis of all regions participating in the PERCEIVE project.

Figures 2.1, 2.2 and 2.3 depict the distribution of the absorption rates of the national ERDF payments to the regions under study for the programming periods 2000-2006, 2007-2013 and 2014-2020, respectively. As shown in Figure 2.1, all regions apart from Calabria, in Italy, and Essex, in United Kingdom, demonstrate a 100% absorption of the ERDF funds during the first period. Specifically, the funding of the British region closed with a 99.5% absorption, while notably for the Italian region the funding is still open reaching in 2014 an absorption of 95%. Comparing the slopes of the distributions, Norra Mellansverige, in Sweden, exhibits the most efficient absorption of the ERDF funds (based on the real ROP data), while the Polish regions the least one (based on the estimated r-NOP data). In this context, efficiency refers to the LMA's capacity of having a high, adequate and uniformly distributed rate of expenditure of funds over time. In addition, although Extremadura, in Spain, starts with a rather quick absorption, after 2006 there is a deceleration of rate. Burgenland, in Austria, and Essex, in United Kingdom, demonstrate a regular absorption, while the two Italian regions exhibit a slightly unbalanced rate between 2004 and 2008.

In Figure 2.2, only Emilia Romagna, in Italy, Warmińsko-mazurskie, in Poland, and Norra Mellansverige, in Sweden, exhibit a 100% absorption of the ERDF funds during the period 2007-2013. Burgenland, Austria, has a final absorption of 96.5%, while for the rest regions the funding is still open. Unfortunately, no data were available for Sud-Est, in Romania, and Essex, in United Kingdom. Concerning the performance of the regions, Burgenland, in Austria, and Norra Mellansverige, in Sweden, demonstrate the best

[1] It should be noted that the annual EU reports for the evolution of payments of the CP funds constitute an **internal communication** and are **not available publicly** on the web. They were sent to the PERCEIVE researchers by EU officers via e-mail communication.

absorption efficiency of ERDF funds, while Calabria, Italy, the worst one. In addition, except for Calabria, in Italy, that demonstrates an abrupt increase of absorption in 2015 (approaching the end of the cycle), the rest regions follow a rather regular sigmoid-shaped absorption pattern. For the latest programming period, Norra Mellansverige, in Sweden, demonstrates the highest funds' absorption, while Extramadura, in Spain, the lowest one (Figure 2.3). However, these last data are not definitive and thus no final conclusion can be drawn on them.

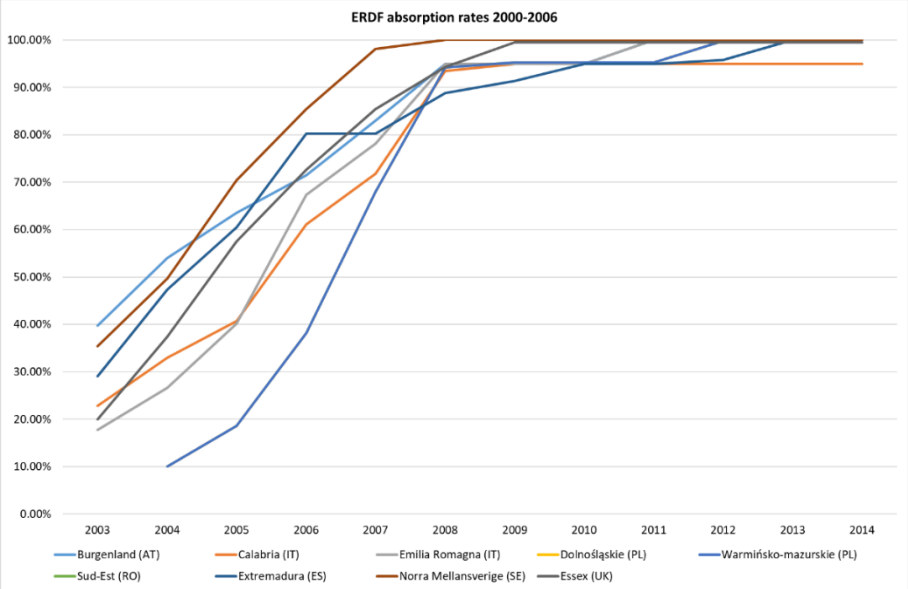

Figure 2.1. Absorption rates for ERDF fund during 2000-2006 period (Own elaboration based on EU reports).

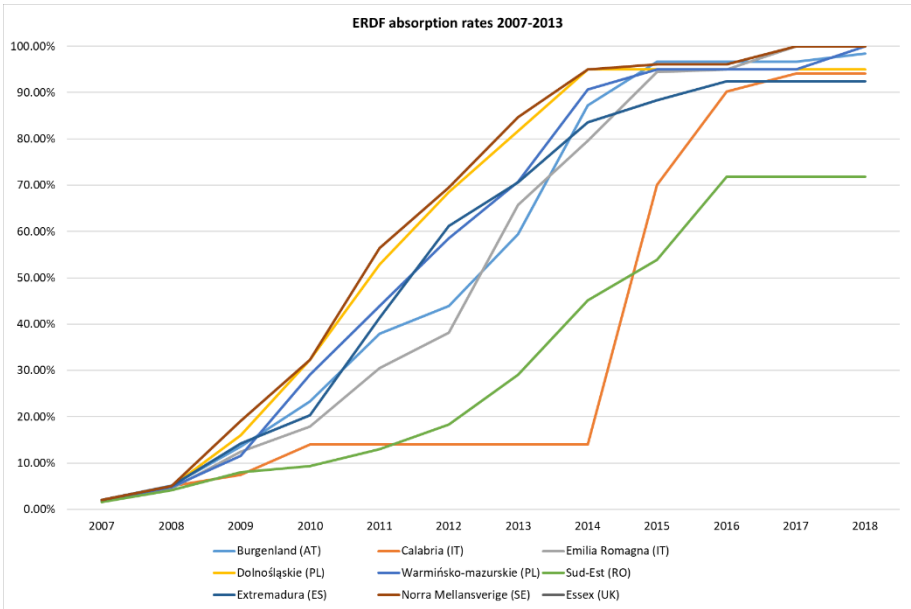

Figure 2.2. Absorption rates for ERDF fund during 2007-2013 period (Own elaboration based on EU reports).

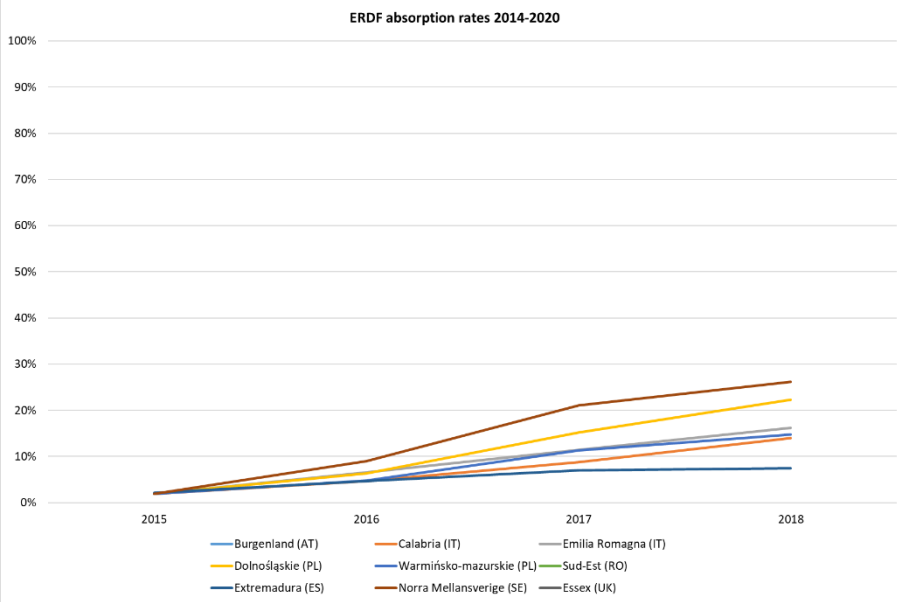

Figure 2.3. Absorption rates for ERDF fund during 2014-2020 period (Own elaboration based on EU reports).

2.1.2. Total funding data

The time series analysis of the total funding data, including both EU commitments and regional co-finance, is performed. The analysis focuses on the two Italian regions (Emilia Romagna and Calabria) during the 2007-2013 programming period, due to the availability of comprehensive time series including regional data retrieved from the OpenCoesione (2019) database.

2.1.2.1. Comparison between commitments and payments

Figure 2.4 portrays the comparison between total (i.e. EU and regional) accumulated payments and total commitments approved in Calabria, in Italy, over time within the ERDF scheme. Total accumulated payments (orange line) increase slowly, yet irregularly, till they almost reach the total commitments. On the other side, the total commitments (bars) approved decrease. This means that the amount of funds that the LMA has available to spend decreases, either due to **EU decommitments** (i.e. reduction of EU contribution) and/or due to **reduction of regional co-finance** (i.e. reduction of regional contribution). The total commitments constitute the sum of the EU (grey bars) and regional (yellow bars) contributions. In fact, while the EU commitments stay constant (no EU decommitments occurred) over time, the regional co-finance decreases in 2012 and 2013. The reduction of regional co-finance is a common strategy used to increase the absorption rate when low performance exists (European Court of Auditors, 2018). In fact, the effect of the economic crisis led to the reduction of regional co-finance in many Member States

where problems were more severe. This policy was approved by the EU in order to help the regions to: (i) meet their part of the funding needed to carry out the programmes, (ii) absorb the available EU financial support (European Commission, 2016).

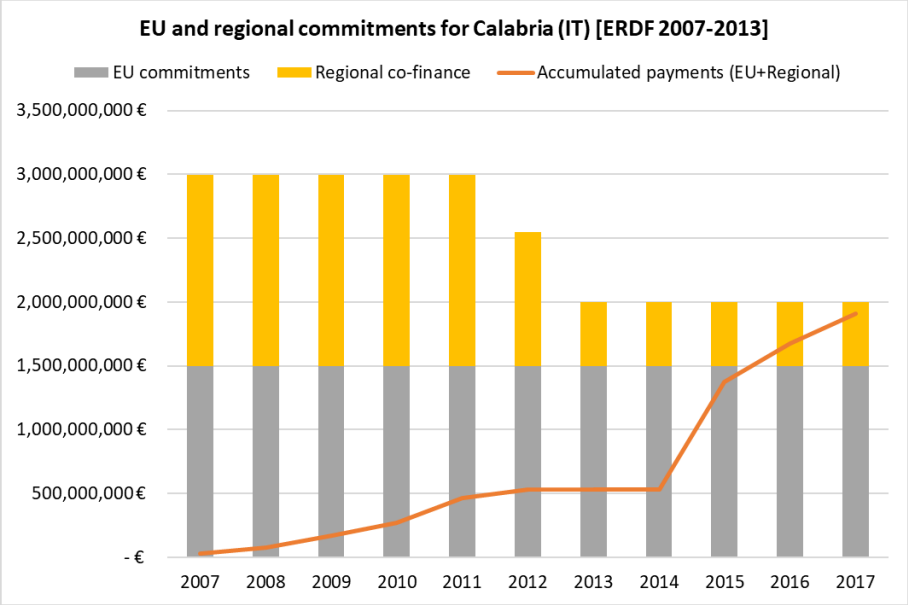

Figure 2.4. EU and regional commitments for ERDF fund in Calabria, Italy, during 2007-2013 period (Own elaboration based on EU reports and OpenCoesione data).

Figure 2.5 illustrates the comparison between total accumulated payments (orange line) and total commitments (bars) approved in Emilia Romagna, in Italy, over time within the ERDF scheme. In this case, the situation is almost opposite compared to Calabria, in Italy. Total accumulated payments grow with a regular and relatively constant rate until they perfectly reach the total commitments. On the other side, the total commitments approved surprisingly increase. Usually, the total commitments stay constant in regions with high performance. However, in case of unexpected urgent events, such as natural disasters, EU commitments and/or regional co-finance may increase for supporting the reconstruction of regional development. In this particular case, total commitments increased due to the earthquakes occurred in May 2012 in Emilia Romagna, in Italy, thus the EU decided to increase the regional budget to support the local community. Moving to the deconstruction of the total commitments, both contributions increase proportionally in 2013, after the earthquakes in the region in 2012.

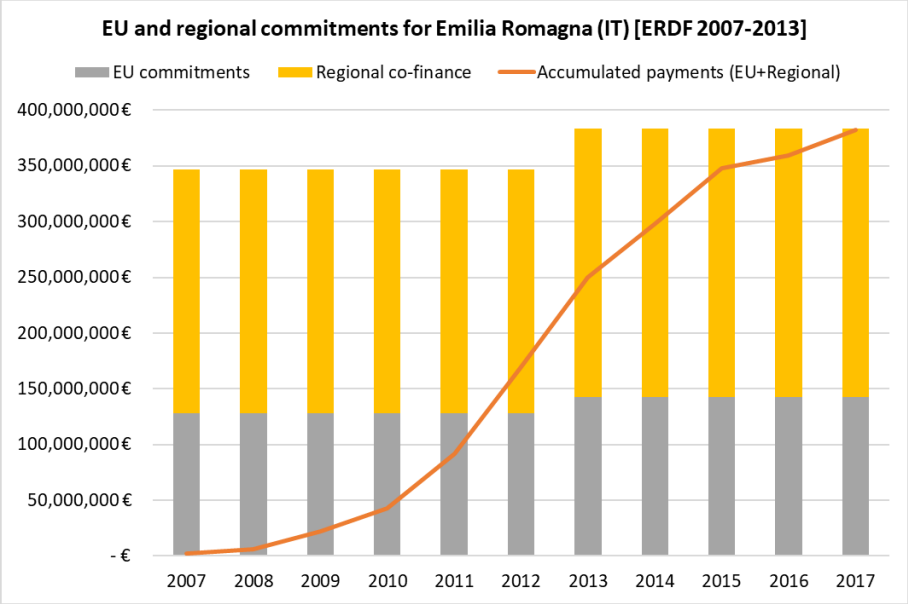

Figure 2.5. EU and regional commitments for ERDF fund in Emilia Romagna, Italy, during 2007-2013 period (Own elaboration based on EU reports and OpenCoesione data).

2.1.2.2. Towards a new absorption indicator

Usually, the values communicated by the EU, the regions or the media refer to the absorption rate calculated based on the updated commitments (i.e. **updated-based absorption rate**). Even though the EU and regional commitments should ideally stay stable, sometimes they can increase or decrease. Thus, the term *updated commitments* refers to the commitments after any increase or decrease either by EU and/or the region. However, this usual approach has some limitations and impede the understanding of what is really happening in a region.

To provide a new perspective on the analysis of absorption, we develop a new indicator of calculating performance: the **initial-based absorption rate.** This rate is simply calculated by using the commitments approved initially (i.e. in the beginning of the programming period) by the EU and the LMA. This way of calculating the absorption allows for the elimination of the effect of the EU decommitments and/or the co-finance reduction, which entail the paradox of improving performance through subtracting committed resources.

Figure 2.6 illustrates the two different types of absorption rate for the total ERDF funds during the 2007-2013 policy cycle in Calabria, in Italy. Given the reduction of the regional co-finance, the initial-based absorption rate is much lower compared to the updated-based absorption rate, which is calculated based on the reduced total commitments (and thus they seem to reach a sufficient level of 95.58%). In fact, the initial-based absorption

rate equals to 63.72%, highlighting that the real absorption of the funds based on the initially approved commitments is rather low.

