Synchro-Modality and Slow Steaming: New Business Perspectives in Freight Transportation

sustainability

MDPI

Article

Synchro-Modality and Slow Steaming: New Business Perspectives in Freight Transportation

Guido Perboli [1,2,*], Stefano Musso [2], Mariangela Rosano [1,2], Roberto Tadei [3] and Moritz Godel [4]

1 CIRRELT, Montreal, QC H3T 1J4, Canada
2 ICT for City Logistics and Enterprises Center, Politecnico di Torino, 10129 Turin, Italy; stefano.musso@polito.it; (S.M.); mariangela.rosano@polito.it (M.R.)
3 DAUIN, Politecnico di Torino, 10129 Turin, Italy; roberto.tadei@polito.it
4 London Economics, London WC2R 1LA, UK; mgodel@londoneconomics.co.uk
* Correspondence: guido.perboli@polito.it; Tel.: +39-011-090-7097

Received: 22 August 2017; Accepted: 6 October 2017 ; Published: 13 October 2017

Abstract: The logistics sector faces substantial challenges in meeting customer demands for higher service quality, speed and flexibility under conditions of continued growth in world trade and worldwide transportation movements, increasing distances and vulnerabilities of the supply chain. Additional challenges relate to the economic and environmental sustainability of logistics operations. While a lot of attention was devoted in the past decades to the operational and technical aspects, the business development phase has been put aside, causing the market failure of several projects. The paper presents the SYNCHRO-modal supply chain eco-NET (SYNCHRO-NET) project, which will demonstrate the effectiveness of slow steaming combined with synchro-modality in reducing the cost and the emissions of international supply chains and improving reliability and sustainability through the optimization of the planning process. Differently from other similar projects, SYNCHRO-NET combines operational aspects with a business perspective and represents a stakeholder-driven approach aimed at developing a close-to-market solution over the timeframe of the project.

Keywords: sustainable supply chain; business models; GUEST method

1. Introduction

Globalization and urbanization, together with just-in-time inventory strategies, have restructured global supply chains and increased the relevance of efficient freight transportation management. Pressures on the transportation sector are increasing, with international trade still registering positive growth. The latest estimates provided by the World Trade Organization (WTO) show that the volume of world trade continued to grow in the 2017 at a rate of 2.4% as measured by the average of exports and imports. Growth is expected to continue until 2020 as world population and economic dynamism increase [1]. The transportation industry is thus characterized by the movement of high volumes of freight, on-time delivery and high service quality level required by customers. Moreover, it is facing new challenges related to the sustainability of the business models from the economic, environmental and social points of view. Logistics service providers respond to the tension between transport demand and transport supply by dynamically adapting their services and strategies, ensuring that producer, product, and client service level requirements are met. Service providers take strategic decisions about the selection of modes of transport, the location of distribution centers and the connections between distribution center locations and modes of transport in an effort to continuously reduce generalized logistics costs [2]. In this context, stakeholders including companies operating in the transportation industry and local administrations have a strong interest in new solutions and business

models that would make logistics activities more sustainable in terms of economic efficiency and environmental impact.

From an operational point of view, synchro-modality and slow steaming are becoming more and more attractive in long-haul shipments both from a methodological and practical point of view, due to their capability to reduce operational costs while giving a clear reduction of the environmental externalities [3,4]. On the other hand, we see a clear split between the research at the operational level and the strategic decisions provided by the management of the different stakeholders. As already analyzed for the entire freight transportation domain, there is a lack of focusing on the business perspective [5]. This is becoming more and more evident while measuring the market impact of the majority of the large industrial projects, and the Horizon 2020 Programme of the European Commission in its Mobility for Growth Horizon 2020 call in particular, with the majority of those projects close after the initial funding [6]. This behavior can be imputed to several causes, but one of the main ones is a lack of global business development vision and a coordination of the technical aspects with the business development. In fact, as witnessed by the recent literature, the researchers are focusing on the technical, Information and Communication Technologies (ICT) and Optimization aspects disregarding the link with the strategic decision processes of the actors involved [7–9]. This is bringing to a fracture between the value proposition of the projects and the needs of stakeholders and companies, with the risk of a delayed exploitation of the results [5].

This paper contributes to the literature by applying a stakeholder-driven approach for analyzing the actual needs and requirements of the different actors involved in the supply chain. In particular, taking into account the stakeholders' actual needs, and involving the potential stakeholders in the development of the solutions, will lead to a large scale adoption of the provided solutions. Concerning the technical aspect, this paper analyzes the development of an optimization tool implementing both synchro-modality and slow steaming strategies, with the aim to show that the combined application of the two strategies can lead to potential benefits for all the actors involved in the supply chain. The results of the stakeholder driven approach are applied to the SYNCHRO-modal supply chain eco-NET (SYNCHRO-NET) project, one of the largest projects funded by the Horizon 2020 Programme incorporating a full business development process. The SYNCHRO-NET project is implemented by a consortium with key stakeholders and partners from 10 countries and 20 organizations [10].

In more detail: the purpose of this paper is to improve the current state of the art along different axes:

- Holistic approach: a methodology based on a comprehensive vision covering all relevant aspects, both managerial and technical, is crucial for developing commercially viable solutions allowing both providers and users to benefit in a win-win scenario.
- Methodology innovation: a stakeholder-driven iterative approach, supported by the adoption of a lean business methodology named "GUEST" and developed by a pool of researchers of the Politecnico di Torino [11,12] is used to analyze stakeholders requirements from the early phases to the different stages of the of development. Knowing these requirements, the development can be steered so as to meet stakeholders in terms of business model and operational aspects. This leads to higher market acceptance of the outputs, which, in turn, supports the creation of new collaborative business models.
- Technical innovation: provide a cloud-based eco-net of advanced optimization, simulation and decision support modules, which enable slow steaming strategies and a complex synchro-modal supply chain operations to be planned and optimized effectively, both at the strategic level and in real time. Through this solution, the different stakeholders can:
  - quickly analyze and calculate the impacts of slow/smart steaming and synchro-modality on the whole supply chain;

– easily implement the preferred slow steaming strategy and corresponding synchro-modal operations to actually achieve the projected benefits (i.e., reduced emissions, de-stressed supply chain, lower costs and increased customer service).

The paper is organized as follows: in Section 2, we introduce a brief description of the GUEST methodology adopted. In Section 3, we discuss the state of the art as reflected in previous European projects that address slow steaming and synchro-modality. In Section 4, we describe the results of the survey administered to a large set of stakeholders of the SYNCHRO-NET project. Then, in Sections 5 and 6, we show respectively the value proposition canvas and the business model obtained considering the information gathered in the survey. Finally, conclusions are discussed in Section 7.

