Using System Dynamics modelling to frame environmental voluntary commitment programs: the French experience

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Abstract

This study stems from a research project aimed at investigating the factors facilitating and hampering the success of the EVE (Engagements Volontaires pour l'Environnement) program recently launched in France. Similarly to other countries, in which successfully environmental voluntary commitment programs are currently in place (SmartWay in the USA), EVE program aspires to improve transport operators efficiency and to reduce CO2 emissions in the environment. However, the multiple relationships between public and private actors involved in the program (ranging from the program coordinator to transport organisations), the complexity of transport and logistics sector (including the differences among the transport operators sub-groups) may prevent the achievement of the desired project outcomes. With the aim to support the EVE program coordinator to design and assess effective policies to pursue the expected goals, a System Dynamics (SD) model will be used. As the research project is in the early stage, the paper outlines the research path, main feedback loops and a preliminary stock-and-flow structure to be used in group-model building sessions with project' participants.

1. Relevance of the transportation and logistics sector in CO2 emissions: environmental mandatory and voluntary commitment programs

Trade growth and expanding global economy are creating an endless demand for freight transport capacity and infrastructure. As a result, carbon emissions from freight transport are growing at a rapid rate. Thus, projections of carbon emissions by 2050 from global freight could nearly quadruple. In Europe and throughout the world, road transportation is the largest source of greenhouse gases from freight (OECD/ITF 2015). Looking beyond 2020, in its climate and energy policy framework for 2030, the European Union set itself a target of reducing emissions to 40 % below 1990 levels by 2030. Transport and logistics activities alone account for more than 20% of global CO2 emissions (Davydenko et al., 2014).

Several public and private initiatives are thus deployed to encourage the actors to collaborate and to instil a policy of "decarbonisation" in particular in the sector of transport and logistics. The need to implement a mode of sustainable development, combining economic, social and environmental development is today widely recognised. Improving the energy efficiency of road transport is more than ever essential to achieve the objectives of a low carbon strategy at the country level.

Since the late 1990s, to face the carbon emissions reduction in the transport sector two different, although complementary, approaches emerged in the forms of mandatory program, regulated by specific legislations, and voluntary programs, engaging multiple actors from the public and the private sphere.

Mandatory programs in the transport sector are implemented in a few countries like UK, through the introduction of the reporting on Carbon Footprint (Dadhich et al., 2015), and France, with the CO_2 reporting. These regulations and legislations either provide an incentive or impose a great pressure on companies to adopt green and sustainable practices and collaborations along the supply chain. In particular, in the transport for freight and passengers in France, a regulatory device was set up since October 2013 bearing on the obligation of calculating and reporting carbon emissions for every transport services having a point of origin or destination on the French territory (decree 2011-1336). Carbon reporting in transport services aims to improve information given to buyers to encourage them to reconsider their choice regarding the design of their supply chains. A research conducted on these mandatory programs in France (Mendy Bilek et al., 2017) confirms the importance of such a regulatory systems. However, research findings also remarked that they do not seem sufficient to drive, alone, a real change in the system.

Since the beginning of the year 2000, several voluntary programs for measurement and reduction of carbon emissions are implemented in US and in Europe. In 2004 in US, the EPA launched Smartway Transport Partnership a public-private initiative between freight shippers, carriers, logistics companies and others stakeholders to voluntarily improved fuel efficiency and reduce environmental impacts from freight transport (Bynum et al., 2018; Tan and Blanco, 1999). In Europe similar programs are in The Netherlands and in France. The Dutch “Lean and Green Program” encourages partnership between shippers, carriers and technology providers to measure and improve CO_2 emissions. In France a similar voluntary program is in place since the year 2009 for carriers, through the framework “Objectif CO_2 les transporteurs s’engagent”. More recently, in 2016 the program FRET 21 includes shippers. Wolmarans et al. (2014) show that shipper initiatives are largely driven by company policy and that shippers tend to push sustainability requirements onto the carriers that work for them. Also, carriers are motivated to adopt sustainable business practices that will make them more competitive and help reduce costs.