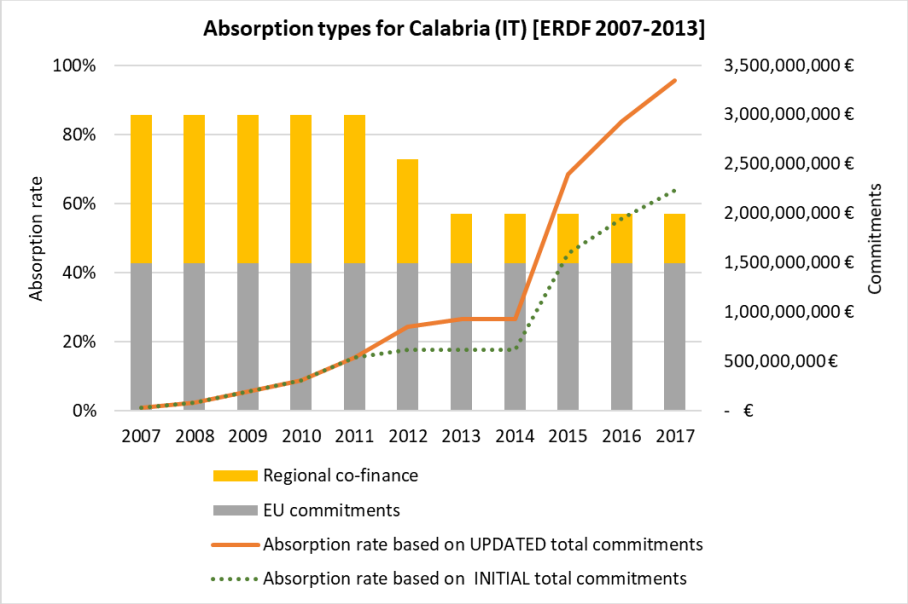

Figure 2.6. Types of absorption rate for ERDF fund in Calabria, Italy, during 2007-2013 period (Own elaboration based on EU reports and OpenCoesione data).

Figure 2.7 depicts the absorption indicators for the total ERDF funds during the 2007-2013 policy cycle in Emilia Romagna, in Italy. In contrast to the previous case, given the increase of the commitments both by the EU and the region during the policy cycle due to the occurrence of a natural disaster in the region, the initial-based absorption rate is higher compared to the updated-based absorption rate which reach the optimal level of 100%. As a result, the initial-based absorption rate now equals to 110.47%, which seems logical, as the initial commitments are less than the finally allocated ones.

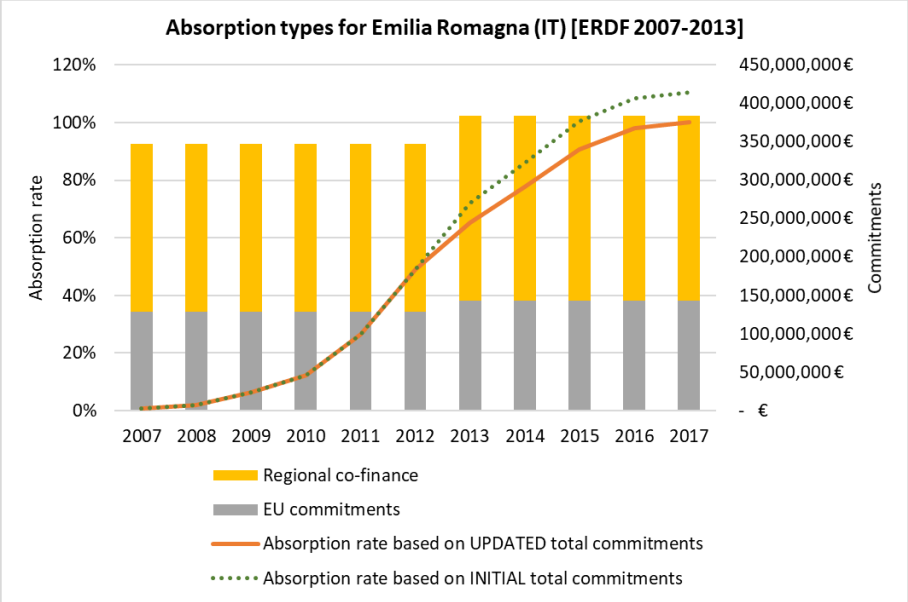

Figure 2.7. Types of absorption rate for ERDF fund in Emilia Romagna, Italy, during 2007-2013 period (Own elaboration based on EU reports and OpenCoesione data).

However, in some regions, this absorption indicators can be further purified. In fact, the absorption rate takes into account also the so-called **'retrospective' projects**[2]. They are used in emergency cases by the LMA to increase expenditure and thus improve absorption when deadlines get closer. In case retrospective projects were not selected, funding shortcuts may have occurred. Notably, EU regulations do not explicitly prohibit retrospective projects. In fact, Member States are not obliged to provide reports on the expenditure declared retrospectively (European Court of Auditors, 2018).

In this context, it could be possible to calculate the **gross and net absorption rates**, namely in cases where retrospective projects are accounted and in case they are eliminated. Given that regions do not provide official information about retrospective projects as they are not obliged to do so, all estimated absorption rates are gross. Although data about retrospective projects are lacking, the Italian Court of Audit indicated that in Calabria, in Italy, during the 2007-2013 period, approximately 44% of the total expenditure (i.e. both EU and regional payments) in the context of the ERDF scheme was comprised of retrospective projects (Corte dei Conti, 2017). In other words, if retrospective projects' expenditure is discounted from the gross updated-based and

[2] According to the European Court of Auditors (2018, pp. 5-6), *"Retrospective projects are those which have incurred expenditure from national sources or are completed before EU co-financing has been formally applied for or awarded, i.e. they are financed retrospectively. In the 2014-2020 program period, projects or operations that are physically completed or fully implemented before the beneficiary submits the application for funding are not eligible for EU funding."*

initial-based absorption rates, then the net absorption rates will equal to 53.52% and 35.68%, respectively.

2.1.3. Absorption data insights

The manner in which absorption rate is calculated and diffused is important for assessing and assigning political accountability. Usually, the values communicated to the public refer to the absorption rate calculated based on the updated commitments (i.e. **updated-based absorption rate**). When the performance of an LMA regarding the EU funds' absorption is low, the reduction of regional co-finance and the use of retrospective projects is usually the norm to increase absorption and 'hide' existing absorption issues. To this end, the use of the proposed **net initial-based absorption rate**, which is filtered from the retrospective projects (i.e. net) and the regional co-finance reductions (i.e. based on the initial commitments approved), could provide a transparent view on the actual LMA performance and thus highlight the regional political accountability concerning EU funds' absorption.

To diffuse this new indicator, **it is recommended that EU utilize the net initial-based absorption rate in their reports and websites in order to:**

(i) allow for internal monitoring of the LMAs performance (which is not performed by the EU until now),

(ii) increase public transparency on EU-regional co-financing rates,

(iii) create a unique and consistent database for all countries and regions to support easy access for practitioners and researchers in the field.

Overall, the performance of the LMAs should be examined over time and not just at the end of the policy cycle as a singly indicator. In fact, the dynamic analysis the absorption rate behaviour has the potential to provide deeper information about the LMA efficiency, as well as on LMA shortcut policies, whose effect is not visible in the final absorption rate. Given that an irregular absorption pattern can hinder the economic benefits provided by the CP (Gandolfo, 2014), it is crucial that EU develops a new methodology for assessing the LMAs performance.

Indicatively, we propose the comparison of the actual LMA absorption rate over time with an ideal absorption rate line (i.e. proportional expenditure), through calculating the average distance, in terms of statistical errors, between the two curves in order to evaluate the fit of the real absorption to the ideal one.

2.2. Funds' absorption model

To capture the actual system's behaviour over time, the System Dynamics (SD) modelling approach is implemented to map the factors that affect the CP implementation and quantify their impact on absorption. Given that the complete qualitative analysis of the model is presented in PERCEIVE Deliverable 6.1, while the description of the formal mathematical model is reported in PERCEIVE Deliverable 6.2., in this report we focus on the analysis of model's behaviour.

More specifically, PERCEIVE Deliverable 6.3 aims at:

(i) testing the robustness and reliability of the qualitative model,

(ii) performing sensitivity analyses for investigating the impact of the parameters' changes in the results.

Notably, although the utilization of SD in the field of CP has been explicitly recommended (Smeriglio *et al*., 2015), to the best of our knowledge, this is the first research effort in exploring the whole CP system from a SD perspective. Although emphasis has been placed on LMAs with low performances in order to investigate the mechanisms that generate these problematic situations, the detailed structure of the developed SD model enables its application at any type of LMA. In the following subsections, a brief presentation of the model, along with an elaborate sensitivity analysis, are provided.

2.2.1. Absorption model overview

The system under study reflects the main flow of European Cohesion Policy (CP) funds from the EU through the regions to the beneficiaries, including all parameters and factors that affect this procedure. Notably, the analysis is **multi-level**, including three key players: the EU, the regions and the final beneficiaries. In fact, the causal loop diagram (CLD)[3] illustrates how the initial EU funding is distributed **dynamically**, beginning from the allocation of the funds to the regions up until the final refund of the beneficiaries for the projects accepted. Four major feedback loops[4] exist in the system, namely: the *"local managing authority learning"* loop (in green), the *"potential applications"* loop (in blue),

[3] The CLD captures the conceptual structure of a system through representing its major cause-effect links, accumulations and feedback mechanisms. Arrows indicate causal links that connect a cause to its effect. Plus (+) symbols indicate that the cause has a positive impact on the effect, while minus (-) symbols a negative one.

[4] A feedback loop is a sequence of causes and effects such as that a change in a given variable circulates through the loop and finally ends up further influencing the same variable. These mechanisms are either balancing (negative) or reinforcing (positive) feedback loops.

the *"word of mouth"* loop (in purple) and the *"strategies to increase absorption rate"* loop (in orange), all of which affecting (and get affected by) the main funding flow. Notably, some of the loops are intertwined, further highlighting the **complexity** of the system. To develop the CLD, three types of sources were utilized: (i) EU literature, (ii) scientific literature, and (iii) interviews with experts on the field. EU literature was used to build accurately the main flow of European CP funding. Figure 2.8 illustrates the CLD of the system, while the stock and flow diagram (SFD)[5] is presented in Figure 2.9. Notably, this absorption part of the model is interconnected with the communication part of the model, thus the outputs of the one is inputs of the other.

[5] A stock and flow diagram (SFD) is an elaborate mathematical representation of the system's structure (CLD) and the interrelationships among all variables. These variables can be stock (i.e. state) and flow (i.e. rate) variables, time delays, auxiliary variables and constants (Sterman, 2000). Specifically, stock variables are states that represent accumulations within the system, while flow variables are rates that fill or empty the stock variables. Mathematically, a SD model constitutes a system of differential equations with integral equations that express the integration of flows into stock variables, and supplementary equations that connect the model's variables through functions.