2. Methodology

As introduced in Section 1, we adopt the GUEST methodology, developed by [12]. It is a lean business methodology extending the work by [13] and the Lean Startup movement, adapting their results to the environment of a Multi-Actor Complex System (MACS), such as freight transportation. GUEST is the acronym of the five steps of the methodology:

- Go: a full description of the company profile, its current behavior and business development status, its environment, the external actors in the system and their interactions.
- Uniform: the knowledge of the system must be assessed in a standard way to obtain a shared vision of the MACS. In this phase, the governance and the business models are explicitly described by means of the Business Model Canvas [13] and the Value Proposition Canvas [14]: two tools used to define which are the customer needs and how to address them. The Value Proposition Canvas is a visual tool used to match, for each type of stakeholder involved in the process, the actual needs with the developed solutions, keeping into account also the potential gains and pains affecting the user in his daily activity. The Business Model Canvas is a lean startup tool developed to highlight how the proposed solutions enable the creation of value for the different types of stakeholders involved in the process. The main strengths of Business Model Canvas and Value Proposition Canvas rely on the capability to show, in an easy and comprehensible way, how the proposed solutions can deal with the user needs, and how users can gain benefits from these solutions.
- Evaluate: the governance and the business models are assessed in a series of actions. The full structure of the costs and revenues is explicitly described in order to evaluate the goals of the initiative. Moreover, a series of problems and opportunities are identified as well as the actions necessary to manage them, and the Key Performance Indicators (KPIs) to measure the effectiveness of the actions.
- Solve: given the specific problems and the actions highlighted to cope with them, a list of operational models is proposed.
- Test: the actions are implemented in case studies and their performance evaluated. The findings are released according with the Results Dissemination Plan.

To apply GUEST to SYNCHRO-NET at the current stage of the project, the steps were defined as follows:

- Go: in this phase, a preliminary analysis of the stakeholders requirements is conducted through a survey. The aim is to gather information about the stakeholder profiles in terms of their self-assessed needs.
- Uniform: for the two main relevant previous projects in the supply chain optimization and slow steaming fields, a Value Proposition Canvas is derived (Section 3). Then, a deep analysis and comparison of the two canvases is performed, bringing out the main similarities and differences compared with the SYNCHRO-NET project. The Value Proposition Canvas is a tool proposed by [14] to support the definition of the value proposition that fits the needs and wants of each

stakeholder involved in the project. This tool is composed of two blocks: the stakeholder profile and the value map. The stakeholder profile describes the stakeholder in a structured way, defining their jobs (what stakeholders want to get done through their activities); pains (bad outcomes, risks and obstacles related to the jobs) and gains (outcomes or concrete benefits that stakeholders want to achieve). The value map defines the value proposition that a company has to offer to each stakeholder according with its profile composition. It is articulated in products and services around which the proposition is created, pain relievers and gain creators that describe how the bundle of products and services respectively reduce the pains or create gains for stakeholders. The fit between the two parts occurs if the the project generates pain relievers and gain creators that combine with one or more of the most important jobs, pains and gains for the stakeholder. For more details about the building blocks of the Value Proposition Canvas, see [14].

- Evaluate: given the outcomes of the two previous phases Go and Uniform, the Value Proposition Canvas and the Business Model Canvas of the SYNCHRO-NET project are shown (Sections 5 and 6). The Business Model Canvas is the other tool proposed by [13]. In this application, it is used to demonstrate how SYNCHRO-NET creates value for different stakeholders and how it captures value in return. This tool summarizes the value proposition, the characteristics of the demand side and finally, the resources, activities and partnerships needed to implement the business model.

As the SYNCHRO-NET project is still ongoing, the Solve and Test phases are presently under development.

2.1. Stakeholders Needs and Desiderata Analysis

The project team developed a survey that was administered by e-mail to a wide range of about 300 potential stakeholders by the members of the consortium at the beginning of 2016. The aim of this survey was to create a knowledge base of the stakeholders profiles. In particular, its purpose was to figure out the main current and future needs perceived by the actors involved in the logistics industry, investigating their level of interest and enthusiasm for the solution proposed by the SYNCHRO-NET project. The questionnaire asked for:

- Details about the respondents and their organization. In the firsts two sections, some generic identifying information was collected (e.g., name, job title of the respondent, organization category).
- Details on the supply/logistics chain. This section gathers, by means of a Likert-scale response format, information about the logistics needs that the respondent organization meets and its perception of challenges faced (e.g., uncertainty in the supply chain leading to over-stocking key products, pressure to reduce the company's environmental impact, etc.). In particular, respondents had to rate on a scale from 1 to 5 their level of agreement with four statements. Responses are interpreted as follows: a low score (1—not at all accurate or 2—not accurate) implies disagreement. A value of 3 implies uncertainty. The values of 4 (accurate) or 5 (extremely accurate) represent the respondent's agreement with a certain concept. The four statements are:
  - I am under constant pressure to reduce my company's environmental impact but the logistics chain is too hard to manage.
  - I believe there are better, lower cost, lower emission transport options available but I do not have time to find them.
  - I over-stock key products due to uncertainties in the supply chain.
  - I do not risk using rail movements for high priority shipments because I am not confident they will arrive on time.
- Intermodal freight logistics research projects. This part of the survey has the aim to investigate on the respondent's awareness about projects on synchro-modality.

- Assessing the role of inter-modal logistics solutions and Future needs. Through a Likert scale, the respondent has to assess the importance of two lists of respectively current and future needs, including 18 factors as reliability, timeliness, sustainability, etc. For each of the factors, the stakeholders assigned a score ranging from 1—not at all important—to 5—extremely important.
- Final thoughts and Solutions to logistics problems. These two sections offer to the respondent the opportunity to present any logistics problems they perceive, which are not included in the previous lists and to propose solutions and express further views on the topic.
- Further participation. Through this section, the respondents can make themselves available to be contacted in order to provide further input and to participate in the ongoing development of synchro-modal solutions.

3. State-Of-The-Art

SYNCHRO-NET is the first project aimed at the realization of a powerful and innovative synchro-modal supply chain fully incorporating a Business Modeling and Stakeholder Value proposition process. Indeed, traditionally the literature in synchro-modality focused on the technical aspects only. In the following, we first review the most recent literature on synchro-modality and slow steaming and then the main results coming from large-scaled exploitation projects.

Synchro-modal solutions are still at the early stage. However, slow steaming and synchro-modality are high on the European Commission's research agenda and supported through funding for research and development and the European Technology Platform ALICE [15]. In particular, in [9], the focus is set on an easy-to-use tool enabling the assessment of different transport modes, in terms of time, cost, and emission, for a given destination. In [8], the authors investigate the collaboration and cooperation among different stakeholders as a crucial aspect to enhance the integrated use of different modalities in intermodal freight transportation. The cooperative planing is formulated as a cooperative model predictive container flow control problem, and then solved with three different approaches in order to evaluate the different solutions. In [7], the authors focus on the communication between the different actors in the supply chain and the collection of real-time data with the aim to improve the efficiency and cost savings. A common data model for the collection of the required information is developed and tested, adopting a bottom-up design approach to keep into account the needs and requirements of different logistics service providers. Considering the reduction of the ship emissions, Chen et al. [16] considers the impact of Emission Control Areas (ECAs) on the route choice, without considering the opportunity to reduce the speed in order to reduce the emissions [16]. The results of the route choice model developed for Asia–Europe shipping show that the establishment of Emission Control Areas will have considerable effects in terms of route choice on small container ships, but moderate impacts on the large ones.