However, the lack of uniform assessment and reporting mechanisms greatly reduced its value for either shippers or carriers to influence decisions (Bynum et al. 2018). Furthermore, the multiple relationships between public and private actors involved in the program (ranging from the program coordinator to the transport organisations), the complexity of transport and logistics sector (including the differences among the transport operators sub-groups and the resistance of transport firms to introduce innovative practices impacting on the environment) may prevent the achievement of the desired project outcomes. The EVE (Engagements Volontaires pour l’Environnement) program recently launched in France does not constitute an exception. This program aspires to improve transport operators’ efficiency and to reduce the impact of transportation flows on the environment. It is coordinated by a public agency and it targets more than 700 carriers, 200 shippers and 70 freight forwarders.

Due to the level of complexity characterising such an environmental voluntary commitment program, the “French Environment & Energy Management Agency” ADEME (Agence de l'Environnement et de la Maîtrise de l'Énergie), who supervises the EVE project, financed a research project aimed at designing a collaborative model to effectively implement the environmental voluntary commitment program EVE. This research project strongly relies on the findings that would emerge from the System Dynamics modelling of the EVE program. The analysis of the context in which all stakeholders involved operate and the investigation of the transport operators’ sub-groups profiles will offer the ground to model the processes underlying actor’s program engagement and the implementation of transport operator efficiency and environmental initiatives. Furthermore, by designing appropriate key performance indicators (such as program attractiveness, transport operators’ engagement and program effectiveness), the SD model will support EVE coordinator to test alternative policies and to assess the success of the program. As the research project is an early stage, the paper outlines the research path and the preliminary stock-and-flow structure that will be adapted based on project’ participants viewpoints during the group-model building sessions.

The structure of the paper is articulated as follows. Section two analyses transport organisation’s behaviours in environmental programs. Section three describes the context of sustainable transportation policies in France and introduces the EVE environmental voluntary commitment program. Section four presents and discusses the research approach used to build the SD model. This section also portrays the main feedback loops and the preliminary stock-and-flow structure built in the early stage of this research. Section five offers some concluding remarks.

2. Framing transport organisation's behaviours in environmental programs: the neo-institutional theory perspective

Neo-Institutional theory provides a useful theoretical framework for researches in sustainable transportation to explain how the external factors push organizations implementing environmental practices in their supply chain management (Sarkis et al., 2010). There are several studies that have examined its important influence on the firms' performance (Tate et al., 2011; Zhu and Sarkis, 2007), and it has been proved to have positive influence on firms' sustainable practices implementation (Yang, 2017). The key components of institutional theory are the three mechanisms of isomorphism", identified by Di Maggio and Powell (1983), which are *coercive*, *normative* and *mimetic isomorphism*. They mention that "isomorphism is a constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions (Dimaggio and Powell, 1983). In the context of sustainable behaviour, the isomorphism is interpreted to the external pressures that lead organizations to adopt similar structures or strategies in supply chain management to respond to social expectations and achieve sustainable development (DiMaggio and Powell, 1983; Yang, 2017). For example, external pressures may include changes in cultural or social values, technological evolution, regulations (Glover et al., 2014; Sayed et al., 2017). Accordingly, these pressures can be grouped into three categories *coercive pressures, normative pressures and mimetic pressures.*

According to Di Maggio and Powell (1983), coercive isomorphism derives from the political influences the problem of legitimacy. Organizations confront with the coercive pressure resulting from other organizations they rely on (e.g. government agencies, headquarters) and the cultural expectations in society (e.g. legislation, social norms and standards). The rationale of voluntary information disclosure program is to provide better information to stakeholders, customers, employees, government agencies and NGO's in order to constitute a form of institutional pressure that can motivate firms to improve along metrics and measures the information disclosed.

Much of empirical studies focused on how organizational practices diffuse through an organizational field but few investigations try to understand the conditions under which an institutional pressure and organizational characteristics explain the adoption of compliance strategies (Delmas and Toffel, 2011).

Normative pressure stems from the professionalization and expectations relating to how work should be done professionally (DiMaggio and Powell, 1983). It may come out from the broader communities (e.g. markets, medias and the general public) (Zhu, 2016). Specially, external stakeholders who have direct or indirect interests in the organizations' environmental management, exert normative pressures that are regarded as legitimate for organizations within their industrial community (Sayed et al., 2017). Also, organizations are confronted normative pressures that are exerted by sustainable trading alliances and associations who have the desire to work with them (Tate et al., 2011). Therefore, normative pressure can be perceived as an important driver for organizations to be more environmental aware and response to environmental issues in order to comply with the social obligations (Glover et al. 2014).