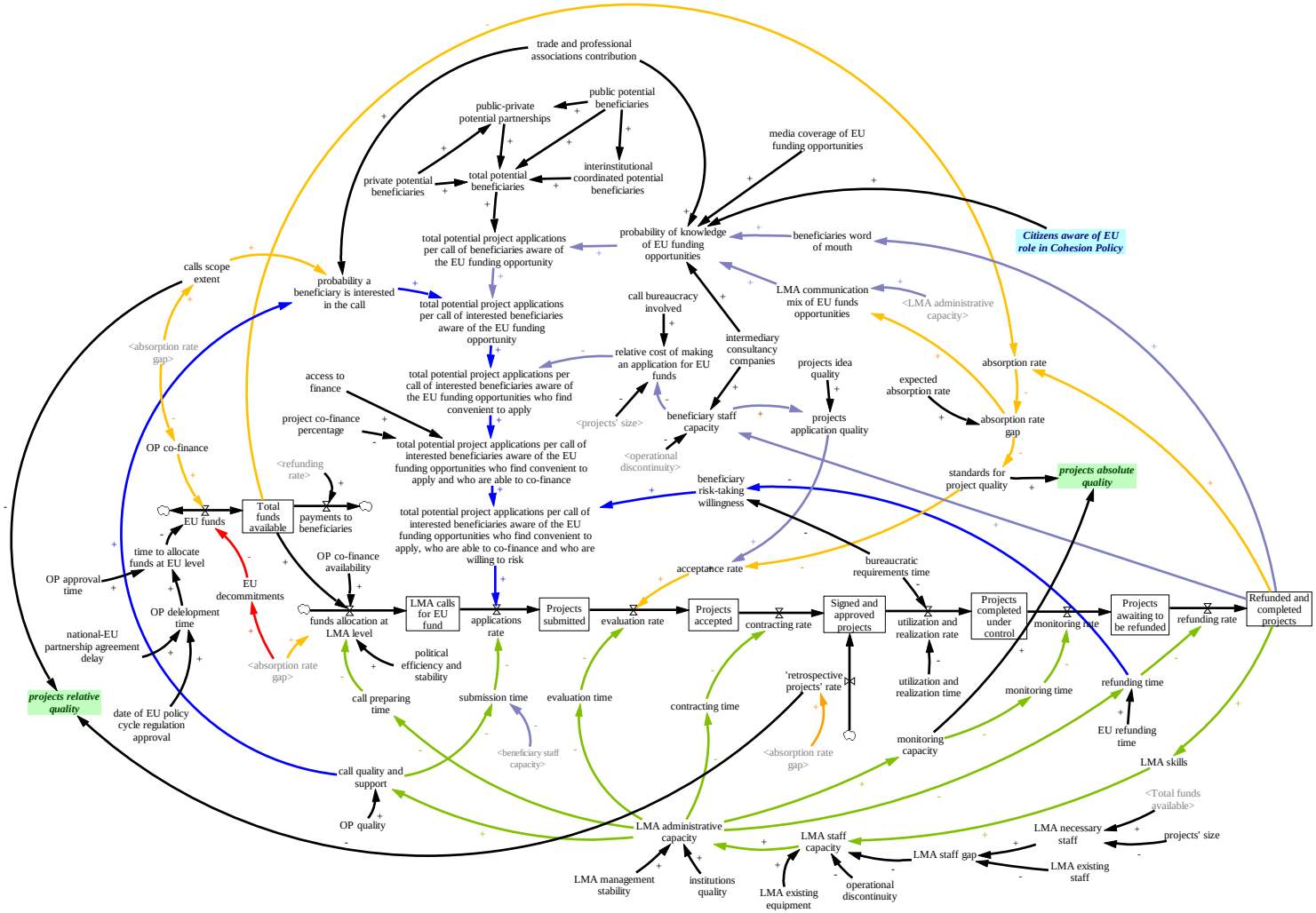

Figure 2.8. CLD of the absorption system under study

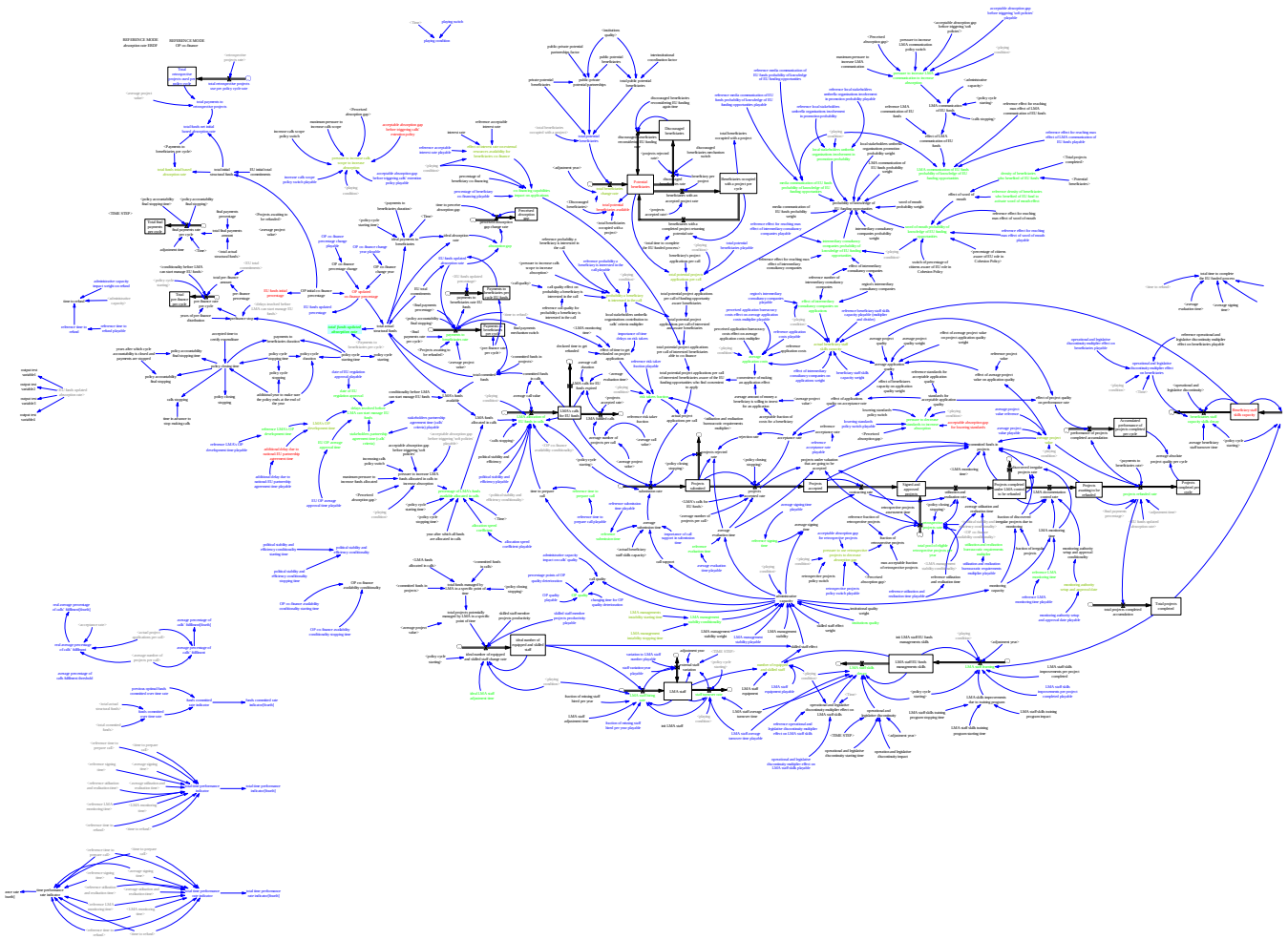

Figure 2.9. SFD of the absorption system under study.

To verify if the SFD structure is reliable, the model has been calibrated to replicate the ERDF total absorption rate (i.e. of both EU and regional contributions) over three policy cycles 2000-2006, 2007-2013 and partially 2014-2020 in the case of Emilia Romagna, in Italy. Figure 2.10 shows the manner in which the developed model replicates the real data available (reference mode). The red lines (1, 2 and 3) indicate the reference modes, while the blue ones (4, 5 and 6) refer to the simulated model outputs. In our simulations, absorption time replicates the empirically observed time needed to absorb funds and close the policy cycle. This time spans well beyond the theoretical 7-years programming period of CP. This is because, beyond the seven full years of program implementation, two further years are usually employed to absorb funds according to the (N+2) rules. In addition, the closing of the policy cycle required on average other two years (e.g. completion of financial statement, EU final payments procedure, etc.).

Therefore, in the following, when we produce scenario analysis for the policy cycle beginning in 2021, we consider an absorption time span between 2021 and 2032 (11 years). These are seven full years of program implementation plus two years for (N+2) rule, so we are already at the beginning of 2030. In addition, we consider that it takes some time to close the policy cycle after the n+2 deadline (we don't know how many years EU will take to close the policy cycle this time but use as reference previous cycles behaviours), so we assume it pays back what is left to pay one year after (during 2031). If we sum we get 11 years.

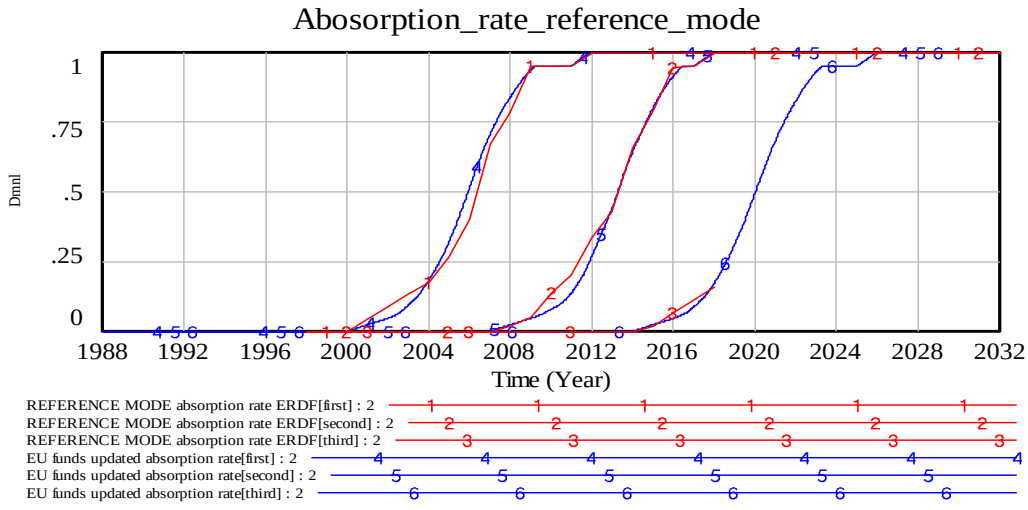

Figure 2.10. SFD model calibration results.

Evidently, the model outputs replicate the reference modes to a sufficient extent, thus the model seems to confirm that the developed SFD structure explains adequately what is happening in the real world. The pattern of both reference modes and model outputs is an S-shaped growth. Initially, the system slowly starts to absorb the funds of the new cycle. The absorption rate constantly increases until it reaches approximately 95%. Towards the end of the cycle, a saturation effect is evident; there are fewer funds and therefore the absorption decelerates, until it reaches 100%. The ability to replicate reality represents an important target of the SD modelling approach, since achieving this goal may provide a first formal validation of the quality of the model (Barlas, 1996; Sterman, 2000). The ultimate aim is to test the model against as many real absorption cases as possible, given that the more absorption rates it replicates, the higher the confidence in it can be.

In addition, we performed a number of validation tests to increase the confidence in the model and its outputs, namely: structure and parameter confirmation test, dimensional consistency, formal inspections, walkthroughs, extreme conditions tests, behaviour sensitivity tests, modified-behaviour predictions (Barlas, 1996; Sterman 2000).

2.2.2. Absorption sensitivity analysis

Since the model has been quantified using real world data, educated guesses and logical estimations, several simulations are performed in order to test the impact of the variables on the system's behaviour and explore possible scenarios through sensitivity analyses. In the upcoming subsections, the most thought-provoking simulated scenarios are presented.

2.2.2.1. What-if scenarios type 1: External shocks

In this scenario, we simulated **legislative and operational discontinuity** in the CP implementation (i.e. change in procedures to manage funds and projects) occurring in year 2021. In addition, we simulated different LMAs with different degrees of resiliency. We refer to resiliency as the availability of diffused learning skills in the organisation of the simulated LMA. We show how a low LMA adaptability (e.g. due to low learning skills), along with a legislative disruption, can lead to an accumulation of delays in the funding process, thus negatively affecting the fund's absorption capacity (Figure 2.11). While the pattern of the absorption rate is marginally decreased in the case of the resilient LMA (red line – curve 2) leading to the same final absorption as in the baseline case, both the behaviour and the final level of the non-resilient LMA (green line – curve 3) is

considerably lower compared to the baseline scenario. Overall, it is recommended that a certain degree of continuity in regulation and operational procedures should be maintained, while the organizational resilience of LMAs, especially in terms of skills' improvement, should be strengthened, in order to avoid delays and low absorption.

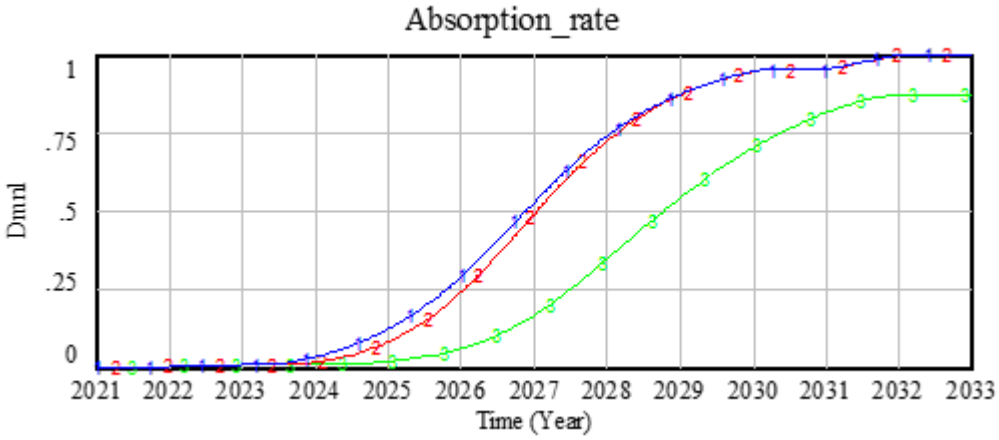

Figure 2.11. Sensitivity analysis of legislative discontinuity on absorption rate (blue line – curve 1: average LMA (baseline), red line – curve 2: highly resilient LMA, green line – curve 3: non-resilient LMA).

Another example of this scenario refers to an external shock in terms of technical capability of the LMA, especially a **staff loss** of about 20% in year 2021, is considered. Once again, a low LMA capacity, along with an unexpected staff loss, negatively affects the process delays of the different steps of the funding pipeline, leading to reduce the absorption rate over time (Figure 2.12). Notably, although the highly adaptive LMA (red line – curve 2) manages to catch up with the final absorption of the baseline case, the final absorption rate of the non-resilient LMA (green line – curve 3) is considerably lower.

Overall, it is suggested that **LMAs should work towards becoming more adaptive and resilient organizations in terms of staff adaptation, skills and productivity, as well as in terms of sufficient and efficient equipment, in order to avoid delays and low absorption.**

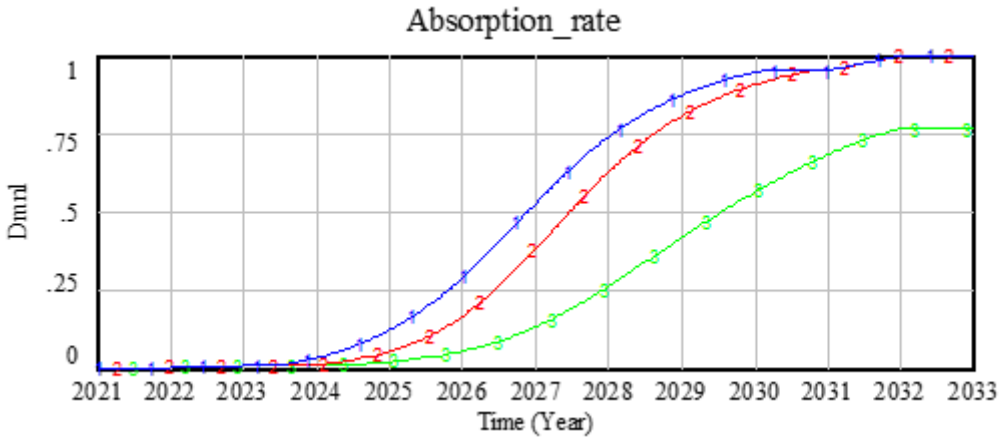

Figure 2.12. Sensitivity analysis of LMA staff loss on absorption rate (blue line – curve 1: average LMA (baseline), red line – curve 2: highly adaptive LMA, green line – curve 3: non-adaptive LMA).

An additional example of external shock simulates the situation in which a **lack occurs in the OP co-finance** required to allocate funds between 2025 and 2027, as the national and regional authorities are not capable of providing it (Figure 2.13). More specifically, LMAs cannot develop any call because they do not have the available resources to co-finance the projects to be accepted (e.g. due to the economic crisis impact). The blue line refers to the baseline case, the red line to an adaptive LMA and the green line to a rather inflexible LMA, while it is considered that the adaptive LMA can hire staff 10 times quicker than the less adaptive one. Before the shock, the blue and red lines are overlapping, while the green line is slightly below indicating the lack of adaptability. However, this difference becomes even more evident when the interruption due to the lack of co-finance occurs; in fact, the resilient LMA (red line – curve 2) recovers quickly trying to catch up with the absorption of the baseline case, while the LMA with lower adaptability (green line – curve 3) absorbs the funds in a less efficient manner. Thus, the LMAs should be flexible in terms of staff hiring in order to proceed with the funding pipeline processes quicker after the shock and improve absorption as much as possible.

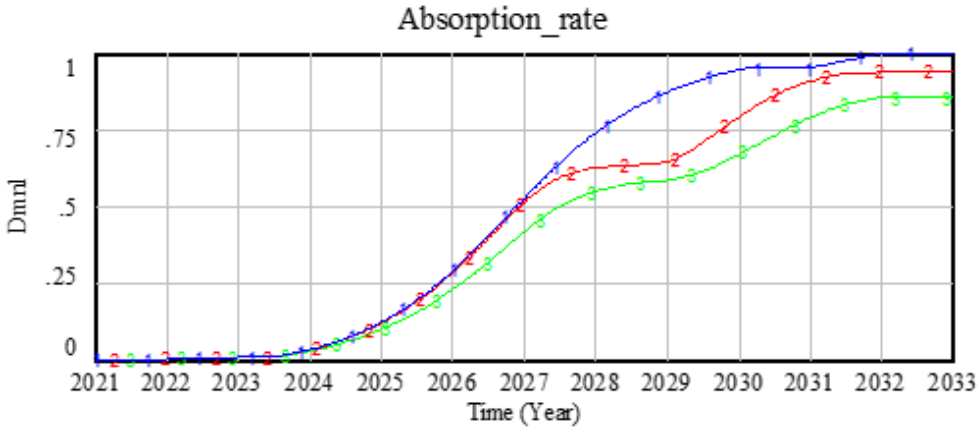

Figure 2.13. Sensitivity analysis of lack of OP co-finance on absorption rate (blue line – curve 1: average LMA (baseline), red line – curve 2: highly adaptive LMA, green line – curve 3: non-adaptive LMA).