Slow steaming is recognized as being both cost saver and environmentally friendly [4]. In terms of cost savings, Refs. [3,4] find that a slow steaming strategy leads to cost savings of about 5–7% for the carriers. In terms of environmental benefits, Ref. [17] provides a quantitative estimate of the reduction in emissions obtained by slow steaming. The author finds that reducing a vessel's speed by 10%, emissions decrease by at least 10–15%. Despite the apparent benefits, there is skepticism from end-users of logistics services due to the perception that slow steaming implies longer transit times, which, combined with port congestion, make the overall supply chain less agile and reliable, and more costly. Consequently, the synchronization of operations and different modes of transportation, so-called synchro-modal transportation, becomes critical.

From the analysis of the literature emerges how the focus of the research is still on the technical, ICT and optimization issues, with the risk to develop technical solution that are not matching with the industrial needs. In fact, synchro-modality and slow steaming are not just a new technical option, but requires a tight integration with the business models of the involved stakeholders.

The aforementioned issues are partially considered in previous reference projects on supply chain optimization and slow steaming. The most relevant are "European Framework for safe, efficient and environmentally—friendly ship operations" (FLAGSHIP) [18], "European e-freight capabilities for co-modal transport" (e-Freight) [19], "e-Maritime Strategic Framework and Simulation based Validation" (e-Mar) [20] and "Consistently Optimized Resilient Secure Global Supply-Chains" (CORE) [21]. This section presents the results of a comparative analysis conducted by the GUEST methodology [11]. In particular, we compare these projects and SYNCHRO-NET in order to show similarities or discrepancies and to bring out the innovative nature of SYNCHRO-NET. In doing this, we adopt a comprehensive approach that considers the technical aspects of the solutions proposed by these projects from a managerial point of view. We adopt a holistic perspective, providing an assessment that is broader than the more customary technical and optimization point of view. Moreover, in line with a managerial perspective, we analyze the previous projects in terms of the value proposition that they offer to the different stakeholders involved by means of the Value Proposition Canvas introduced in Section 2. At the time of writing, some of the previous projects are ongoing and some of their deliverables are not published (not available on the official project websites), which means that information on these projects is insufficient for a detailed analysis. For this reason, we only present a detailed analysis of the two completed and successful projects that are most similar and relevant in relation to SYNCHRO-NET: e-Freight and e-Mar.

3.1. e-Freight Project

The European e-Freight capabilities for Co-modal transport (e-Freight) initiative was a research and development project co-funded by the European Commission under the 7th Framework Programme and ran from the 2010 to 2013. It involved a team of 30 partners from 14 EU member states and Norway and represented a contribution to the goals of the Freight Transport Logistics Action Plan and the Intelligent Transport System (ITS) Action Plan. As shown in the Value Proposition Canvas illustrated in Figure 1, the different stakeholders involved are:

- Compliance officers, who review and evaluate the compliance issues and monitor the impact of regulations.
- Port authorities, responsible of the efficient use of infrastructures and supporting transport users by providing information about the available infrastructure and the schedules of arrival and departure times of different ships.
- Customs, which provides different services related to the security of the transportation flow.
- Transport users (i.e., Freight carriers, Logistics service providers and Shippers), which manage the cargo at the operative level.

Each stakeholder is affected by specific pains, listed in the canvas (Figure 1), which are grouped in the following main issues:

- Intra-European trade is complicated due to the disconnections and vulnerability of the logistic chains.
- Safety and security particularly in establishing efficient collaboration between authorities and transportation stakeholders to improve the development of capabilities for proactive and remedial measures to protect the environment as well as the security of freight transport networks.
- Unharmonized and inefficient freight information exchange in the context of multimodal transport.

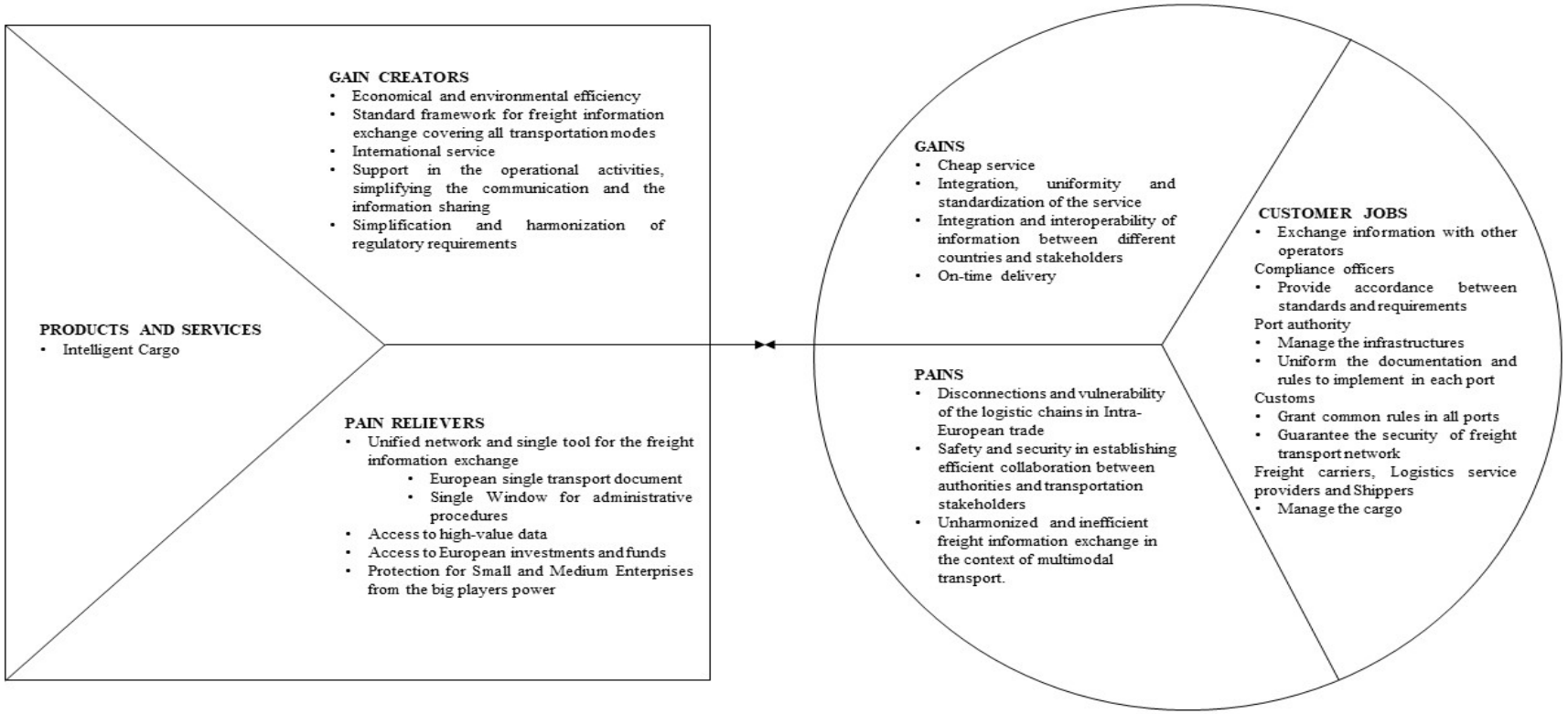

Figure 1. Value Proposition Canvas of the e-Freight project.