Concerning *mimetic pressure*, there are, in most cases, proactive leaders, reactive followers and stagnant laggards in any industry and any field of business. According to DiMaggio and Powell (1983), "organizations tend to model themselves after similar organizations in their field that they

perceive to be more legitimate or successful". They seek to replicate the successful path of the leaders with the purpose to gain more benefits from the market (Prajogo et al, 2012). In the context of institutional pressure, when industry leaders take an action in response to institutional pressure, the followers may simply follow suit as they perceive them to be more legitimate and successful, irrespective of whether they are directly affected by the regulation or not (Loannou and Serafeim, 2017). Firms that are uncertain of the external environment or incapable of interpreting institutional pressures on their own are quite likely to be influenced by mimetic isomorphism (DiMaggio and Powell, 1983). There is a prerequisite for mimetic isomorphism to take effect, which is that there must exist successful firms that can be imitated. This phenomenon (DiMaggio and Powell, 1983) explains the tendency to homogenize organizational behaviour by identifying three mechanisms, including coercive isomorphism resulting from formal and informal pressure exerted for example by the state. But, as Meyer and Rowan (1977) point out, there may be a contradiction between compliance with the institutionalized rules and the search for efficiency required by internal coordination and control of activities. The decoupling between the obligation to display CO_2 and the requirements of profitability of the company sometimes undermined by the cost (real or perceived) of sustainable practices can thus generate contradictory tensions (Abernethy and Chua, 1996).
The results thus suggest that the evolution of practices (CO_2 display and / or CO_2 reduction) results more from a combination of coercive, mimetic and normative pressures. Coercion by customers and other stakeholders such as shareholders appears here to be potentially more effective than that exercised by the state. Companies would also tend to imitate (or "benchmark") those that have already proven themselves in practice. Finally, the development of benchmarks, labels, standards related to the measurement of CO_2 emissions within the profession could encourage companies to achieve greater compliance.

3. Designing a sustainable transportation policy in France: the expected contribution of the EVE environmental voluntary commitment program

3.1 Designing a sustainable transportation policy in France

In recent years, the French government and public authorities have been devoting all their attention to the reduction of CO_2 emissions, considered essential to deal with global warming. Several public and private initiatives are thus deployed to encourage the actors to collaborate and to instil a policy of "decarbonisation" in particular in the sector of transport and logistics. The need to implement a mode of sustainable development, combining economic, social and environmental development, is in fact today a consensus. In this perspective, improving the energy efficiency of road transport is more than ever essential to achieve the objectives set in France's low carbon national strategy. These objectives seem to be achievable only if all players in road transport are committed to improving their energy performance.
From the beginning of the 2000s, in France, the agency of Environment and Energy (ADEME) showed the need to adapt the transport and logistics sector to meet this challenge through the reorganization of production and purchasing systems aimed at improving both of environmental performance and economic competitiveness. In particular, it encouraged some players in the supply chain, notably shippers (manufacturers and distributors) and carriers, to work together to control their environmental and energy performance. In 2008 started the "Objective Charter CO_2" program in the road freight transport and the implementation of the "CO_2 Objective Label" (a certificate showing the adherence of the transport organization to comply with the program measures). In 2001, this program was extended to passengers transport and in 2017 also to shippers (FRET 21 program).

The quantitative objectives set were well achieved since 5,500 companies were made aware, out of a target of 3,000, and almost 1,600 were supported. In 2016 and 2017, 540 charters were signed and more than 300 companies certified.

Can these results make possible to establish a real virtuous dynamic in a sector which counts more than 6,000 passenger road transport companies and 35,000 road freight transport companies?

Unfortunately the answer isn't positive. This appears evident if we consider than the 80% of companies are made up of very small businesses, while the majority of companies currently "labeled" have more than 50 employees.

Several reasons can explain the inertia of the sector despite the significant resources that have been deployed. At the structural level, the lack of incentive from prime contractors and the difficulty for companies to promote the process internally and at the commercial level is regularly highlighted. Also, the multiplication of systems and public and private initiatives without real coordination has given professionals the demotivating impression of a certain inconsistency. At a cyclical level, relatively low energy prices over the 2016-2017 period, and the economic difficulties of the sector have also limited the willingness of companies to commit to a long-term approach that requires immediate human and financial investment against future fallout.