2.2.2.2. What-if scenarios type 2: Low beneficiaries' demand

In this scenario, there is a low demand of beneficiaries that apply for the regional calls and thus the LMA may launch several **soft or moderate policies** (Figure 2.14). The blue line (curve 1) refers to the baseline case in which demand is sufficient. The black line (curve 5) refers to the case in which the demand is low but there is no LMA action to improve the situation, while the red line (curve 2) simulates the case in which the LMA acts towards increasing promotion of LMA funds in order to tackle the low demand. The orange and green lines (curves 4 and 3) illustrate the situation in which LMA extends the scope of the calls in order to increase the audience of potentially interested beneficiaries. The difference between the two lines lies in the fact that the orange line depicts a timely adaptation, while the green line refers to a delayed LMA action (the LMA may need some time to understand the issue). Overall, more drastic policies, such as calls' scope extension, have a better impact on the absorption compared to simpler ones (i.e. promotion through the media). However, even if the calls' scope extension can be considered more efficient, it should be noted that there is the clear risk of shifting away of the original OP purposes and thus accepting projects that do not correspond effectively to the CP strategic goals. **Thus, it is proposed that LMAs should work towards increasing their flexibility and adaptability for tackling efficiently a low beneficiaries' demand both in the short and medium terms.**

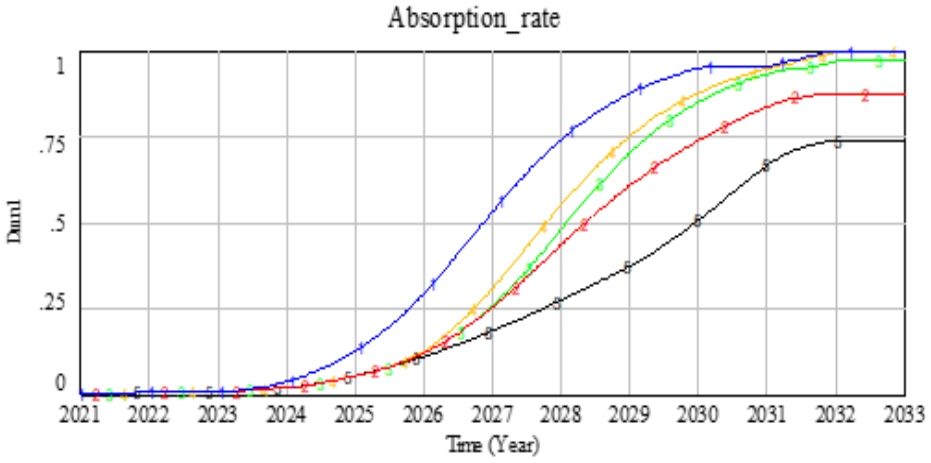

Figure 2.14. Sensitivity analysis of low beneficiaries' demand and soft/moderate LMA policies on absorption rate. (blue line – curve 1: sufficient demand (baseline), black line: low demand – no LMA action, red line – curve 2: low demand – calls' promotion, green line – curve 3: low demand – delayed calls' scope extension, orange line – curve 4: low demand – timely calls' scope extension).

Another example of this scenario refers to the situation in which there is a low demand of beneficiaries that apply for the regional calls and thus the LMA, in concertation with national authorities, may implement a **hard policy**, such as the reduction of regional co-finance (Figure 2.15). The blue line (curve 1) refers to the baseline case in which demand is sufficient, while the black line (curve 5) refers to the case in which the demand is low but there is no LMA action to improve the situation. The other lines depict the cases in which the LMA reduces the regional co-finance by 40% in year 2024 (red line), 2027 (green line) and 2030 (orange line) in order to respond immediately to the low demand. Notably, the optimal intervention in the case of low demand in terms of timing is the reduction of co-finance just before the closing of the period (i.e. 2021-2028) (green line – curve 3), as the final absorption reaches the highest value as in the baseline case. In general, a quite early decrease in the co-finance (red line – curve 2) seems counterproductive, as the absorption cannot catch up with the baseline one; not only does the reduction of regional co-finance diminish the total funds available but also reduces the LMA's targets. In addition, a rather late reduction in the co-finance, especially after the end of the policy cycle (orange line - curve 4), does not allow enough time for the LMA to absorb even the reduced funds. However, a late co-finance reduction (orange line) seems to perform better compared to an early one (red line) in terms of final absorption rate. Therefore, it seems that there is a time frame in which reducing the regional co-finance pays-off more. Overall, LMAs should focus on setting ambitious yet realistic goals in the

beginning of each policy cycle and work towards retaining them. In addition, **it is recommended that the regional co-finance reduction should be discouraged, since it generates an 'artificially' increased absorption rate indicator.**

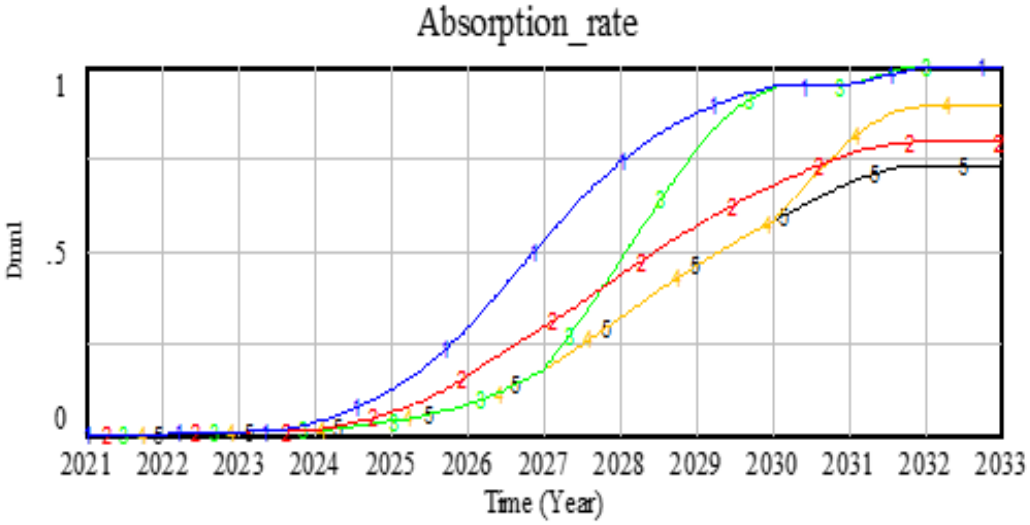

Figure 2.15. Sensitivity analysis of low beneficiaries' demand and hard LMA policies on absorption rate (blue line – curve 1: sufficient demand (baseline), black line – curve 5: low demand – no LMA action, red line – curve 2: low demand – co-finance reduction in 2024, green line – curve 3: low demand – co-finance reduction in 2027, orange line – curve 4: low demand – co-finance reduction in 2030).

2.2.2.3. What-if scenarios type 3: Reduction in LMA administrative endowment

In this scenario analysis, we consider three different cases of **reduction of LMA administrative capacity** (i.e. low technical capabilities, inadequate equipment or staff capacity) in year 2021. We simulate drop in resource endowment of 20% (red line – curve 2), 40% (green line – curve 3) and 60% (orange line – curve 4) compared to the baseline case (blue line – curve 1). As already mentioned, a low administrative capacity increases the process delays in the funding pipeline, leading to the decrease of the absorption rate, namely of both the dynamic pattern and the final value (Figure 2.16). More specifically, in case of a 20% reduction in the LMA capacity, the absorption finally catches up with the baseline case's one. However, beyond 20% decrease capacity a threshold occurs and the final absorption rate decreases; thus, LMAs absorb considerably less funds. In our simulations, the decrease of the absorption rate is more than proportional than the LMA capacity decrease. This suggests that the management of LMAs' administrative capacity is a delicate issue. The consequences of the reduction in LMAs' capacity may be characterised by tipping points and thresholds beyond which the recovery of absorption

pattern may be irreversible of may require exaggerated resources. For example, with a large enough drop in LMAs' capacity, LMAs might be pushed to increase the absorption with radical shortcut strategies in order to see visible results quickly. This can result in a higher risk of lowering the quality of the projects to be accepted. Therefore, we suggest that **effort should be spent towards building a strong LMA administrative capacity, which requires long-term investments and commitment since it takes more time (compared to the shortcut strategies implementation) to obtain the expected positive results.**

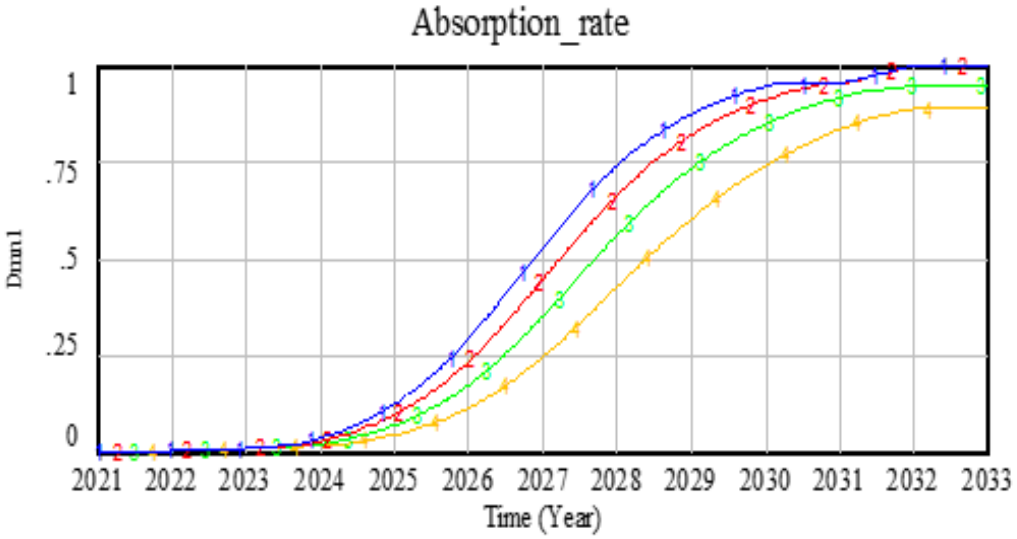

Figure 2.16. Sensitivity analysis of LMA capacity reduction on absorption rate (blue line – curve 1: no reduction (baseline), red line – curve 2: 20% reduction, green line – curve 3: 40% reduction, orange line – curve 4: 60% reduction).

On similar lines, we simulated a drop in the **quality of top-level management of LMAs**. The red line (curve 2) in figure 2.17 simulates a drop in the quality of top management after year 2021 compared with a LMA which has always been investing in human resources management and administrative empowerment (i.e. hiring highly skilled personnel in key positions, promoting leadership and commitment among personnel) (blue line – curve 1) (Figure 2.17). As in the case of LMA capacity reduction, a decrease in the quality of the top-level management generates delays in the CP implementation, leading subsequently to a lower absorption rate and thus to a higher risk of lowering the quality of the projects to be accepted (red line – curve 2). Notably, considering that the decrease refers to the capabilities of the top-level management of an LMA (top-level positions are usually only a few), the impact on the implementation and absorption can be interpreted as significant mainly due to the fact that these are key position of a LMA's

administration. **Thus, it is recommended that considerable effort should be placed towards LMA administrative empowerment.**

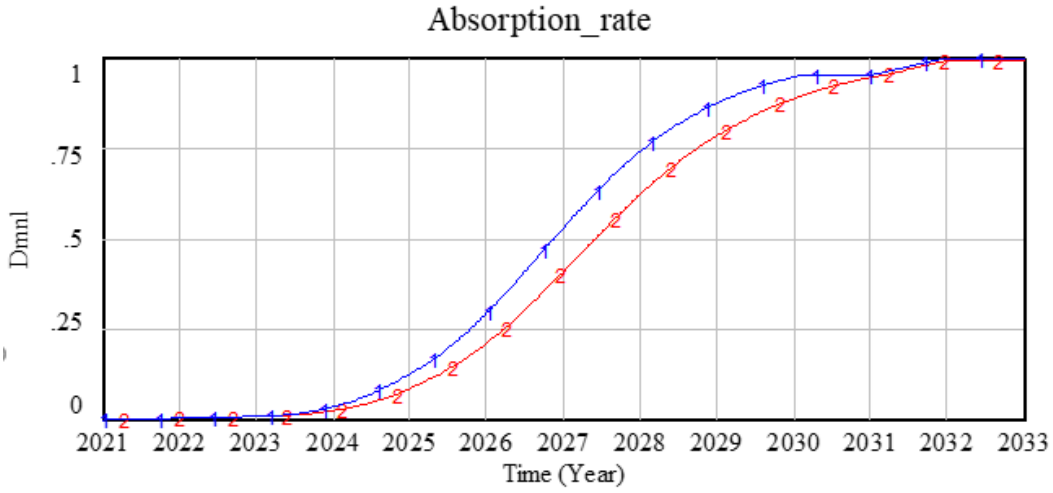

Figure 2.17. Sensitivity analysis of low-quality top-level management on absorption rate (blue line – curve 1: high-quality, red line – curve 2: quality reduction).

An additional example of this scenario refers to the cases of **increased staff turnover rate**. Considering the blue line (curve 1) as the baseline simulation, the green line (curve 3) depicts a staff turnover rate that is six times quicker, while the red line (curve 2) represents the same increased staff turnover rate along with a lower ability of LMA to learn (Figure 2.18). Given that the case of a staff member leaving equals to a loss of experience, an increase of the staff turnover rate (green line – curve 3) leads to a considerable increase in the time needed to complete the different CP implementation steps and finally to a decrease in the absorption rate. However, when an increased turnover rate is combined with a low ability of the LMA to learn, the negative impact on the absorption rate is even more potent. Therefore, a greater LMA learning ability can partially compensate the increased staff turnover and lower the loss of skills. However, given that this compensation takes time, efforts should be placed on the long-term commitment of the LMAs to increase their learning capacity for improving performance.

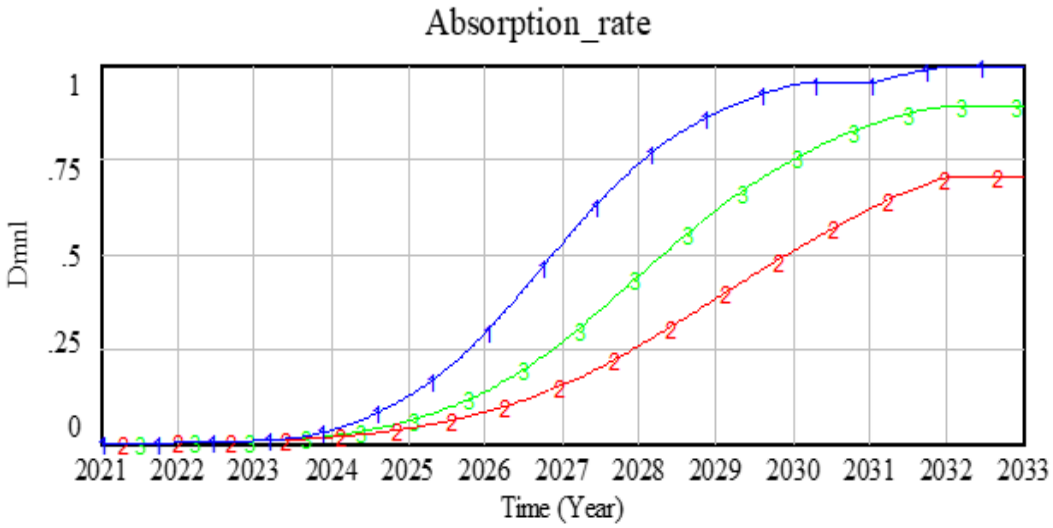

Figure 2.18. Sensitivity analysis of increased staff turnover rate on absorption rate (blue line – curve 1: average turnover rate (baseline), red line – curve 2: increased turnover rate, green line – curve 3: increased turnover rate – lower LMA learning).

2.2.2.4. What-if scenarios type 4: Increased process delays

In this scenario, three different cases in which there are **increased delays** (i.e. high average evaluation time) due to bureaucratic variations in CP regulations (red line: 5 months, green line: 7.5 months and orange line: 1 year) compared to the baseline case (blue line: 2.5 months) are considered (Figure 2.19). In fact, when the time of each step of the funding pipeline (indicatively the average evaluation time) increases, the implementation of CP faces delays and thus the absorption rate becomes lower due to the increased complexity in the system. Therefore, both the Commission and the national or regional authorities are encouraged to make efforts towards the simplification of the procedural steps of CP implementation for improving funds' absorption.