The aim of the e-Freight project is to overcome these issues by means of an "Intelligent Cargo" solution that makes goods self-aware, context-aware and location-aware as well as connected to a wide range of information services, creating an automated freight transportation management process. This solution is the basis of the project value proposition that consists of the following benefits for stakeholders:

- Vision of a paperless and standard framework for the freight transport process where an electronic flow of information is linked to the physical flow of goods, resulting in a leaner freight information exchange that encompasses all modes.
- Simplification and harmonization of regulatory requirements.
- "Single Window" (single access point) for administrative procedures in all modes.
- Introduction of an Information highway for co-modality, assisting transport operators to establish a common end-to-end transportation processes including compliance and intelligent monitoring.
- Improvement of the efficiency of the whole supply chain considering both economic and environmental impacts.

3.2. e-Mar Project

The e-Maritime Strategic Framework and Simulation based Validation (e-Mar) project was a research initiative that ran between 2012 and 2014, in which the 28 participants addressed the topic "Upgraded maritime transport information management" as a part of the European Commission's 7th Framework Programme. The aim of this project is to support the development of sustainable maritime transport in Europe through the definition of a framework based on the latest information, communication, and surveillance technologies [20]. As shown by Value Proposition Canvas in Figure 2, the main beneficiaries of the e-Mar outcomes are:

- Freight forwarders.
- Freight integrators, shipping agents and multi-modal transport operators.
- Infrastructure managers and port authorities.

These stakeholders are affected by several pains, in some cases overlapping with those addressed by the e-Freight project, and mainly related to the different interpretation of regulation and standards and the lack of interoperability and harmonization of the information exchange process. Building on previous initiatives including e-Freight, the e-Mar projects aims to provide an ICT infrastructure whose main pillars are:

- the eMAR Optimisation System (EOS), which provides the maritime stakeholders with a tool for the optimal planning and scheduling of their operations using real-time data.
- SafeSeaNet, Port Community System (PCS) and Port Single Window (PSW), facilities that improve the exchange of information through standardization and secure processes.

This e-Mar platform represents the basis of the value proposition of the e-Mar project, with consequent benefits in terms of:

- Simplification and automation of information exchanges between administrations and maritime operators to achieve quantum improvements in maritime safety, security, customs control, environmental protection and cost savings for logistics operators.
- Facilitation of commercial transactions [20].

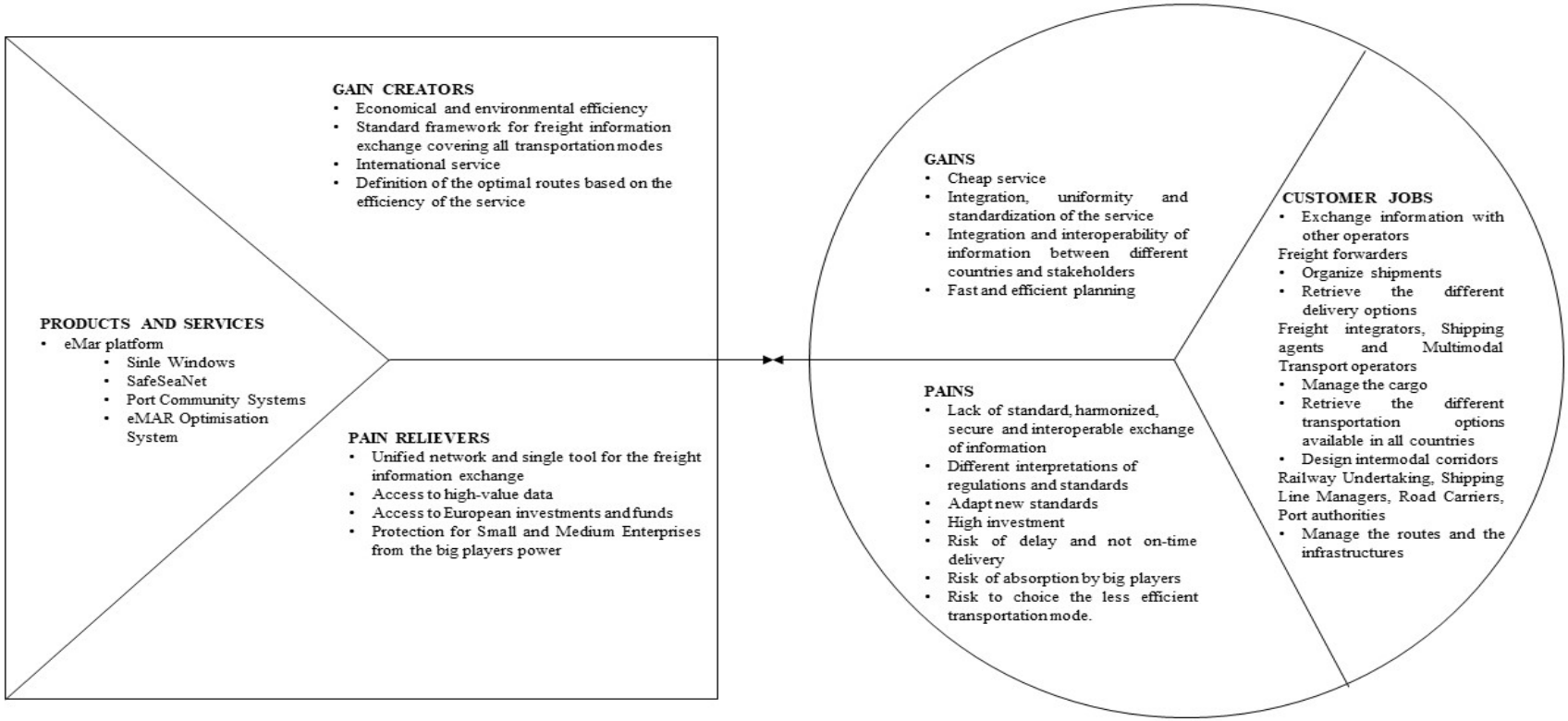

Figure 2. Value Proposition Canvas of the e-Mar project.

The SYNCHRO-NET project takes into account the lessons learned, the knowledge base and the solutions provided by successful research projects such as e-Mar and e-Freight. SYNCHRO-NET incorporates some of their technical features and contributions in order to maximize the benefits obtained from the ever-increasing availability of real-time transport and logistics data. For example, the initial optimization module in e-Freight forms a starting point for SYNCHRO-NET. Table 1 summarizes the value propositions of the previous projects and provides a brief comparative analysis between them and SYNCHRO-NET.