Previous research (Mendy Bilek et al. 2017) confirmed that "the regulatory and voluntary mechanisms do not seem sufficient to stimulate, on their own, a real dynamic of change". For the above reasons, it is important to study the role and the interdependencies between the multiple stakeholders (e.g., public agencies, private transport organisations) involved in the environmental voluntary program and how to stimulate a virtuous interactive behaviour.

The above complex and dynamic picture outlines a suitable field of study on which to apply the System Dynamics methodology (Forrester, 1961; Sterman 2000). The SD methodology aims at supporting decision makers learning processes to better understand how to deal with complex phenomena (Sterman, 2000). Delays, nonlinearities and policy resistance factors often make, public and private, managers' decision-making processes uncertain and investigated phenomena behaviours hard to interpret. Through the use of feedbacks structures and simulation models, SD has shown its ability to support decision makers in dealing effectively with this level of complexity (Sterman, 1989, 2000; Repenning, 2000; Kunc and Morecroft, 2010; Rahmandad, 2015). As Sterman (2000) argues, particularly, simulations can be a very effective way to learn in and about complex systems. Feedback structures, i.e. closed cause-and-effect relationships between two or more variables, are considered responsible for the dynamic behaviour portrayed by a given problem. In other words, the SD methodology tends to look inside a system for the real causes of the investigated phenomenon.

3.2 The French EVE environmental voluntary commitment program

The EVE program, from the French "Engagements Volontaires pour l'Environnement" (Voluntary Commitment to the Environment), attempts to improve transport operator's efficiency and to reduce Greenhouse Gas (GHG) emissions in the environment. This program can be associated to those initiatives oriented to pursue the French National Low Carbon Strategy, which aims for carbon neutrality by 2050. With this intent, the EVE program is promoted by the French ministry of the ecological and solidarity transition (e.g., the Ministry in charge of transportation), and it is funded using energy savings certificates financed by the Total Marketing France.

This program, similarly, to other countries, in which successfully environmental voluntary commitment programs are currently in place (see, for instance, SmartWay in the USA), matches together different groups of private and public stakeholders.

In this case, the "French Environment & Energy Management Agency" ADEME (Agence de l'Environnement et de la Maîtrise de l'Énergie), supervises the EVE project, which is coordinated and implemented by a non-profit organisation, the "Eco CO_2". The Eco CO_2 covers different activities. First, it advertises and promotes the program goals with the intent to engage a high number of freight industry operators. The EVE program targets more than 700 carriers, 200 shippers and 70 freight forwarders.

Second, it coordinates primary French freight professional organisations (such as AUTF, CGI, FNTR, FNTV, OTRE and Union TLF), who are also partners of the EVE program, in designing effective energy savings and emission reductions measures. Typical examples are the development of fuel saving technologies and the use of tracking tools to monitor efficiency improvement and emissions reduction.

Finally, the Eco CO_2 also provides the "Objectif CO2" certification to transport operators who comply with the suggested measures.

The expected success of the EVE program can lead to a win-win situation for the freight industry and the ADEME. On the one side, the freight industry can benefit from the support of experts in achieving fuel savings thereby making the sector more competitive. The "Objectif CO_2" certification can also help transport operators to improve their image and to meet customers' expectations, who are particularly sensitive to select suppliers adopting GHG emissions practices.

On the other side, the EVE program can support the ADEME to pursue the French National Low Carbon Strategy, as a result of the drop in fuel consumption and CO_2 emissions.

However, the multiple relationships between public and private actors involved in the program (ranging from the program coordinator to the transport professional organisations), the complexity of transport and logistics sector (including the differences among the transport operators sub-groups and the resistance of transport firms to introduce innovative practices impacting on the environment) may prevent the achievement of the desired project outcomes. To support the EVE coordinator in designing and assessing effective policies to pursue the expected program goals, the use of a SD model is here suggested.