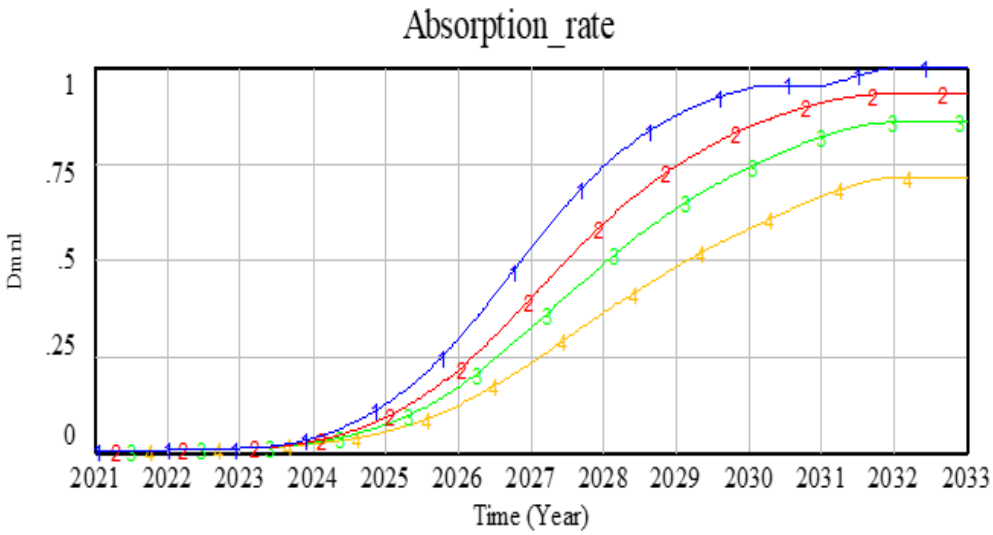

Figure 2.19. Sensitivity analysis of increased average evaluation time on absorption rate (blue line – curve 1: 2.5 months (baseline), red line – curve 2: 5 months, green line – curve 3: 7.5 months, orange line – curve 4: 1 year).

2.3. Funds' absorption discussion

In the following subsections, grounding on the integration of analysis of empirical data, secondary data and interviews, on the one hand, and the insights emerged from the simulation experiments, we propose a number of considerations.

2.3.1. Towards new monitoring indicators

Currently, the absorption rate constitutes the most used indicator at European and national/regional levels to estimate LMA performances. This indicator monitors the performance of LMAs using a parameter that is located downstream in the implementation process, namely only when most of the processes of the funding pipeline have been completed. In fact, absorption rate can show if there are problems in the implementation system only at the end of the flow. Thus, there is an intrinsic delay involved. For example, considering an LMA with a low performance due to unfulfilled calls, this problematic behaviour will be discovered only years later when absorption indicator will manifest the undesired trend. Clearly, this delay in the perception consequently postpones also the possible interventions for the correction of the problem (i.e. better calls, recalibrated OP), thus providing an inadequate impact on the system to correct the undesired state. To this end, we propose the development of new performance indicators in order to promptly signal where problems are located and solve them quickly.

The first indicator, named as **percentage of call fulfilment**, has the ability to monitor the LMA calls for projects that remain unanswered. More specifically, it assesses the success of a call among the local community; hence, it provides an indication of the number of potential beneficiaries that can apply for this call. It is calculated by dividing the number of applications by the places available (i.e. average number of projects to be accepted as a ratio of the call value over the average project value) for a certain call:

$$percentage\ of\ call\ fulfilment = \frac{number\ of\ applications}{average\ number\ of\ places}$$

The meaning of this indicator is the following:

- $0 \leq$ *percentage of call fulfilment* ≤ 1

  The calls have been partially gone unanswered. If it is zero, nobody applied. The closer it gets to one, the closer the applications got to the average number of places available.

- *percentage of call fulfilment* = 1

  It means the demand perfectly matches the supply. In other words, the number of applications equal average number of places available.

- *percentage of call fulfilment* ≥ 1

  It means that there are more applications than the average number of places available.

However, even high-performance LMAs can draft a lowly appreciated call, while low-performance LMAS a highly appreciated one. Thus, the **average percentage of calls' fulfilment** among all calls can be more valuable from a systemic perspective. In this case, the indicator is developed by summing all the call performances and then dividing them by the number of calls for a certain period:

$$average\ percentage\ of\ call's\ fulfilment: \frac{\sum\left(\frac{number\ of\ applications}{average\ number\ of\ places}\right)}{number\ of\ calls\ in\ a\ period}$$

This indicator can be useful in order to understand if absorption issues arises from the demand (beneficiaries) or the supply (LMAs) side. If the beneficiaries do not apply, there must be a problem on the demand side. In this case, at the moment, the only possible policy intervention seems to be the engagement and discussion with the local community. If the beneficiaries apply, dysfunctions are located on the LMA side and therefore effort

should be made on improving LMA efficiency. To identify better the problem in the second case, two additional indicators have been developed as described below.

The second proposed indicator is the CP **funds committed rate**. It represents the total amount of funds that are committed (or already refunded) in all different phases compared to a reference desired value (e.g. as defined by the Commission). Specifically, funds committed comprises all funds that are allocated in calls, committed to projects under evaluation, approval, signature, execution, monitoring and waiting to be refunded, as well as all the refunded funds. The equation of this indicator is:

$$funds\ committed\ rate = \frac{funds\ committed}{desired\ funds\ committed}$$

In fact, absorption rate cannot be calculated from the beginning of each cycle, since no absorption is made (it takes time to complete the whole pipeline of processes and gets refunded). Thus, *funds committed rate* is a much broader concept compared to absorption rate, as it allows for the monitoring of the LMA effort in real time since the day one of the policy cycle. However, this indicator works best if combined with the *average percentage of calls fulfilment* and *absorption rate*. If, while analysing an LMA with a low performance, the *average percentage of calls fulfilment* is sufficiently high, then attention should be paid at the *funds committed rate:* it might show that although the calls are fulfilled, the amount of money allocated, committed and refunded is too low compared to what it should be in order to reach an adequate absorption. On the other hand, if there is a sufficient *funds committed rate* with a proper *average percentage of calls fulfilment* and the absorption rate is still too low, the problem might be located in the length of the different procedural steps that build up the main CP pipeline.

The third indicator is a set of parameters that can be indexed in a matrix. Monitoring the timings to perform the necessary procedures can indicate how quick LMA performs its duties. Thus, this indicator could be helpful in identifying where the bottleneck in the absorption is. The building process of the matrix is described as follows (Table 2.1): in the first column there is the list of the reference average times that each step requires to be performed (i.e. the time that the European Commission evaluate as a standard time to make each step) and in the second column is the list of the average time the LMA needs to perform that step in reality. In the third column, the ratio of the average real time over the related reference value is calculated for each step. At the end, reference and real times are summed and the **time performance indicator** is calculated as the ratio of the respective

sums. If the time performance indicator is greater than one, thus indicates that the LMA takes more time to complete the steps on average, while if it is less than one the LMA is quicker than expected. If it is one, it requires on average the reference as defined by the Commission.

Table 2.1. Matrix of reference and real time for the funding pipeline's steps.

Reference time	**Time**	**Time performance indicator**
$\boldsymbol{Step\ 1\ reference\ time}$	$Step\ 1\ time$	$Step\ 1\ time / Step\ 1\ reference\ time$
$\boldsymbol{Step\ 2\ reference\ time}$	$Step\ 2\ time$	$Step\ 2\ time / Step\ 2\ reference\ time$
…	…	…
$\boldsymbol{Step\ n\ reference\ time}$	$Step\ n\ time$	$Step\ n\ time / Step\ n\ reference\ time$
$\sum_{\mathbf{1}}^{\boldsymbol{n}} \boldsymbol{Step\ n\ reference\ time}$	$\sum_{1}^{n} Step\ n\ time$	$\sum_{1}^{n} (Step\ n\ time) / \sum_{1}^{n} (Step\ n\ reference\ time)$

Overall, the three new indicators could act as suitable tools to support the LMAs avoiding the use of policies that could decrease the total amount of funds allocated to the region. The main principle that supports the development of these new indicators is to work on the upstream phases of the CP implementation, allowing for the identification of the problematic areas and timely interventions. Their potential public availability could improve understanding among researchers, stakeholders, journalists and the society in general. Ideally, the EU could gather all indicators in a dataset in order to compare performances and enhance analysis and understanding of the CP system. However, given that the exact type of information and data available in the datasets of LMAs and EU is not known, providing precise indicators ready to be used is rather difficult at this present time. Based on the metadata available online, these indicators could act as initial directions of action and should be further developed in future research. Finally, in the era of big data not only seems feasible but also mandatory to monitor the real performance of an LMA.

2.3.2. Chronicity of low LMA performances

Regions with highest need of funding support also experience the most difficulties regarding CP funds absorption (Jurevičienė and Pileckaitė, 2013). This might seem a paradoxical situation, but it might be not that surprising if a broad perspective is adopted. It can be considered that a convergence region is administered by a LMA with low administrative capacity. However, it is expected that a low LMA performance would improve over the policy cycles, until it reaches a level similar to a high-performance LMA, which is also one of the goals of the CP. Figure 2.20 illustrates an ideal case in which a region starts the policy cycle 2000-2006 with low LMA administrative capacity. Then, its performance increases cycle by cycle, until the region absorbs all the funds properly in the last policy cycle 2021-2028.

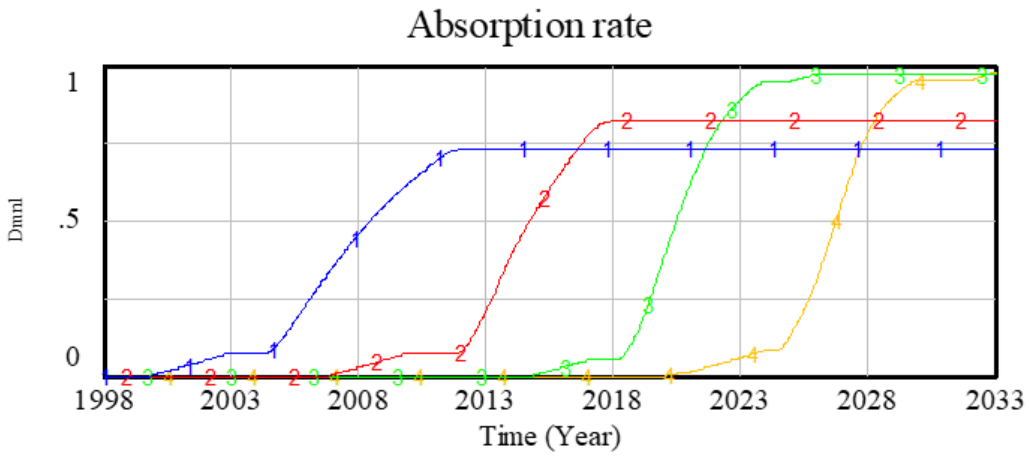

Figure 2.20. Ideal evolution of absorption rates of an initially low-performance LMA.

Therefore, the real problem does not refer to the low absorption of an LMA in a specific policy cycle but to the **chronic** repetition of low performances in consecutive CP cycles, which can be a demonstration of a lack of LMA capacity in managing EU funds. One possible explanation of this chronicity refers to the extended *'overlapping effect'*, which often occurs in reality. If policy cycles overlap for a long time, LMAs that are delayed in the previous cycle tend to start with a delay the subsequent one. Thus, the overlapping effect entails the risk of generating a cascade of delays, which can negatively affect the LMA performance. For example, a comparison between Calabria, in Italy, with low performance (Figure 2.21) and Emilia Romagna, in Italy, with high performance (Figure 2.22) for the ESF scheme (only for the EU commitments) during the 2000-2006 and 2007-2013 periods is presented. In fact, the overlapping of the policy cycles is more evident to the first region compared to the second one.

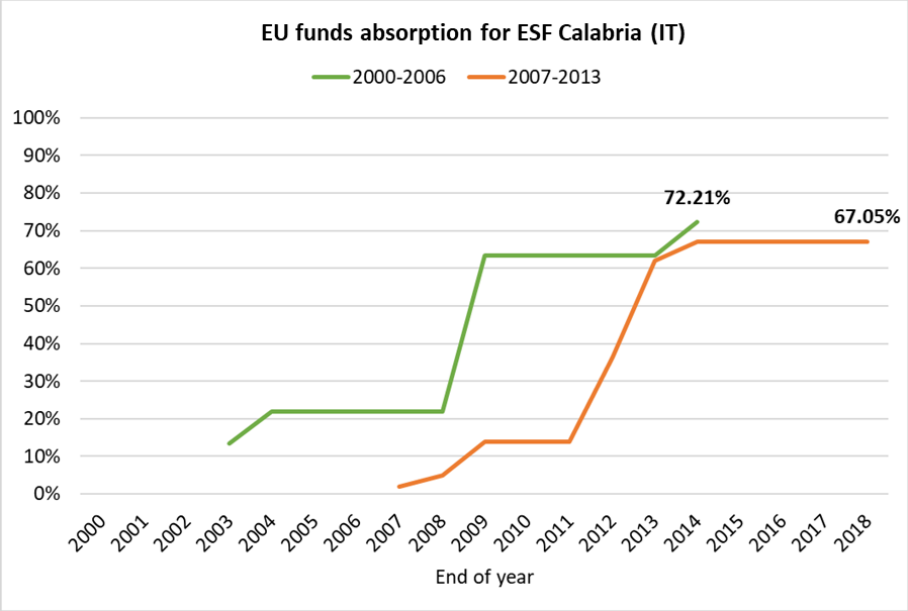

Figure 2.21. Overlapping effect for ESF fund in Calabria, Italy (Own elaboration based on EU reports).

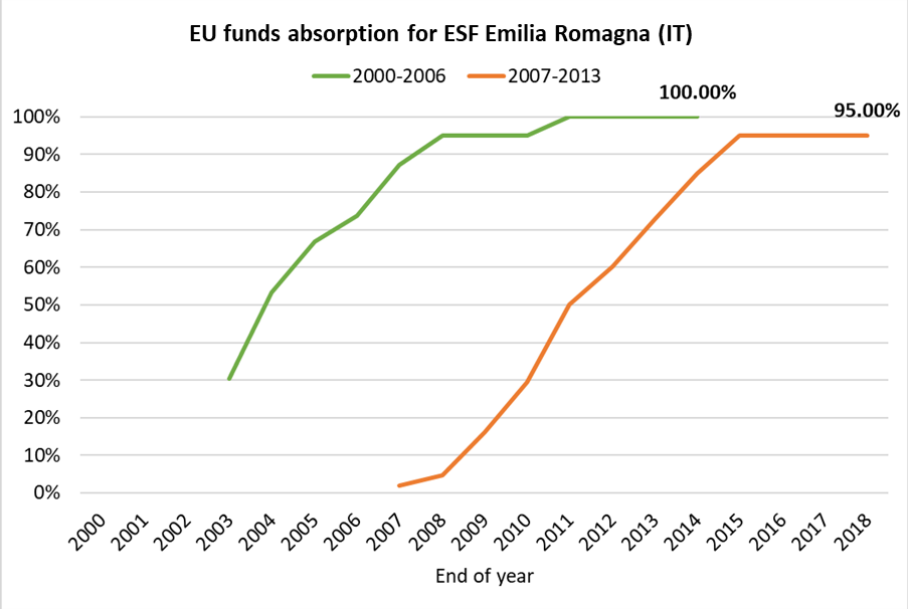

Figure 2.22. Overlapping effect for ESF fund in Emilia Romagna, Italy (Own elaboration based on EU reports).