Table 1. Comparative analysis between the previous projects and SYNCHRO-NET.

	e-Freight	**e-Mar**
Value Proposition	Intelligent Cargo that makes goods self-aware, context-aware, location-aware and connected	e-Maritime platform for easier information exchange and e-Maritime services
Similarities with SYNCHRO-NET	Synchro-modal system to manage freight transportation in the EU Supply chain optimization and slow steaming Paperless freight solution Single Window concept	Supply chain optimization and slow steaming Paperless freight solution Single Window concept Stakeholder-driven approach
Differences with SYNCHRO-NET	No commercial and business perspective	

SYNCHRO-NET exhibits similarities (e.g., the focus on supply chain optimization and slow steaming) with e-Freight and e-Mar, which represent a useful starting point due to their experience gained through surveys and pilot developments. These similarities are due to the deliberate integration of the existing knowledge by the SYNCHRO-NET Consortium into a larger framework for freight delivery. In addition, SYNCHRO-NET adds a further layer of innovation that extends the current state of the art in different ways. According to a recent study of EU-funded logistics research projects, a lack of standardization and cooperation between the parties involved are common obstacles to innovation in the logistics field [22]. The issue of standardization has played a central part in previous projects. The SYNCHRO-NET project proposes to address the issue of cooperation through a holistic approach covering all relevant aspects (not restricted to ICT), thereby promoting new forms of collaboration and stimulating the introduction of innovative collaborative business models across Europe. SYNCHRO-NET adopts a stakeholder-driven iterative methodology (illustrated in Figure 3), where the requirements of end users in the industry drive the development of the prototypes tested in business case demonstrators, and the resulting feedback is used to refine and enhance subsequent prototypes [10,23]. The outcome is the integration of a commercial and business perspective into the SYNCHRO-NET project.

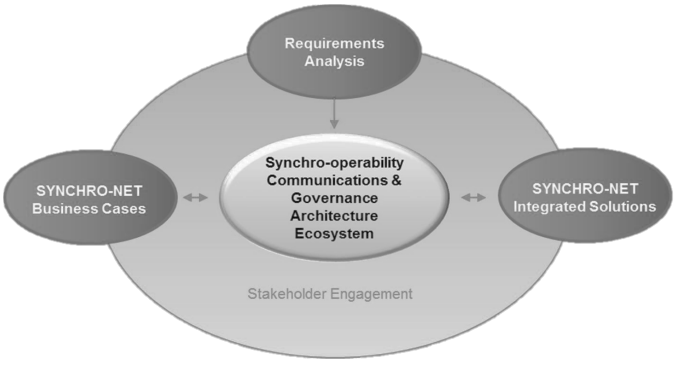

Figure 3. Methodology adopted. Source: SYNCHRO-NET Grant Agreement [23].

This approach pushes the adoption process of the innovation, facilitating user acceptance, captivating industry-driven entities and empowering authorities to open European networks to a new form of collaboration. Moreover, considering the stakeholders requirements and needs at an early stage of the development allows us to anticipate issues, increasing the probability of success for the research project. Table 1 highlights the absence of a commercial perspective from the previous European projects, which already face financial barriers as shown by the study by [22]. This lack of a commercial perspective is a barrier to the concrete realization and implementation in the market of the solution proposed by such projects, which commonly finish at the end date of the project or when funding runs out. In contrast, the SYNCHRO-NET project is strongly commercial product-oriented. In fact, it is intended to create a feasible and economically sustainable solution during the project phase. The anticipation of business and managerial aspects during the research and development activities of the project represents a value added for SYNCHRO-NET. Combined with the above mentioned collaborative business models it enables in the industry, SYNCHRO-NET aims to guarantee the long-term practicability, sustainability and widespread endorsement by industry and the public at large of the project results. To reach these goals, SYNCHRO-NET introduces a methodology beforehand adopted only by the e-Mar project, known as the stakeholders-driven approach (see Table 1). However, the novelty in the SYNCHRO-NET application respect to the prior European project in this field is the continuous consideration of the stakeholder feedbacks, along all the stages of the solution development and not only in the early phase. The stakeholders-driven approach, described in Section 4, includes the analysis of stakeholders requirements by means of a survey, whose results are used to prepare the Value Proposition Canvas and the Business Model Canvas according to [13,14], and finally, to transit from the business model, which represents the project *"as is"*, to the operational model from a *"to be"* perspective, obtaining a more comprehensive vision of the project domain.

4. Results

The survey achieved 193 responses, 164 of which were complete and thus relevant for the analysis. The respondents represent the following stakeholder groups:

- Logistics operators. They manage freight, picking up it on ships, trains and trucks and moving it across long distances. In particular, they are responsible of the safety and the efficiency of the delivery.
- Firms. They are the companies that will use the platform to coordinate the transportation of their goods (both for final products and raw materials) across Europe, benefiting from better planning of the delivery process.
- Public authorities. They are responsible of the maintenance of public infrastructure and they set regulations and requirements for the other actors.
- Port authorities. They can be both public or private authorities that manage ports and related activities.
- Research institutions. Mainly universities and researchers working to improve the current system.
- Trade associations. They are organizations founded and funded by businesses that operate in a specific industry.

As shown in Table 2, about the 65.2% of the stakeholders are classified as logistic operators, followed by firms (15.2%), and public authorities (8.5%). 2.4% of respondents are not classified in the above mentioned categories.

Table 2. List of stakeholders involved in the survey with the respective percentage.

Stakeholders	% of Participation
Logistics operators	65.2
Firms	15.2
Public authorities	8.5
Port authorities	3.0
Research institutions	3.0
Trade associations	2.4
Others	2.4

4.1. Challenges in Meeting Current Logistics Needs

Focusing on the question "Supply/Logistics Chain" of the questionnaire, concerning the perception of current logistics needs, Table 3 shows the average scores assigned by the respondents to the different proposed items. For each item, respondents were asked to express their answer through a Likert scale where: 1 = Not at all accurate, 2 = Not accurate, 3 = Somewhat accurate, 4 = Accurate, 5 = Extremely accurate.

Table 3. Challenges in meeting current logistics needs.

	I am under constant pressure to reduce my company environmental impact but the logistics chain is too hard to manage	I believe there are better, lower cost, lower emission transport options available but I do not have time to find them	I over-stock key products due to uncertainties in the supply chain	I do not risk using rail movements for high priority shipments because I am not confident they will arrive on time
Overall	**2.79**	**2.80**	**2.51**	**2.91**
Logistic operators	2.67	2.91	2.56	2.91
Firms	2.92	2.56	2.64	3.33
Public authorities	3.54	2.46	2.00	2.31
Port authorities	3.40	2.00	1.40	2.40
Research institutions	2.50	2.75	2.00	2.50
Trade associations	2.50	2.50	3.00	3.50
Other	2.50	3.75	3.50	2.75

A striking founding is the low confidence in the use of rail, since a large part of respondents do not risk using rail for high priority shipments because they are not confident that they will arrive on time. The following items are the scarce time to find better, lower cost, and lower emission transport options and the constant pressure to reduce environmental impacts of the activities.