4. A preliminary SD model to support the design and implementation of a sustainable transportation policy in France

4.1. The research approach used to build the System Dynamics model

The research lasts in total 24 months, while the modelling phase covers about 14 months. In the initial stage (6 months), project activities are oriented to conduct the literature review of environmental voluntary commitment programs and of those factors facilitating or tackling the introduction of fuel saving and GHG emissions measures in the freight industry. After this literature review, a field research will be conducted with freight industry operators to investigate the level of participation in the EVE program, the obstacles and the benefits recorded. The above findings will offer the basis to build a preliminary SD model. Such a preliminary SD model will be then used to conduct group-model building sessions with ECO CO2 and freight industry operators' managers.

The SD literature remarks the interactive nature of the model-building process (Richardson and Pugh, 1981; Roberts *et al.*, 1983; Vennix, 1996; Sterman 2000). This interaction can be detected at two different levels: among the multiple model building stages and, between the different actors involved, such as the modeler/s and final user/s (i.e., who will benefit from the model use).

The first level refers to the modelling process, which can be summarised in five recurrent steps (Sterman, 2000). The first step is the *problem articulation*, which dictates the boundary and the scope of the modelling effort. Once the problem is identified and observed over an extended time horizon to capture its potential symptoms, a *dynamic hypothesis* is formulated. This second step offers an explanation of the problem in terms of the underlying feedbacks and stock-and-flow structure. The third step is the *model formulation*, which implies data collection and the estimation of parameters were not available or easy to access. The fourth step is the *model testing*, consisting in the evaluation of the correct formulation and the robustness of the model to simulate the actual behaviour of the investigated phenomenon. Finally, once the model is tested, it can be used to *policy design and evaluation* to intervene on the problematic behaviour under investigation. Insights generated from simulation results can lead to a redesign of the feedbacks and the stock-and-flow structure, thereby changing the quality of information available and the adopted policies. Such an interaction is likely to feed both modeller and decision maker's learning processes.

The second level of interaction is particularly critical as the user/client cooperates with the modeler in providing information and data needed to feed all the modelling steps. As quantitative and, particularly, qualitative data (e.g., user's perceptions of the relevant feedbacks causing the observed phenomenon) characterise all stages of the modelling process, a more formal approach to collect, store and analyse data is required (Vennix, 1996; Luna-Reyes and Andersen, 2003). In particular, Vennix (1996) argues that the carefully design of the group model building process can contribute to successfully increase the effectiveness of the model, thereby enhancing team learning, fostering consensus and creating commitment with the outcomes.

The group model building process appears particularly suitable with the complexity outlined by the EVE project goals (reduction of fuel consumption and CO_2 emissions) and the presence of multiple actors involved in the process (ADEME, ECO CO_2, freight operators and freight professional organisations). Vennix (1996) suggests two alternatives to start the modelling process once the scope of the project is defined. The modeller can build the SD model from scratch involving main participants to offer their viewpoints or alternatively can construct a preliminary model which serves as starting point for the group-model building sessions.

In the first case, the SD model is built directly with participants in a group setting. However, if the written material, such as the literature review and project reports, is not adequate to build the preliminary model, the modeller can conduct in advance a number of interviews to get a better understanding of the problem.

In the second case, where project documentation is available and interviews with participant possible, the modeller can build a preliminary SD model. The model is then used to facilitate a discussion with key-actors involved in the project. Suggestions and comments from participants are used to fit the model with the participants' viewpoints.

In this research, we decided to build first a preliminary SD model based on project documentation. Then, the model will be validated during the group model-building sessions with project participants. This decision, as also suggested by Vennix (1996), would allow us to speed up the group model-build process and to allocate more time to data gathering, to fine tuning the model and to design and implement alternative policies.

As the research project is the early stage, the remaining part of the paper outlines the main feedback loops and the preliminary stock-and-flow structure that will be adapted based on project' participants viewpoints during the group-model building sessions.

4.2. Main feedback Loops

Since the EVE initiative is a voluntary program, it needs to be attractive for shippers and carriers. Their participation in the program and their effective engagement are a prerequisite to collaborate with ECO CO2 selected experts in identifying appropriate solutions to address energy and environmental issues in the transportation and logistics industry.