2.3.3. Undesired traps of LMA shortcut policies

It might appear reasonable to say that LMAs of regions most in need, which receive the highest amount of resources, cannot spent these funds and become locked up in a paradoxical situation. Obviously, several LMAs in this condition suffer from a low

institutional quality that determines their capability of spending. In addition, the overlapping effect, which was already mentioned in the previous paragraph, creates delays that can reduce the absorption level. To this end, the setting of clear-cut deadlines is believed to be a partial solution to the problem.

In addition, other mechanisms might trap the system in this condition. Those systemic traps are generated by the perverse effects of some policies implemented by LMAs that face problems in absorbing the CP funds. In the literature, systemic traps can be found under the name of **system archetypes** (Braun, 2002; Meadows, 2009). They are a simplified representation of recurrent situations in which the system actors act, aiming at improving the system state; however, they end up by perpetuating the problems or even render them worse.

According to Braun (2002), **shifting the burden** can be one of the systemic archetypes (Figure 2.23). It can be resolved working on the *'fundamental solution'* (i.e. that can solve the problem on the long term. However, working on the fundamental solution requires effort, while a positive effect will be evident only in the long term after a certain delay[6]. Thus, the subject facing the problem might need to alleviate the symptom a soon as possible, without focusing on the root of the problem. However, opting for the superficial *'symptomatic solution'* might generate side effects that undermine the fundamental intervention. This later choice eliminates the pressure from solving the root causes, shifting the burden away from the fundamental solution.

[6] In the Causal Loop Diagrams (CLD), delays are highlighted on the cause-effect arrows with two short parallel straight lines.

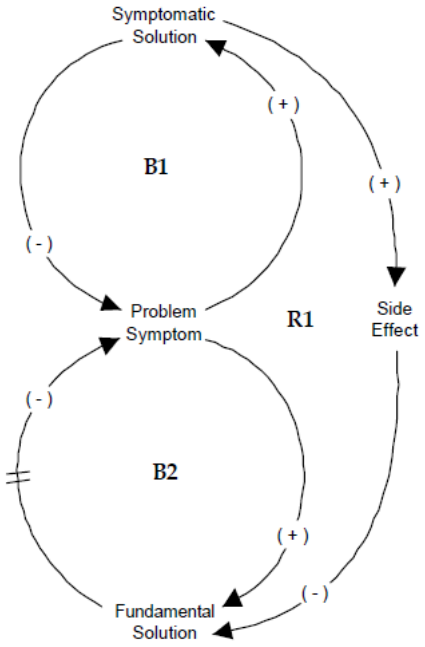

Figure 2.23. Shifting the burden archetype (Braun, 2002).

For example, an endemically low LMA administrative capacity is considered as a fundamental cause of the problem. If a LMA uses policies, such as regional co-finance reduction or retrospective projects, to increase absorption, it works only on alleviating the symptoms of the problem. This choice produces the undesired effect of reducing the pressure on the LMA to adjust its administrative capacity. Therefore, LMA polices act as shortcuts and might have the effect of relieving the LMA from its goal of increasing its administrative capabilities. In addition, even more paradoxically, those shortcuts tend to decrease the total amount of resources that a region has available for investments. Thus, several mental model that map the logical framework of actors and provide the root reasons of problematic behaviours are outlined in the following subsection.

2.3.4. Mental models as roots of system behaviour

As already mentioned, several LMA actions actually end up paradoxically in reducing the resources allocated for regional investments. However, those actions are not clearly performed with the purpose of decreasing the total amount of resources. The problem lies in the underlying mental model, which provided the system with a logic. In fact, the mental models are defined as *'networks of facts and concepts that mimic reality'*, from which policy-makers *'derive theory opinion of strategic issues, options, courses of action, and likely*

outcomes' (Morecroft, 1994: p. 8). In this context, the quality of decisions and actions depends on the quality of mental models.

Mental models represent the underlying drivers of a system. Usually, those concepts are presented in the literature using the *'iceberg metaphor'* (Figure 2.24). The events (top of the iceberg) is the visible side of the system; usually, people tend to infer their actions or ideas based on what they see. However, below the sea level, there is a hidden concept with different levels (root of the iceberg) that can provide an explanation on the reasons of the event (Gürdür and Törngren, 2018). Translating the metaphor into the SD language, the patterns of the system over time is the visible event that usually has a more complex behaviour over time (first level). Such behaviour is then interpreted as consequence of a particular system structure, based on feedback loops and delays (second level). Then, the mental model is the third and deeper level of the system understanding, or else the idea (conscious or more often unconscious) through which the actors approach the system.

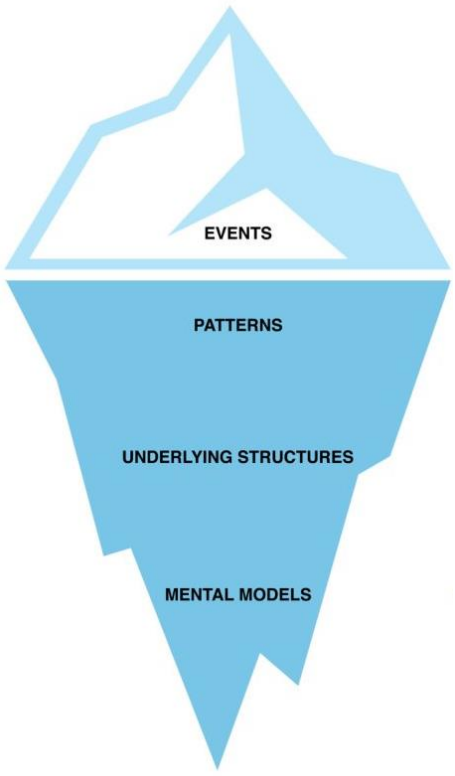

Figure 2.24. The iceberg metaphor (Gürdür and Törngren, 2018).

Focusing on the CP funds' absorption system, the most interesting mental model is the one referring to the LMAs. After analysing their behaviour, it seems clear that their decisions are driven by the objective to increase their absorption rate, which constitutes

a common denominator among the LMAs all over EU. It is important to note that this objective refers only to the regional contribution and not to the total amount of CP funds expenditures. In fact, the reward-punishing system based on the absorption rate is severe and can end up with the decommitments of the EU funds (Polverari, 2011), which is perceived as a major political damage for a local administration. In general, the CP system allows the high-performance LMAs to keep an adequate absorption pace; if they face any issue on their organizational resilience, they can resolve the problem with minor corrective policies. On the contrary, this condition appears to be problematic for LMAs with low performance; to keep up with deadlines, LMAs may be forced to implementing 'hard' policies, such as regional co-finance reduction or retrospective projects. Since a LMA cannot increase the EU funds absorption properly, it decides to decrease the total amount of resources it has available (e.g. reduction of co-finance), use EU money to fund projects that would have been funded through other national/regional sources (e.g. use of retrospective projects) or decrease the standards of accepting a project proposal.

The use of 'hard' strategies ends up decreasing the total amount of investments in the regions. This actually goes in the opposite direction compared to one of the main principles of the CP, namely the additionality principle (European Commission, 2006; Fitzgerald and Christelle, 1996; Gandolfo, 2014; Tosun, 2014; Wostner, 2008). This principle states that CP should be intended as an addition to the national investment schemes and not as a replacement, with the aim to provide the greatest possible impact to the local community. Dysfunctionalities further arise from a normative context oriented more on financial absorption than on the general performance results (Gandolfo, 2014). The level of paradox can increase even more, considering that a possible strategy that a LMA can implement in order to increase absorption is to decrease its quality standards and thus accept projects that would have been normally rejected, reducing the positive impact on the sustainability of the local community. Therefore, increasing absorption rate has become the centre of gravity of the OP, gathering efforts and concerns of LMA and leading to the use of strategies that undermine the CP impact and purposes (Rainoldi, 2010).

Focusing on EU decommitments, the original idea was to create a disincentive in order to overcome the previous slow absorption through prompting LMAs to spend the CP resources timely, since irregular expenditure undermined the CP impact and implementation (Gandolfo, 2014). However, as already mentioned, sometimes EU decommitments privilege financial and procedural dimensions over the general

performance and quality of projects (Polverari, 2011), generating the need of increasing the absorption rate even if it is counterproductive for the region's sustainability. Notably, the idea of EU decommitments as a *'punishment'* for LMAs with low absorption performance tends to be a reality since they are the regions with the highest need for investments Georgescu (2008).

Several interventions to improve performances are possible.

First, **the use of the net initial-based absorption rate could considerably transform the political accountability system**. In this way, LMAs' and administrators' performance would be judged based on their real ability to spend EU funds by disclosing the effect of regional co-finance reduction and retrospective projects use.

In addition, a program of relevant journalists' **alphabetization** could be meaningful through courses about managing this new indicator and deepening their knowledge on CP.

The analysis of this indicator over time would also explain more about the quality of expenditure. This would also correct the perception about the OP trends and provide explanation why OPs with high absorption rates have low impact on regional wealth and thus on the perception of EU.

The prohibition of the use of retrospective projects and the reduction of regional co-finance could be another possible solution, as such practices can ultimately generate undesired side effects that undermine CP ultimate goals. In fact, *"for the 2014-2020 programme period, the use of retrospective projects has been restricted somewhat. Operations (consisting of one or several projects) that have started to incur expenditure but have not been physically completed or fully implemented before the beneficiary submits the application for funding under the programme to the Managing Authority may be eligible for EU funding. However, the risk of ineligible expenditure as well as the question of the added value of the EU co-financing remain"* (European Court of Auditors, 2018, pp. 39-40). However, this prohibition requires a revision of the targets; during the interviews in the context of the PERCEIVE project, even LMAs with excellent performances reported that they used retrospective projects in order to meet expenditure deadlines, especially in the beginning of the policy cycle where deadlines appear to be unrealistic. With respect to the regional co-finance reduction, a relevant limitation could make member states more responsible when they decide the amount of resource to allocate before the beginning of the policy cycle. The regulation of co-finance poses many legal issues (it is difficult to bind

legally the member states' internal expenditure), thus the discouragement of this practice at the moment seems to be the most viable option.

Nevertheless, the fundamental long-term solution from an organizational perspective is to reconstruct the automatic EU decommitments mechanism. A provocative approach would allow Commission to manage directly the decommitted LMA funds, instead of revoking allocated money to LMAs with low performances. Given that EU decommitments have a negative effect on citizens and not on LMAs, the Commission could get involved in the LMAs implementation and help in absorbing the funds. This recommendation is in line with the idea of CP, based on which the EU should not be a punisher of low-performance LMAs but a true CP promoter through assisting LMAs in improving their capacity and enhancing regional sustainability. Moreover, the Commission in this way can understand better the problematic local dynamics and improve the future policy schemes. This intervention may also act as a motivation for LMAs to perform well, since having part of EU funds commissioned might he a politically undesired outcome for local administrators.

3. General public awareness system

The second subsystem under study refers to the citizens' awareness about projects in the EU regions that are funded by the CP. In this section, the available time series of awareness are provided, the general public awareness model is presented and analysed to provide meaningful simulation results and finally several insights are provided for enabling discussion in the field of study.

3.1. General public awareness data

Data were initially retrieved from the EU Eurobarometer reports (European Commission, 1992; 1995; 2008; 2010; 2013; 2015; 2017). Notably, these reports are not annual, thus the collected data are unequally scattered along the time. The first report is identified in 1992 and the last one in 2017. However, some nations under study in the context of PERCEIVE were not members of the EU since 1992, therefore the relevant data are not available. Although the general question asked in the Eurobarometer surveys is stated as:

"Have you heard about any EU co-financed project that improves the region you live in?", slight differences in the statement exist[7].

3.1.1. Eurobarometer data

Figure 2.1 illustrates the citizens' awareness at a national level about regional EU funded projects according to the Eurobarometer reports. Each point in the graph constitutes the percentage of aware citizens as provided by the EU, while all values of the awareness between the documented ones are assumed to follow a linear trend. The awareness data among the countries do not seem to have the same behaviour. More specifically, although in Austria, Italy, Spain, the awareness is increasing up to 2008, following the average EU trend, in the United Kingdom and Sweden, a decreasing or constant trend is identified. After 2008, only in Poland, citizens' awareness increases, reaching the highest percentage among all regions in 2017 (approximately 80%). Austria, Spain and the United Kingdom exhibit a considerably decreasing trend, while Romania and Sweden demonstrate a slightly increasing up to 2010 but then a decreasing one. In Italy, awareness seems to fluctuate after 2008, showing a decrease up to 2010, an abrupt increase up to 2013 and then a decrease again. In general, the EU average decreasing trend after 2008 may indicate a possible impact to the awareness due to the economic crisis.

More specifically, several peculiarities are identified in the Eurobarometer results:

- Recently new member states, such as **Poland** and **Romania**, follow a different pattern. Although Romanian citizens' awareness follows with some delay the EU average decreasing trend (red dashed line), Polish citizens' awareness continues to increase reaching approximately 80% (purple dotted oval shape).
- **Sweden** has a rather constantly low awareness (around 20-25%) over time[8] unlike EU average trend (fuchsia dotted oval shape).

[7] 1992/1995: *"EU provides a regional development fund (ERDF) to help less developed UE regions. Do you know any activity of this EU regional development fund (ERDF) in your country?"*

2008: *"Europe supports its regions and cities through EU Regional Policy. Are you aware that your city or region receives support from the EU Regional Policy?"*

2010/2013/2015/2017: *"Europe provides financial support in regions and cities. Have you heard about EU co-financed projects to improve the area (you live in/where you live)?"*

[8] According to the research of Barberio et al. (2017), while an increase in the EU budget for raising public awareness through mass media could lead to higher awareness about CP on average, such process may have a negative impact in the Swedish context; Swedish citizens possibly perceive such spending on advertisement as wasteful, thus the positive perception about CP funds is reduced.

- **United Kingdom** follows an interesting pattern considering the Brexit vote in 2016: Awareness is increasing similarly to the rest EU members, yet in a quicker pace. Then, it is slowly decreasing until 2015 (reaching less than 10%, which is the lowest value among the analysed members) and finally rises considerably in 2017 (turquoise dotted oval shapes).

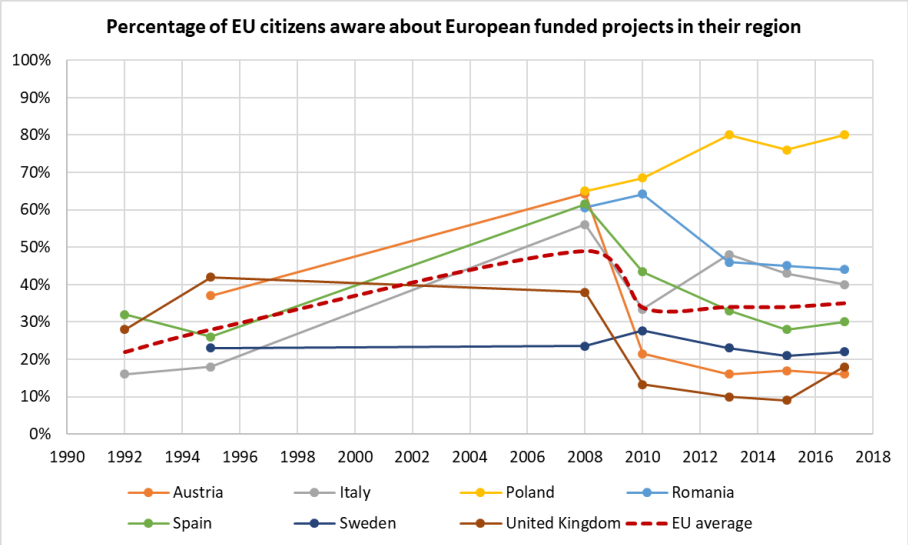

Figure 3.1. Citizens' awareness on regional projects funded by the EU over time (Own elaboration based on Eurobarometer reports).