Analyzing these results by stakeholder type, it emerges that logistic operators state that it is possible to optimize the operations, moving toward more efficient (in terms of costs and emissions) transport options. However, they do not have enough time to analyze these options (or they do not have sufficient incentives). Furthermore, logistics operators do not trust the railway transport systems, particularly when they are under time constraints. The same distrust of railway systems emerges strongly from the firms responding to the survey, and is confirmed by the trade associations, which reflect the needs (or the pains) of different types of operators. Public and port authorities are mainly affected by pressures to reduce environmental impact, but they find it hard to manage the logistic chain in order to cope with these requirements. While they make up only the 2.4% of respondents, an interesting outcome from the trade associations is that they report that firms over-stock key products to reduce the impacts of the uncertainties in the supply chain (the reduction of the supply chain uncertainties is one of the objectives of SYNCHRO-NET project, achievable through the implementation of synchro-modality and slow steaming strategies). Summarizing, the survey identifies the following key issues by type of stakeholder:

- Logistic operators and research institutions believe that there are better, lower cost, lower emission transport options available but there is not enough time to find them.

- Firms are concerned about the effectiveness of the rail transport system and about environmental impact.
- Public and port authorities are under pressure to reduce the environmental impact and find it hard to manage the logistics chain.
- Trade associations report distrust in the rail system and over-stocking due to uncertainties in the supply chain as key concerns.

4.2. Awareness of Other Research Projects

Generally, the awareness of other research projects on intermodal freight logistics solutions is low, since 77% of respondents are not aware of any such projects. Less than a quarter of the total (23%) know of other research projects. The most frequently mentioned ones are the following:

- TENT-T.
- B2MOS.
- Ifreightmed.
- MOS4MOS.

4.3. Assessing the Role of Intermodal Logistics Solutions for Current and Future Needs

To make easier and clearer the presentation of the results obtained in the two questions of the fourth part of the survey, concerning the meeting between the intermodal logistics solution and current and future needs, the 18 factors mentioned above are grouped into four categories:

- Time and reliability factors.
- Costs and sustainability factors.
- Management and risk factors.
- Customer, quality and other factors.

Tables 4 and 5 show the average scores assigned by the respondents to the different factors perceived as current and future logistics needs. For each item, respondents were asked to express their answer through a Likert scale where: 1 = Not at all important, 2 = Not important, 3 = Somewhat important, 4 = Important, 5 = Extremely important.

Table 4. The role of intermodal solutions for current logistics needs.

Item	Overall	Logistic Operators	Firms	Public Authorities	Port Authorities	Research Institutions	Trade Associations
Time and reliability factors							
Reliability	4.62	4.65	4.76	4.23	5.00	4.25	4.50
Responsiveness	4.29	4.30	4.36	3.92	4.40	4.25	4.25
Timeliness	4.33	4.37	4.80	3.31	3.80	3.75	4.25
Frequency	4.03	4.07	4.33	3.38	4.40	3.50	3.50
Cost and sustainability factors							
Sustainability	3.72	3.64	3.70	3.85	4.40	4.00	4.00
Simplified paperwork documentation	4.01	4.00	4.08	4.00	4.00	3.50	5.00
Low carbon operations	3.32	3.25	3.32	3.38	4.00	3.75	2.75
Cost efficiency	4.60	4.68	4.68	4.00	4.80	4.25	4.50
Management and Risk factors							
Liability for carriers	3.98	4.05	4.20	3.23	4.20	3.00	4.00
Container tracking	3.81	3.86	3.72	3.23	4.20	3.50	4.50
Routing flexibility	3.51	3.62	3.44	2.77	3.80	3.25	2.75
Trust coordination between managers	3.94	4.04	3.88	3.62	4.00	3.50	3.25
Risk management	3.92	3.86	4.29	3.85	4.20	3.25	3.75
Consistent transit times	4.23	4.35	4.46	3.23	4.40	2.75	4.50
Customer and Quality factors							
Customer claims settlement	3.83	3.86	3.88	3.62	4.00	2.75	4.25
Door to door service	3.96	4.01	4.00	3.23	4.40	4.00	4.25
Meeting customer demands	4.45	4.46	4.60	4.08	4.60	3.25	5.00

Comparing the same items in the two tables, it emerges that all the analyzed factors are expected to gain importance in the perspective of the future logistics needs. In particular, some factors related with cost and sustainability are expected to increase their score by 14% (sustainability) and 23% (low carbon operations) compared with the current situation. Other factors with an expected high growth in importance are routing flexibility (13%), container tracking (9%), and customer claims settlement (9%). Furthermore, the table shows how public authorities generally assign lower scores than the other types of stakeholders involved in the survey. Time and reliability factors are seen as the most important logistics needs both in the current and future perspectives. In particular, reliability is by far the most important factor in terms of meeting the current and future logistics needs, followed by timeliness. Considering cost and sustainability, cost efficiency and simplified paperwork documentation are the most important factors, and they are expected to gain further importance in the future. Focusing on management and risk factors, consistent transit times are by far the most important factor, followed by liability for carriers, trust coordination between managers, and risk management. Routing flexibility is less important considering the current logistics needs, but its importance is expected to increase in the future (with an increase by 13% compared with the current situation). Considering factors related with customer and quality, meeting the customer demands is the most important one, with high growth expectations in particular for port authorities and firms. Customer claims settlement and door to door service are less important factors in the current perspective, but their growth expectations in the future are high (9% and 8%, respectively).

Table 5. The role of intermodal solutions for future logistics needs.

Item	Overall	Logistic Operators	Firms	Public Authorities	Port Authorities	Research Institutions	Trade Associations
Time and reliability factors							
Reliability	4.73	4.75	4.83	4.38	5.00	4.50	4.50
Responsiveness	4.51	4.50	4.75	4.23	4.60	4.00	4.50
Timeliness	4.49	4.51	4.92	3.77	4.40	3.50	4.67
Frequency	4.29	4.34	4.50	3.77	4.75	3.00	4.50
Cost and sustainability factors							
Sustainability	4.23	4.19	4.33	4.23	5.00	4.00	4.00
Simplified paperwork documentation	4.34	4.31	4.54	4.15	4.60	3.50	5.00
Low carbon operations	4.09	4.06	4.21	4.00	4.80	4.00	3.25
Cost efficiency	4.73	4.81	4.83	4.38	4.60	3.33	4.75
Management and Risk factors							
Liability for carriers	4.13	4.21	4.22	3.69	4.20	3.25	4.25
Container tracking	4.16	4.20	4.04	3.77	4.60	4.00	4.50
Routing flexibility	3.95	4.01	4.00	3.31	4.20	3.75	3.75
Trust coordination between managers	4.11	4.12	4.25	4.08	4.40	3.75	3.25
Risk management	4.18	4.13	4.29	4.15	4.80	3.75	4.00
Consistent transit times	4.39	4.45	4.54	3.85	4.80	3.50	4.25
Customer and Quality factors							
Customer claims settlement	4.16	4.21	4.08	3.77	4.40	3.50	4.75
Door to door service	4.27	4.30	4.35	3.77	4.60	3.75	4.50
Meeting customer demands	4.59	4.57	4.83	4.38	5.00	4.00	4.75

Respondents were also asked to specify other important factors affecting current and future logistics needs. Among the responses, some frequently mentioned items were:

- Compliance with regulations and standards, particularly for pharmaceutical products.
- Traceability/lead time.
- Communication/information flows and forecasting.