From the analysis of the literature on voluntary program it emerges the key role of stakeholders' awareness towards the adoption of environmental measures by transport organisations (shippers and carriers) in their operations. In fact, if consumers (e.g., shippers, in this case) are highly sensitive to environmental performance in the selection of the freight operators (e.g., carriers), this will make a pressure on carriers to enrol in initiatives, such as the EVE program. The enrolment of carriers in the EVE program can be also stimulated by advertising initiatives aimed at promoting participants benefits. This phenomenon can be associated to the reinforcing loop "R1 - *Carriers growth*" reported in figure 1. As the number of carriers enrolled in the program grows up, program attractiveness boosts accordantly. In fact, the enlargement of the carriers enrolled leads to a higher number of new carriers who join the program. This is likely to expand also the professional experts engaged in the program. The role of such experts consists in supporting carriers to design and implement fuel-saving and emission reduction measures. Professional experts engaged in the program may show a similar behaviour to carriers. The raise in program attractiveness and incentives offered to professional experts can bring inside the program more experts, thereby expanding the number of professional experts engaged in the program (see feedback loop R2 – *Professional experts growth*). The increasing in carriers and professional experts may lead to two other reinforcing feedback loops. The loop "R3 – *Effect of the program benefits on carriers dynamics*" is particular important. In fact, thought the participation in the program is an important indicator of its attractiveness, carriers implemented measures aimed at improving fuel saving and emission reduction captures the program effectiveness. It refers to the ability of the program to timely meet carriers' requests. This can lead to a boost in program effectiveness and perceived carriers' competitiveness, thereby bringing more carriers into the program. The causal loop "R4 – *Effect of industry awareness*" results from the diffusion of the freight industry awareness. The increase in carriers can make the freight industry more aware of the potential benefits of the program and stimulate emulating behaviour by other carriers.

Figure 1 also depicts four balancing feedback loops which may contribute to limit or stabilise the EVE program desired results. As the number of carriers grows up, more services and implemented measures will result. Therefore, the EVE coordinator may experience a lack of available capacity limiting the expansion of program (see the balancing feedback loop B1 – *Program capacity limit to growth*). This phenomenon can be counterbalanced by introducing a desired level of the program capacity. In such a way, the EVE coordinator through the use of professional experts incentives can stimulate the minimise the gap in program capacity, thereby restoring the desired level of services offered to carriers (see the balancing feedback loop B2 – *Restoring desired program capacity*). Two other balancing loops may prevent the program to achieve the expected results. The balancing feedback loop "B3 – *Operating costs increase*" shows how the investments sustained by carriers to implement the suggested measures may discourage transport operator to enrol in the program as perceived competitiveness slows down. This is particular true in the very highly competitive and uncertain transport industry. Many carriers are often sceptical to invest in innovation and technology which may not improve performance or may result in breakdowns and loss of service in the short term. Rather, they prefer to avoid innovation and pass the cost of inefficiency on to the final customers (e.g., shippers) via fuel surcharge policy (Wolmarans et al., 2014; Bynum et al., 2018). Though this may appear as a myopic policy, it may prevent carriers to incur in an economic loss in the short period. Another phenomenon that may tackle program benefits refers to the decreasing appealing it may encounter as soon as it is not perceived by carriers as a distinctive source of competitive advantage (see the balancing feedback loop B4 – *Perceived Diminishing program returns*).