3.1.2. Awareness data insights

An important insight that can be obtained by the awareness data representation is that people are very sensitive to the way questions are asked and thus a more detailed question may lead to limitation in the responses. To this end, the scientific community should work on standardizing the data collection processes in order to increase consistency and allow policymakers and researchers to use common awareness inputs and obtain coherent findings in their research. In fact, without a standardization we risk decreasing our ability to understand what happens in the real world and spending again and again funding resources for similar research which cannot ultimately compared.

Overall, although the accumulation of the projects over time, as well as the funds' absorption, follows an increasing trend, the citizens' awareness does not follow the same pattern. In other words, although more regional EU funded projects are carried out through the years, it seems that there is a missing communication link that leads to deficient citizens' awareness about the European CP scheme. However, the citizens' perception of the awareness over time seems to be different and closer to the increasing

absorption trend. Interestingly, the interpretation of growing awareness is depicted by several experts who played the awareness game in the context of the PERCEIVE project.

3.2. General public awareness model

Based on the available empirical data already presented, the EU citizens' awareness about CP is a complex issue that follows a rather unexpected path compared with the number of projects completed in the CP context. In fact, the number of projects completed in region accumulates over time since the projects refunded during the policy cycle are constantly increasing. Thus, the fact that, while the number of projects completed in a region is growing, the citizens' awareness about CP funded projects does not accumulate. Rather it tends to erodes over time. Interestingly, this simple circumstance goes against the interpretative models of experts in the field of CP, who, when interviewed, suggest that citizens' awareness follows an increasing pattern similar to the general increasing pattern of the projects completed. In other words, field experts, when asked what pattern they believe awareness shows in the period 1992-2018, indicate a behaviour similar to the one observed in Poland (continuous growth) rather than the most common oscillating behaviour.

To explain the oscillating behaviour of awareness, we explored a number of underlying dynamics that, se suspect, affect awareness about CP funds. In this context, the SD methodology is used to investigate the mechanisms (i.e. *'cause-effect'* relationships) behind the dynamic awareness behaviour and provide meaningful insights for further discussion. Notably, to the best of our knowledge, the use of a modelling approach to explain citizens' awareness is a first research effort in the field of CP communication. In the following subsections, a brief presentation of the model, along with an elaborate sensitivity analysis, are provided.

3.2.1. Awareness model overview

To unfold the dynamics of the citizens' awareness and CP communication, a conceptual SD model is developed (Figure 2.2). The core of this model refers to the "closed pipeline" mechanism (black part) that analyses the dynamic interaction between citizens' awareness and forgetfulness about regional EU funded projects, providing an innovative and original theoretical explanation of the reason why this behaviour occurs. The available data collected about awareness on CP constituted the base for investigating the factors that affect this circular structure. Then, the systemic structure portraying the flow

of information to promote CP communication is presented. This flow has been conceptualized in four main streams of information that further affect the citizens' awareness inputs about CP funds, including all major factors that potentially influence these streams of information. In fact, those four main streams are: (i) the "EU direct" stream (in blue), (ii) the "local managing authority" stream (in orange), (iii) the "media" stream (in red), and (iv) the "funded projects implemented stream" (in green.). Therefore, main the essence of this part of the study on the streams is to provide a preliminary structure on how the streams of awareness inputs are structured in reality.

The procedure used to build this model was different from the one our team used to build the funds' absorption system. Given that there is an absence of literature in field of CP awareness and communication (as it constitutes a rather new research area), the SD methodology was utilized as theory building approach (De Gooyert, 2016; Forrester, 1994; Schwaninger and Grosser, 2008). Thus, the model is developed following logical steps and, through the formalization of these steps using the SD language, a formal theory able to explain the awareness pattern developed. In fact, an exploratory inquiry mode is used to conceptualize a basic principle and test the fit of other theories in similar fields of study.

To understand awareness dynamics, it was necessary to consider the basic diffusion dynamics (Bass, 1969). Then, citizens became aware through: (i) being actually informed ("*total number of citizens informed on EU role in cohesion policy*"), (ii) paying attention to the topic of EU funding in order to internalize the related inputs ("*collective attention on cohesion policy*" theory-mechanism). According to Candia et al. (2018), collective attention is a well-fitted theory for a cultural object (e.g. CP scheme), thus translated in the SD language. Attention is affected by preferential attachment ("*preferential attachment effect on cohesion policy attention*") in which attention begets attention. For those societal structures, it is then necessary to consider the individual mechanism through which people tend to forget information after a while ("*citizens 'forgetting' of EU role in cohesion policy*"), which is consider to be true also in the case of citizens' awareness. The concurrency of those dynamics in the model generates an initial increase of awareness followed by a decay, replicating the real data behaviour.

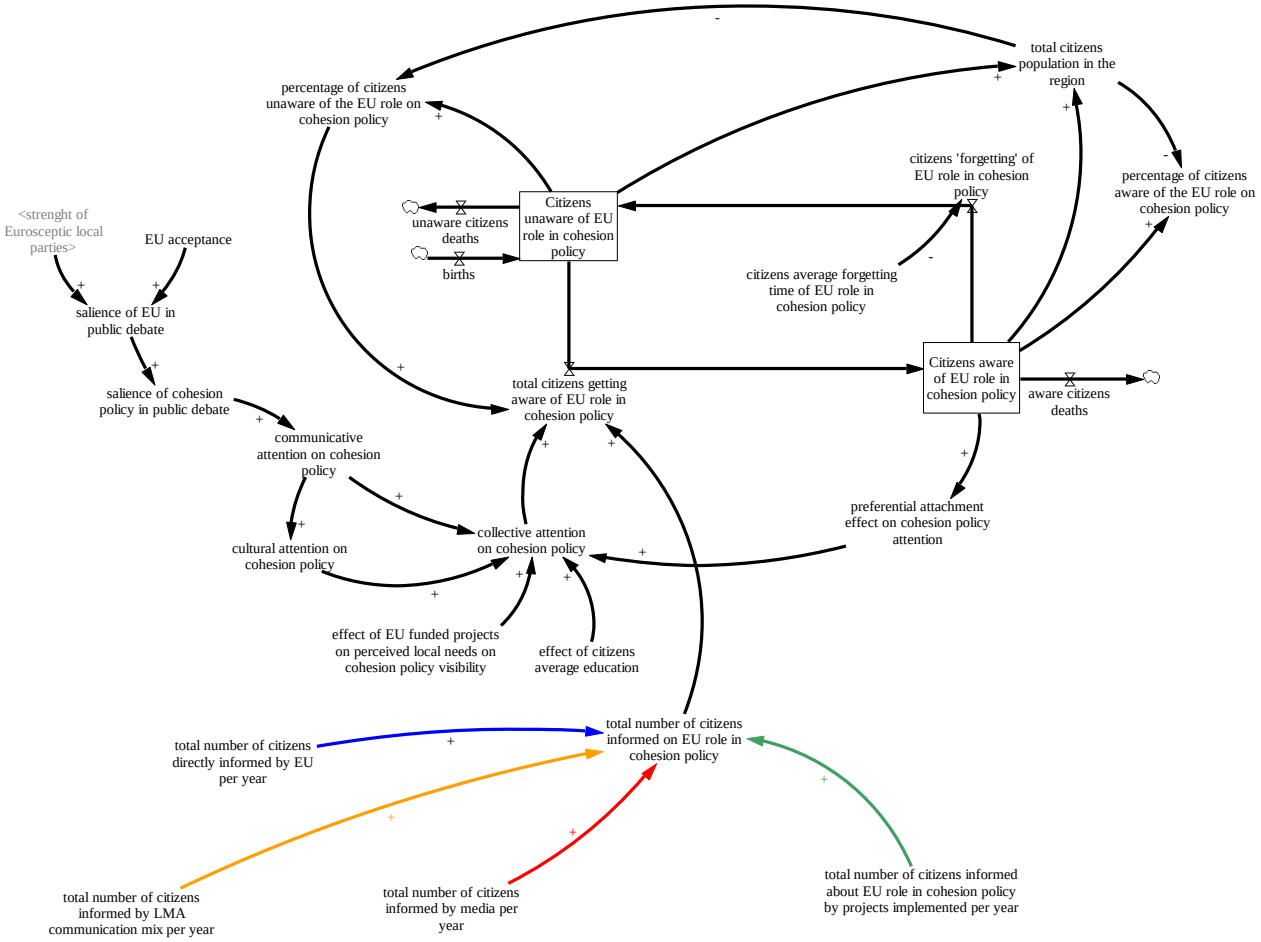

Figure 2.2. CLD of the closed pipeline structure.

To build and quantify the model, Italy was used as reference case. Given that the absorption model was calibrated using the Emilia Romagna region, we tried to build this model using the same region. Since only national data on awareness are available over time, we made a reasonable assumption that Emilia Romagna's awareness equals to the Italian one.

To use the model as a reliable tool to investigate the sources of oscillating awareness behaviour, we conducted a model's parameters optimization process. Specifically, Figure 2.3 illustrates the optimized simulation results (blue line) compared to the real data of awareness (red line) in the case of Emilia Romagna, in Italy. Overall, an initial increase of the citizens' awareness about CP in a region occurs due to the initial high attention for the new phenomenon. This awareness slowly decreases over time since citizens (i) tend to forget about past CP benefits gained and (ii) pay less attention to the new information

about CP funds. These two forces appear to be the most relevant factors in the system as they strongly affect awareness levels over time.

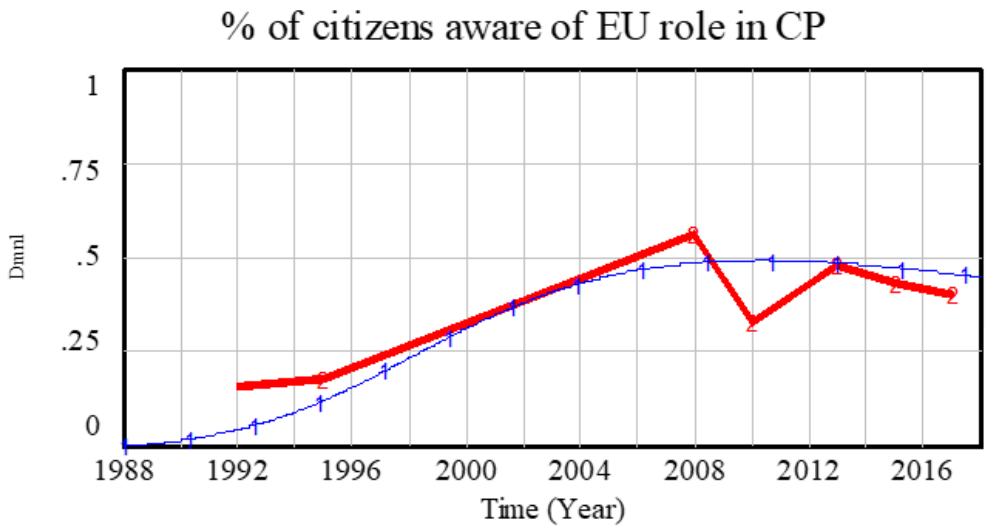

Figure 2.3. Simulation of the awareness model.

Blue curve 1: Simulated awareness; Red curve 2: Reference mode (real awareness)

3.2.2. Awareness sensitivity analysis

In Figure 2.4 we simulate the expected behaviour of awareness in a situation in which communication policies do not change. The graph shows that the awareness continues to decrease after 2018, since the main driver of the system, namely the decay of attention, will reduce the level of awareness.

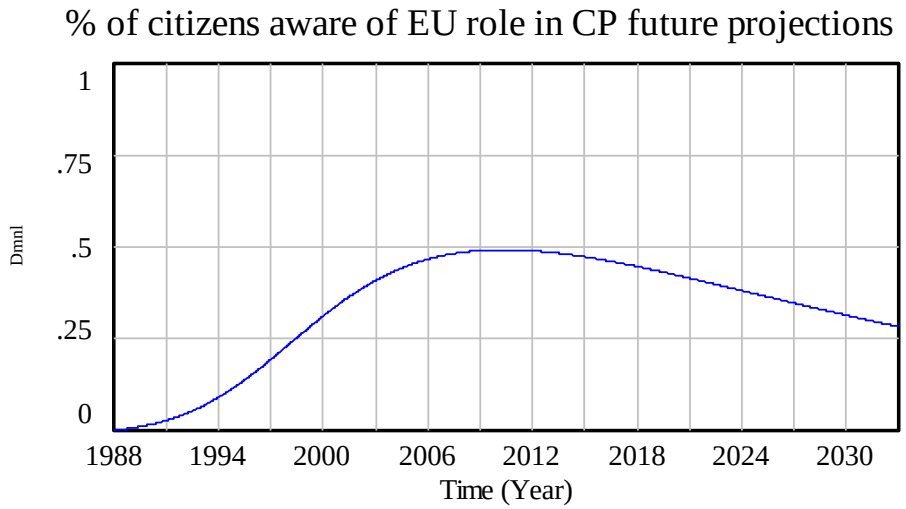

Figure 2.4. Awareness baseline scenario.

In the next case, we compared to the initial base scenario (blue line – curve 1), a simulation run in which we assume a sudden increase in the communication effort of LMAs (e.g. number of LMA campaigns, investments in communication, improvements in communication quality, staff skills, etc.) or beneficiaries (i.e. communication due to the projects implemented) occurs in 2018 (red line – curve 2). The aim is to generate a 100% growth in the number of citizens informed compared to the base scenario (blue line – curve 1). Figure 2.5 indicates clear improvement in the awareness. Yet, the simulation shows how a powerful driver of the system is the decay of attention that reduces awareness in the long term. Thus, this effort could be a temporary solution, yet not lasting in the long term.

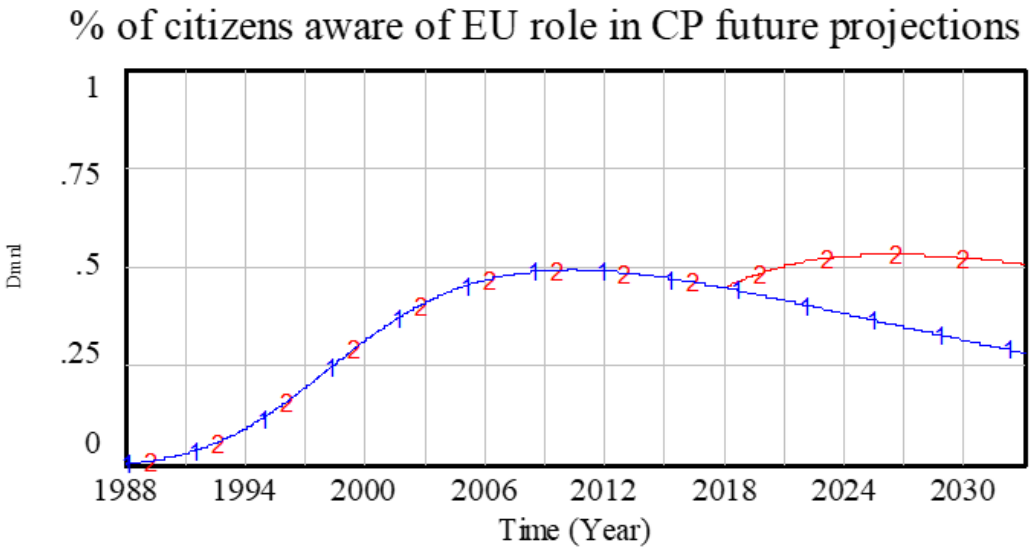

Figure 2.5. Sudden increase of communication.