4.4. Assessment of Logistics Needs, Challenges and Perceived Solutions

In order to add another level of detail to the analysis of the role of intermodal logistics solutions for current and future needs for each stakeholder, we juxtapose the current situation and the expected future situation across all the potential needs.

Logistics operators. Logistic operators foresee no great changes in terms of logistics needs overall. Low-carbon operations and sustainability as well as routing flexibility stand out as categories that are seen as becoming more important in the future.

The mains logistics problems that present a challenge for logistic operators in their current or future operations are:

- Lack of information available online. Logistics operators use online information sources extensively, but many carriers do not put detailed information online.
- Managing the information from the field to improve responsiveness and service levels.
- Regarding multi-modal platform: speed and reliability of transportation if put in context of the service capabilities required for an express courier to be competitive.

Concerning the solutions for the previously mentioned logistics problems, logistics operators state that mobile applications, both cloud and web connected, can extend the scope itinerant services and business models.

Firms. Firms also see the importance of low carbon operations, sustainability and routing flexibility increasing. The main priorities continue to be timeliness and cost efficiency.

Some logistics challenges quoted by firms are:

- Fluctuation of the transport market between industrial and fresh produce sector.
- Stocking model in the current warehouse not reflecting business needs.
- Reliability, flexibility, costs, forecasting, etc.

Firms see centralized distribution centers as a way to address some of these problems. Having all products in a single place allows them to meet the customers requirement for faster deliveries.

Public authorities. Public authorities see logistics needs increasing across a broad set of categories, mainly in routing flexibility, low carbon operations, consistent transit times, container tracking, door to door service, liability for carriers, and timeliness. Public authorities ascribe high importance to reliability, responsiveness, sustainability, cost efficiency, and meeting customer demands.

The relevant logistics problems, which present a challenge to their current or future operations, are:

- Single window implementation.
- Supply chain management.

The main potential solutions proposed are:

- Flexibility of the labor market in relation to dockworkers.
- Increased need for storage areas and higher turnover of goods.

Port authorities. Port authorities also see all of the factors increasing in importance, with the exception of cost efficiency, which sees a small decrease. Low carbon operations, timeliness, simplified paperwork/documentation, and risk management show the largest increases in importance. The highest importance is ascribed to reliability, sustainability, and meeting customer demands.

Port authorities see the improvement of rail infrastructure (e.g., for deep-sea connections) as a key challenge, in line with the large expected increase in the importance of low carbon operations.

Research institutions. Research institutions have an unusual outlook in that they see various factors decreasing in importance in the future, including cost efficiency and frequency. Customer claims settlements, consistent transit times, and meeting customer demands are seen as becoming more important.

Research institutions report that are still a lot of open problems in the domain of real-time coordination for synchro-modal logistics.

Trade associations. Trade associations see a large increase in the importance of frequency and routing flexibility. Simplified paperwork is seen as the most important factor overall, with no change in this priority expected. However, trade associations represent only 2.4% of respondents and, therefore, it is not possible to generalize these findings.

5. Value Proposition of the SYNCHRO-NET Project

The aim of this section is to analyze the value propositions that the SYNCHRO-NET project offers to the main stakeholders involved (i.e., logistic operators, firms, public authorities, and port authorities), which fit their needs and requirements as revealed by the survey discussed above. The tool used for this analysis is the Value Proposition Canvas [14], described in Section 2. For each actor, we provide a brief description of jobs, pains and gains, in order to identify which ones are common for two or more actors and which ones are stakeholder-specific. This information is then summarized graphically in the Value Proposition Canvas for the SYNCHRO-NET project, shown in Figure 4, which represents, together with the Business Model Canvas, the main outcome of the Evaluate phase. The jobs, pains and gains for each type of stakeholder are described in the Table 6. Each type of actor has different jobs, with some common objectives. Both public and port authorities want to increase their control over the freight flows in their areas with the aim to better allocate resources and prevent bottlenecks. Increased control over freight flows could strengthen firms' control over the delivery process, thus making delivery times more reliable. Moreover, optimized management processes for port authorities could help logistic operators to better plan their activities, making the best use of available storage spaces in ports and terminals, and making it possible to choose the optimal transport solutions given time, cost and risk constraints. Regarding customer gains, we can identify a set of commonalities related to increasing efficiency, quality, and awareness of environmental issues. For logistics operators and firms, an increase in the efficiency means optimization of resource usage and planning of activities. As a consequence, the quality perception by final users will increase in terms of service reliability. For public and port authorities increasing efficiency means optimization of infrastructure utilization, with positive consequences for the quality of the service provided. Environmental issues are usually seen as constraints by the stakeholders, being imposed by national and European regulations, but they can also be exploited to obtain a positive return on image. Finally, logistic operators and port authorities can provide better conditions for workers through an increase in the efficiency and an optimized planning of activities. Even for customer pains, it is possible to identify a set of commonalities, mainly related to the absence of a single tool to plan the activities, with consequent difficulties in retrieving information about different transport modes. The absence of a single tool also leads to difficulties in the traceability of deliveries, making delivery time unreliable, and in the management of externalities.

The resulting value proposition of the SYNCHRO-NET project consists of a single platform, in which all the actors involved in the supply chain can interact to optimize and synchronize operations. One of the main benefits of planning and monitoring the supply chain with a single tool is the increase of communication and information exchange among the different actors, with a consequent increase in the service provided in terms of quality and reliability. Moreover, the increase in service reliability means more reliable delivery times for firms, allowing a reduction of buffer stocks. An optimized, long-term planning process for the supply chain leads to more efficient resource usage for logistic operators and port authorities, allowing better working conditions for workers. For public authorities, an optimized planning and monitoring process lead to better control over infrastructure usage, preventing road/rail congestion and bottlenecks. The synchronization between different transport modes can be used to bolster the role of lower-emissions modes (e.g., railway), thus reducing the impact on the environment, complying with European directives on greenhouse gas (GHG) emissions and enhancing the image of firms and logistics operators. Moreover, an optimized synchronization between different transport modes could be used to foster the adoption of slow steaming strategies for ships and trucks, also with a positive impact on the environment.

Table 6. Jobs, gains and pains of each stakeholder involved in the SYNCHRO-NET project.