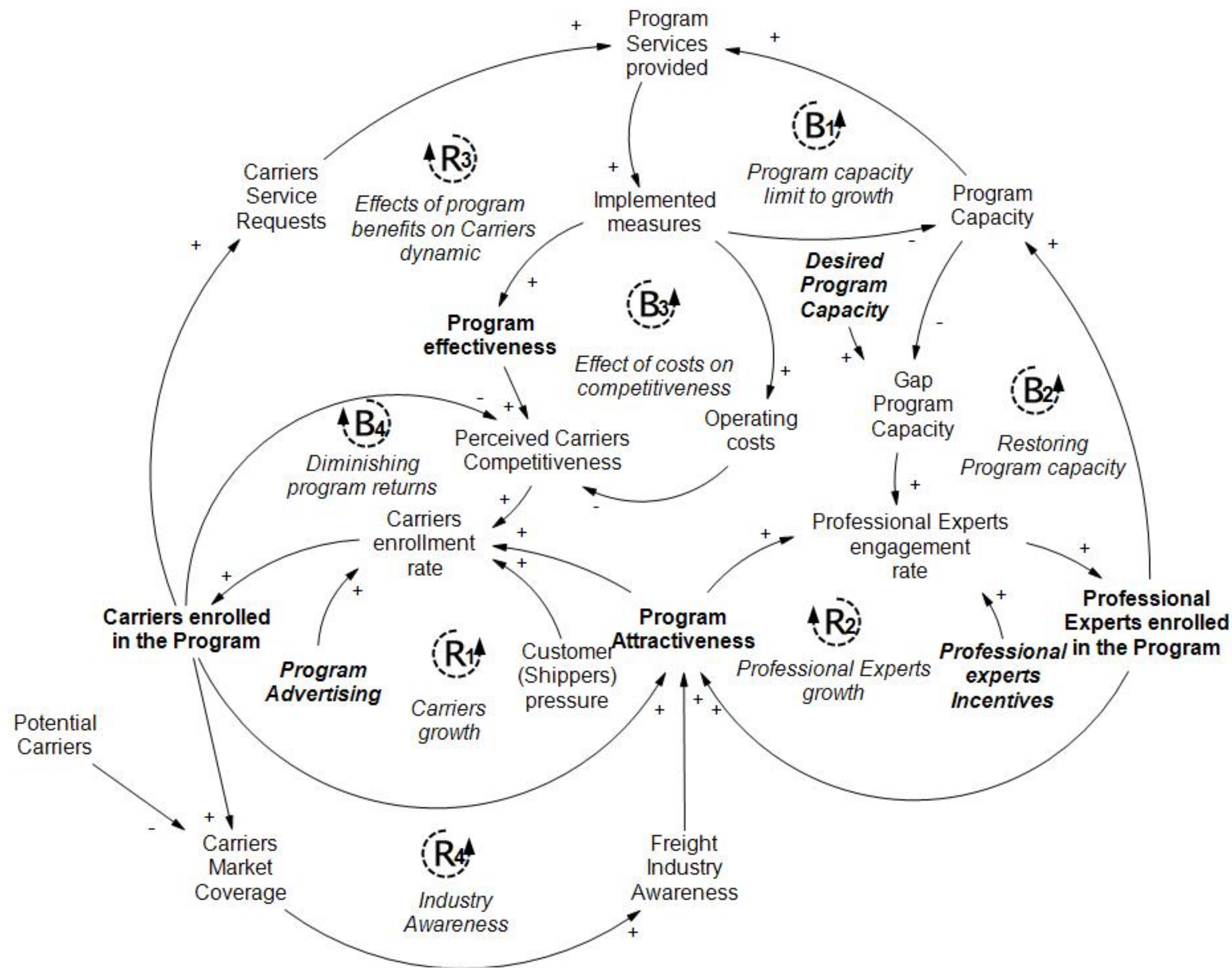

Figure 1 – Main feedback loops of the EVE program

4.3. The preliminary stock and flow structure

As discussed in the previous section, based on the adopted research design, a preliminary stock and flow structure was built. Such a model will be used during the group-model building sessions with project' participants and it will be adapted to reflect their viewpoints. The preliminary model aims to capture the main reinforcing and balancing loops described in figure 1.

To build the stock and flow structure the concept of a multi-sided digital platform (Ruutu et al., 2017; Eisenmann et al., 2011) is here used. Similarly to the EVE program, multi-sided digital platforms aim at connecting demand-side (e.g., carriers) and supply-side (e.g., professional experts) participants through innovative forms of value creation processes (Täuscher & Laudien, 2018). When a community of actors is developing platform-based services, such as the EVE program, it is important that a critical mass of actors is reached in order to achieve self-sustaining growth.

Initially, platform development may be promoted or subsidized using external funding, but over the long term the success of a platform depends on its ability to attract customers. In the initial phases, the so-called 'chicken-and-egg' situation has to be faced. Too few demand- and supply-users inhibit the growth of each side of the user customer base, and vice versa (Casey and Töyli, 2012). If fact, if the number of carriers enrolled in the program is too low, professional experts will not join the program as well, resulting in a failure of the program.