In addition, the impact of a change in the time to forget ("*citizens average forgetting time of EU role in cohesion policy*") is explored on the long term. In Figure 2.6, the blue line (curve 1) reports the base scenario (13 year average forgetting time), while the red (curve 2), green (curve 3) and orange (curve 4) lines refer to 10, 16 and 30 years, respectively. In fact, the lower is the time to forget (i.e. citizens forget quickly), the lower the awareness is. Projecting the future behaviour, the general trend of awareness continues to decrease due to the inherent decay of attention. However, we notice that same communication efforts lead to very different results in terms of resilience of awareness depending on the forgetting time. **This suggest that LMAs should concentrate, not on the amount spent in communication, rather on the quality and resilience of communication.**

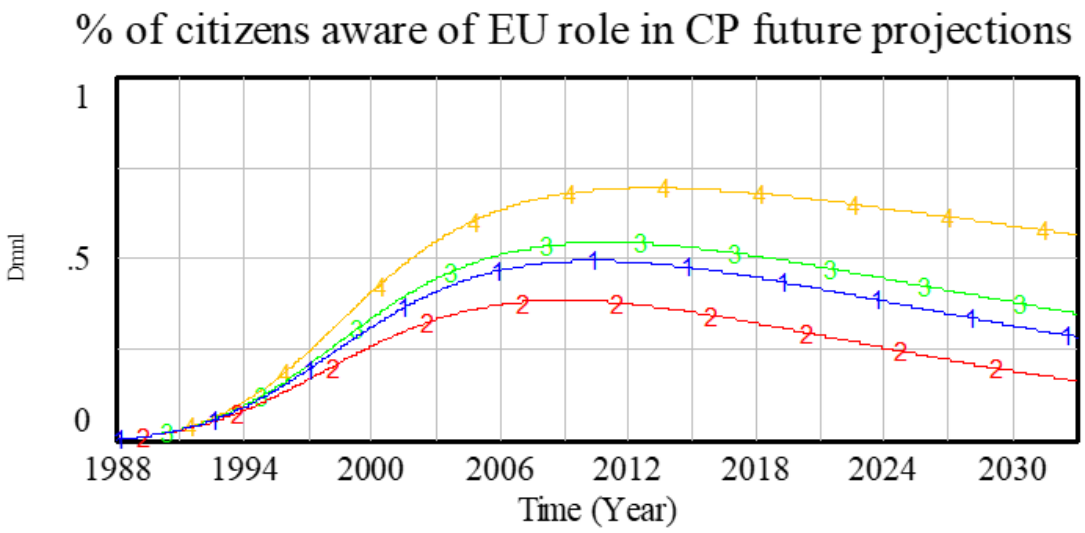

Figure 2.6. Different levels of forgetting time.

In general, given the strong effect of attention decay, **another potential solution could be to maximise citizens' initial attention to CP and then work on the individual memory of citizens in order to strengthen the settlement of information**. Figure 2.7 illustrates the results obtained by setting the time to forget as 30 years and by increasing the level of communication by 100% for the whole period (red line). In this case, awareness is significantly increased, while it erodes with a lower rate. To this end, in case an authority desires to increase the awareness, it should spread the information timely, since the beginning of the policy implementation. In addition, authorities should work on improving the citizens' memory through working on the individual cultural level (for example, by enacting specific courses in schools) and on trying to keep the memory active (for example by continuously promoting public discourse on those topics).

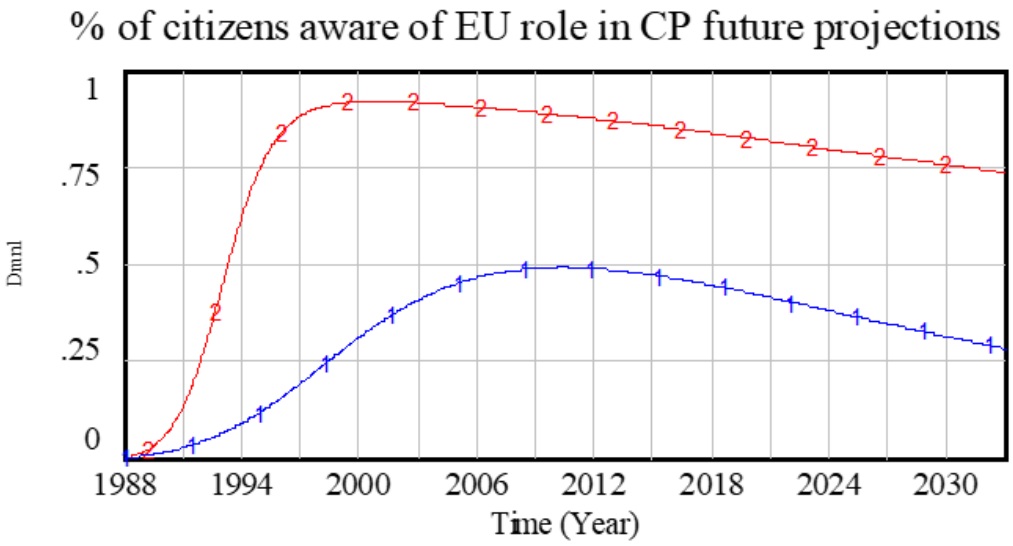

Figure 2.7. Increase in communication level and time to forget.

Improving the decay rate that influences the *"collective attention on cohesion policy"* can be another possible solution. According to Candia et al. (2018), this factor represents the way society process its attention to a theme. Figure 2.8 depicts the new results in case the decay rate is reduced by 50% (red line – curve 2). Manipulating the decay in the short term do not seem feasible, since it entails working on the societal inner features that drive its attention to phenomena high and constant on subject. Normal human trend and attitude that requires a considerable amount of time to mutate. However, authorities have to try to **work on deep cultural mechanisms and to deeper investigating the way in which attention and information is stored and conveyed in the system in the long term**. On one hand, affecting these societal features is a very sensitive action that could be seen negatively as an intervention in fields that are generally believed to be left independently. On the other hand, the authorities could spend effort on the culture of attention and memory, which seems a socially acceptable action. Thus, it is suggested that EU should develop an action in this direction.

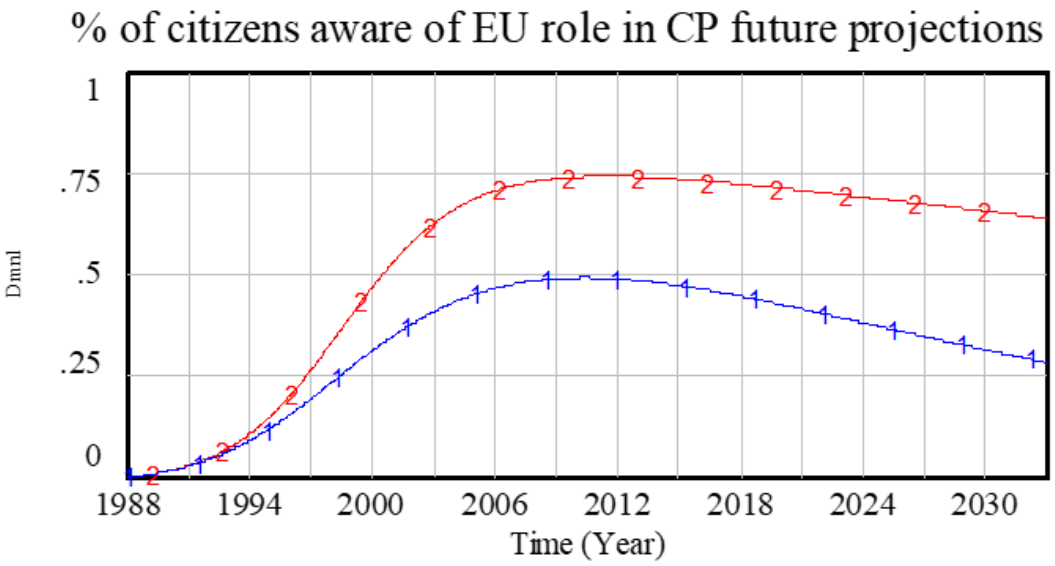

Figure 2.8. Alternative scenario – Decrease in decay rates.

In conclusion, **increasing communication effort can address awareness reduction only temporarily**. To more effectively affect awareness, authorities should increase constantly the communication effort, but this is maybe not enough, since attention decay seems stronger, and overall it might be costly over time. Thus, **authorities should go towards the direction of making people forgetting slower through working on memory and stimulating the collective attention** (e.g. by renewing CP, changing in paradigm, developing new schemes, investing in new relationships with citizens).

3.3. General public awareness discussion

Notably, this work is a first effort towards tackling the problem of communication and awareness systemically. The *'cause-effect'* operational analysis (both qualitative and quantitative) constitutes a new framework to conceptualize the system under study, acting as a milestone starting point for future research. In addition, this is also a first attempt to integrate different fields of research (e.g. statistics, social science, computational-operational research) to explain CP awareness dynamics.

From a technical perspective, the aforementioned SD process of theory building could be meaningful for the SD community, in terms of the procedure used and the specific content itself (i.e. CP awareness and communication), which can be utilised as a useful practical example. Overall, this research effort can be a step forward in computational social sciences, confirming the utility of SD in this field as operational research tool.

At the same time, it seems that groups might tend to forget what the benefits that the EU provides them are. Although EU offers a wide positive effect to member states in terms of a condition of peace among them, integration and cooperation, euro sceptics grow. This, we suggest, maybe because they have taken for granted the importance of EU in protecting their everyday lives. In general, the mechanism of forgetting expresses the idea that in society there is a potential ***'take-for-granted effect'***: after an initial period of attention and appreciation for an object (e.g. CP), people start to forget the benefits this object is providing them, taking it for granted (Simon-Vandernbergen et al., 2007; Pain and Smith, 2008).

4. Conclusions

In this work, we have discussed and analysed a large part of the CP system and its behaviour over time. However, to do so we had to break it down in two 'smaller' pieces, focusing first on the fund absorption and then on the citizens' awareness of CP allocation and outcome in their area. To do so, SD methodology was utilized. This approach is the most suited when dealing with complex system and their states over time. It allows researcher to adopt a holistic perspective, looking at the systemic underlying structure (build upon cause-effect relationships, which makes the tool not only theoretical but also operational) and how this set of relationships generates the trends the systems manifest in real life.

Grounding on a number of simulation experiments, we enacted a dialogue between computer-generated and empirically observed behaviours such as absorption rates and awareness of cohesion policy. The dialogue allowed us to derive hypotheses on the conditions under which a specific empirical phenomenon may be the outcome of a specific candidate underpinning cause-effect structure, which is contained in the simulated formal model.

Along this line, a formalized simulation model complements the collection and analysis of empirical data through the process of abduction. Abduction is an inference that goes from the observation of a fact to the hypothesis of a principle that explains the observed fact (Burks, 1964; Fann, 1970). The model is a candidate theory; had the world crystallized into the theory to be true, observed patterns of behaviors would be reasonable.

In this perspective, having a detailed (often formalized) description of a causal structure and a description of a repertoire of plausible behaviors, a researcher has a variety of

points in which the theoretical hypothesis, which crystallized in to the model, can be paired with real data (Bell and Bell, 1980).

We use abductive inferences to derive insights on possible intervention on absorption and awareness.

Investigating absorption rate

With respect of the absorption system, it appears clear that assessing performance through just absorption rate might be misleading since it cannot account for some practices LMA can implement to increase this rate and it does not take into consideration the distribution of spending performance over the policy cycle. Thus, we suggest moving beyond and we recommend to local, national and European institutions and media to utilize different ways to calculate absorption.

For example, we showed how to measure absorption grounding on initial total commitments (using the amount of funds to be spent estimated at the beginning of the policy cycle, including also national co-finance) and without including retrospective projects as absorbed funds (or, if impossible, making their use transparent to the audience informing how much funds have been spent in those type of projects). This would increase the transparency of EU funds management by LMAs and thus will improve political accountability towards citizens. Second, we suggest to assessing LMAs' performance by looking at the absorption behaviour over time and eventually by comparing observed longitudinal patterns on absorption with an ideal absorption trend in order to obtain standardized values. This because observing absorption distribution over the policy cycle can provide many information on how the LMAs spent the funds. With regards of retrospective projects, we identified that their usage and the implementation of other policies (e.g. national co-finance reduction) with the scope of increasing the rate of absorption, might be detrimental for the LMA organization in the long term. This happen because those strategies generate what in the managerial field is called *organizational traps*; actors prefer to intervene by minimizing long-term investments. Such shortsighted policies, when implemented by LMA, obtain limited benefits in the short time at a cost of compromising long-term intervention. Those traps could be one of the causes for the repetition of absorption problem in some European regions, since these create the incentives for LMAs not to solve root causes of the problem but only to increase the value of absorption rate. We propose an explanation why those systemic traps occur. The main

reason for those situations to happen has been identified in a pathological attitude that may influence LMAs' administrators. This attitude materialized when LMAs are mainly driven by the objective of lowering the chance of facing decommitments rather than by the aim of maximising investments. Therefore, to escape from those traps the short-term solution appears to be the limitation of the use of those policies. While the long-term solution seems to be the reconstruction of the decommitments mechanism in order not to make it anymore the centre of the attention of LMAs. On top of that, scenario analysis, showed the importance of having LMAs that are flexible, resilient (e.g. high learning capacity), that can adapt to change in the context (e.g. modify the OP if necessary) and that is able to dispatch funding allocation and monitoring procedure timely. All those findings are in line and support the recommendations made by other PERCEIVE WPs.

Communication and Awareness

In regards to the communication system, a first consideration concerns the scarcity of past information collected over time on citizens' awareness. Yet, given the data available, we noticed that awareness seems fairly unstable and oscillating. Thus, we build a computer model to explain the observed general awareness behaviour (initial increase and a subsequent slow decrease). The main idea of this model is that an initial societal high attention to a phenomenon (in this case CP) is followed by a slow decline. Those dynamics combined with the individual elements of forgetting (after some time people forget that their area benefitted of CP) generates a behaviour that has similarity with real patterns empirically observed for awareness. Therefore, we inferred that a causal structure similar to the one that underpins our formal model might as well offer a possible explanation of observed awareness behaviour. Thus, we advise to consider the dynamics of attention formation and erosion when dealing with citizens' awareness. In the long term, the decrease of attention and the dynamic of forgetting information may be the key drivers to explain long-term consequences of communication policies. To limit this decrease, the solution seem to combine actions on renovating citizens' memory and acting on the societal factors that lead to a decrease in attention. A possibility, in line with the finds of other PERCEIVE teams, is that promoting a local based public discourse on the impact of CP on citizens could reactivate the attention mechanism and thus increase the effectiveness of all the communication efforts done so far.

In conclusion, this work offers an original perspective on the CP thanks to the methodology used. Overall, the results support the claims stated by other PERCEIVE reports (in particular policy briefs) and it shades new lights on some new aspects that so far have not been deeply explored. Thus, this effort is believed to be useful for both researchers (since it might nurture a new way of investigating CP and new topics for academic discussion) and policymakers (the operational nature of the model can support policymakers in policy development and it has already been used to suggest new possible policy intervention on multiple levels). As already mentioned, future research, we suggest, should be directed at increasing data availability and quality. New, robust, data may be used to further improving our model's robustness and to explore new scenarios.

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