The two sides of the program is modelled by extending the Bass (1969) model of innovation diffusion that considers adoption through exogenous efforts (advertising or incentives) and adoption from word-of-mouth (see figure 2). Here, the stocks of potential carriers and carriers are calculated separately from the stocks of potential professional experts and professional experts. The Carrier adoption rate depends on the advertising, customer (shippers) pressure and carriers program attractiveness, while professional experts engagement rate refers only to incentives. The model also includes discard rates, which depend on the carriers perceived program effectiveness and professional experts program attractiveness respectively. The program service capacity plays as important role in affecting carriers perceived program capacity. In fact, if the program shows a lack professional experts to adequately support carriers, carriers perceived program capacity declines leading to raise in the carriers dropout rate. To overcome such a potential limit to growth (see B1 in figure 1) the EVE program coordinator may incentive professional experts to engage in the program.

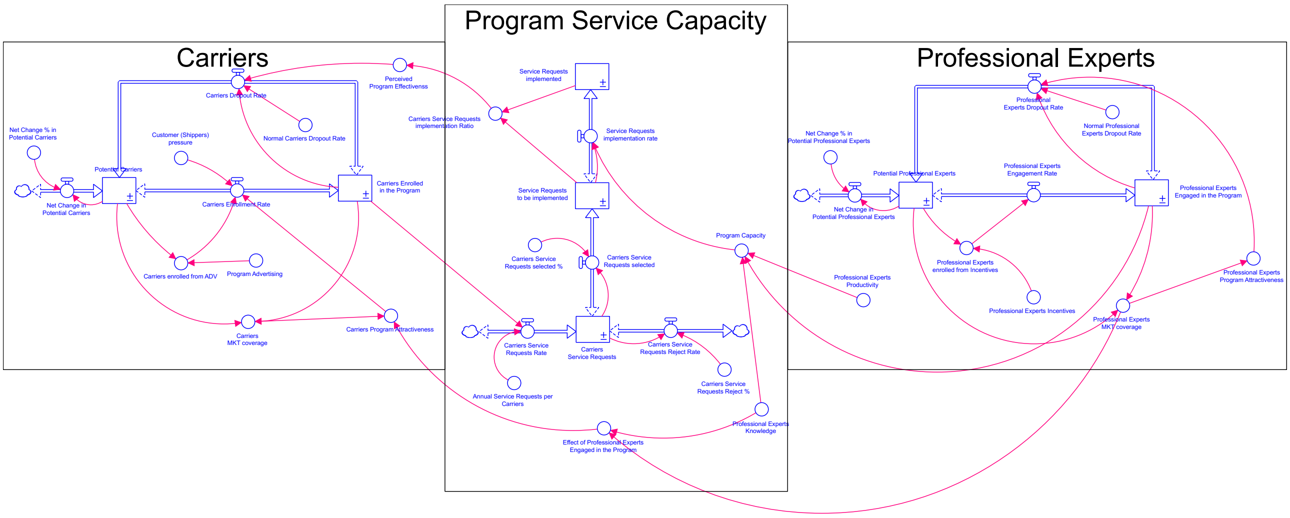

Figure 2 – A preliminary stock and flow structure of the EVE environmental voluntary engagement program

5. Conclusions

France, similarly to other European and non-European countries, launched an environmental voluntary commitment program in the freight industry to improve transport operators efficiency and to reduce CO2 emissions. However, it has been demonstrated that these programs do not seem sufficient to drive, alone, a real change in the system. Several are the reasons of such a potential failure. Among the others, the difficulties to understand the multiple relationships between public and private actors involved in the program, the complexity of transport and logistics sector, the uncertainly and hypercompetitive market segment may contribute to prevent the achievement of the desired project outcomes. With the aim to support the Franch EVE coordinator to design and assess effective policies to pursue the expected program goals, a System Dynamics (SD) model is suggested. As such, the analysis of the context in which all stakeholders involved operate and the investigation of the transport operators’ sub-groups profiles will offer the ground to model the processes underlying actor’s program engagement and the implementation of transport operator efficiency and environmental initiatives. Furthermore, by designing appropriate key performance indicators (such as program attractiveness, transport operators’ engagement, program effectiveness, program long-term sustainability), the SD model will support EVE coordinator to test alternative policies and to assess the success of the program. As the research project is the early stage, the paper outlines the research path and the preliminary stock-and-flow structure. In the next steps of this research, the preliminary SD model will be used in a group-model building process setting to adapt the model on project' participants viewpoints.

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