	Stakeholder Jobs
Logistics operators	access available storage space in ports and terminals Identify the optimal transport modes in order to satisfy objectives (cost, time, risk, etc.)
Firms	Plan and monitor the delivery process
Public authorities	Monitor freight flows to prevent bottlenecks
Port authorities	Monitor freight flows in the port area Optimize management processes, taking into account infrastructures, facilities and personnel availability
	Stakeholder Gains
Logistics operators	Increase efficiency Increase the quality of the service provided Increase awareness of environmental issues Reduce empty trips Provide better conditions for workers
Firms	Increase the efficiency Increase the quality of the service provided Increase awareness of environmental issues Increase service reliability (reliable delivery times) Have a single tool to monitor the delivery process Reduce uncertainty through inter-modal solutions
Public authorities	Increase efficiency (in terms of infrastructure utilization) Increase the quality of the service provided (in terms of infrastructure usage) Increase awareness of environmental issues (reduce pollution) Optimize freight flows to reduce congestion
Port authorities	Increase efficiency (in terms of infrastructure utilization) Increase the quality of the service provided (in terms of infrastructure usage) Increase awareness of environmental issues (reduce pollution) Anticipate/control uncertainties through better planning of activities Provide better conditions for workers
	Stakeholder Pains
Logistics operators	Difficulties in retrieving information about availabilities and timetables Manage externalities Uncertainty about custom operations Wasted time because of infrastructures/facilities/personnel constraints in ports and terminals
Firms	Difficulties in retrieving information about availabilities and timetables Manage externalities Uncertainty about custom operations Difficulty in the monitoring process Delivery time not reliable
Public authorities	Manage externalities Lack of control over infrastructure usage
Port authorities	Manage externalities Uncertainty about custom operations Temporary constraints in terms of infrastructures/facilities/personnel

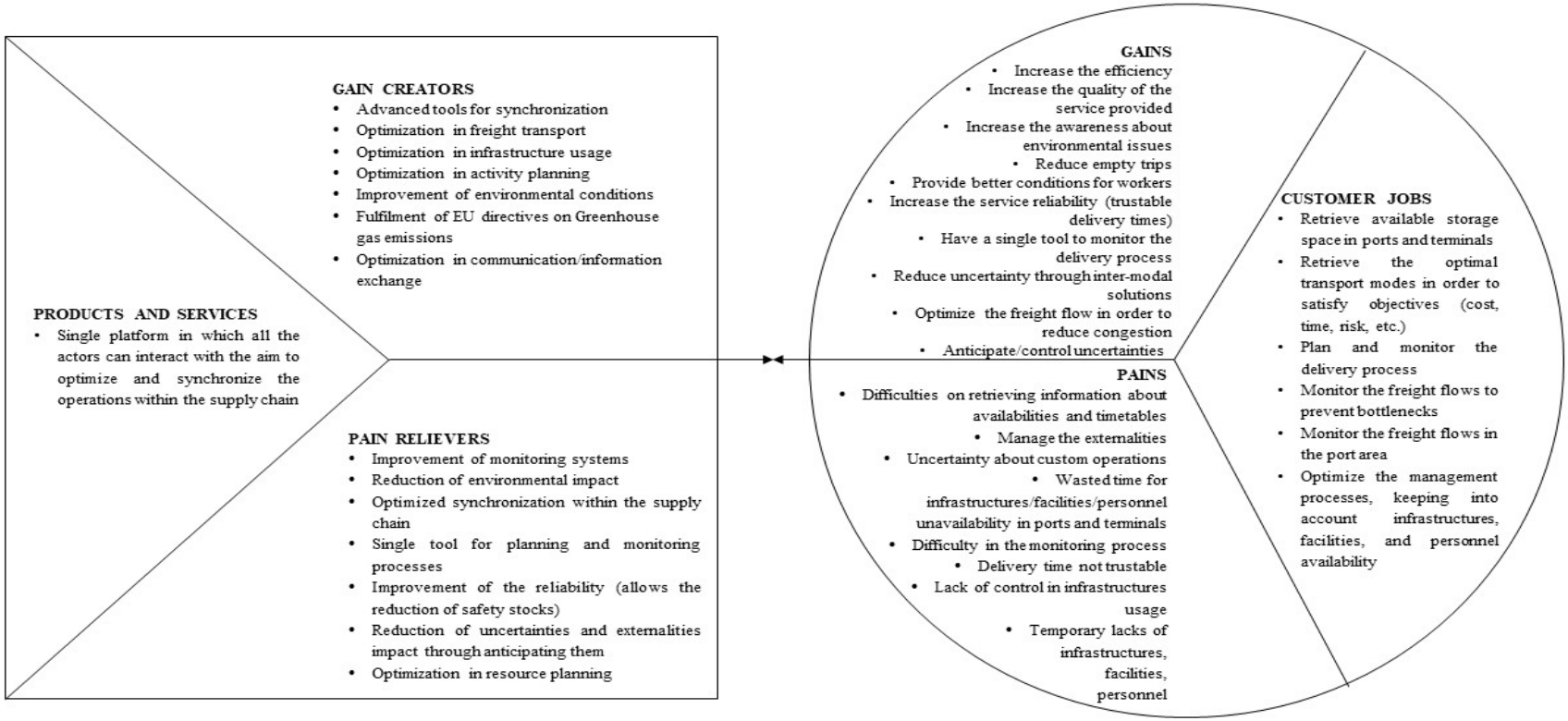

Figure 4. Value Proposition Canvas of the SYNCHRO-NET project.

6. Business Model of the SYNCHRO-NET Project

As discussed in Section 3, the innovative feature of the SYNCHRO-NET project is its business approach and product-oriented perspective. For this reason, according to the GUEST methodology, the aim of the Evaluate step was to build a business idea and take the preliminary strategic and operational decisions for the implementation of a commercial viable solution. In fact, from the outcomes obtained in the Go phase, a high-level Business Model Canvas of the SYNCHRO-NET solution is designed. This means that it is the result of a first iteration, while progressive refinements will be included to up as the project development goes along. This approach allows to create an internal consistency in the business model and respect to the stakeholder requirements. Moreover, an innovative feature of SYNCHRO-NET is that the stakeholder-driven approach is not closed to the survey. In fact, the continuous engagement of customers, logistics providers, shipping companies and public authorities is guaranteed by a specific component named *Dynamic Stakeholder Impact Assessment Module*. This module represents one of the most important innovations in SYNCHRO-NET as it is capable of recording the views of all stakeholders in the supply chain, and to use this information in a controlled way to guide the optimization of the synchro-modal supply chain. In particular, it is composed by the Dynamic Stakeholder Assessment Methodology. It allows to understand the stakeholders preferences over different attributes (e.g., length of route, trip duration, fuel usage, etc.), levels (e.g., measured in kilometers, hours, etc.) and situations (i.e., to rank the importance of different attributes that determine the choice of synchro-modal itineraries).

The Business Model Canvas shown in Figure 5 is described in this section. We discuss each of its building blocks in turn. The customer segments are the stakeholders of the project as identified through the survey (see the Section 4). They are the addressees of the value proposition defined in Section 5. To reach these stakeholders and communicate with them, the SYNCHRO-NET project uses the following channels:

- Platform/website. Single tool to communicate and to interface with all the partners and stakeholders of the project. It represents the main source of information about the project, providing multi-modal maps, timetables and data.
- Community newsletter. It is a common direct channel of information sent to the members in order to provide periodic updates about services.
- Events and exploitation. These are intended to build a community and to increase the awareness and knowledge of services offered by SYNCHRO-NET. It also contributes to a better understanding of emerging needs and improvements, according to the stakeholder-driven framework adopted in the project.
- Dissemination. Intended to achieve a critical mass of interest required for the self-perpetuating of the project. Includes contributions to the literature, to create initial awareness and dissemination of results throughout the projects. The focus is on journals and conferences in transportation, logistics, and slow steaming fields.
- Customer Relationships Management system (CRM). Required to manage business relationships, data and information of the partners and stakeholders.
- Marketing activities. Marketing efforts to make the full solution available for commercial implementation and develop the platform to become a reference tool in the freight transportation industry.

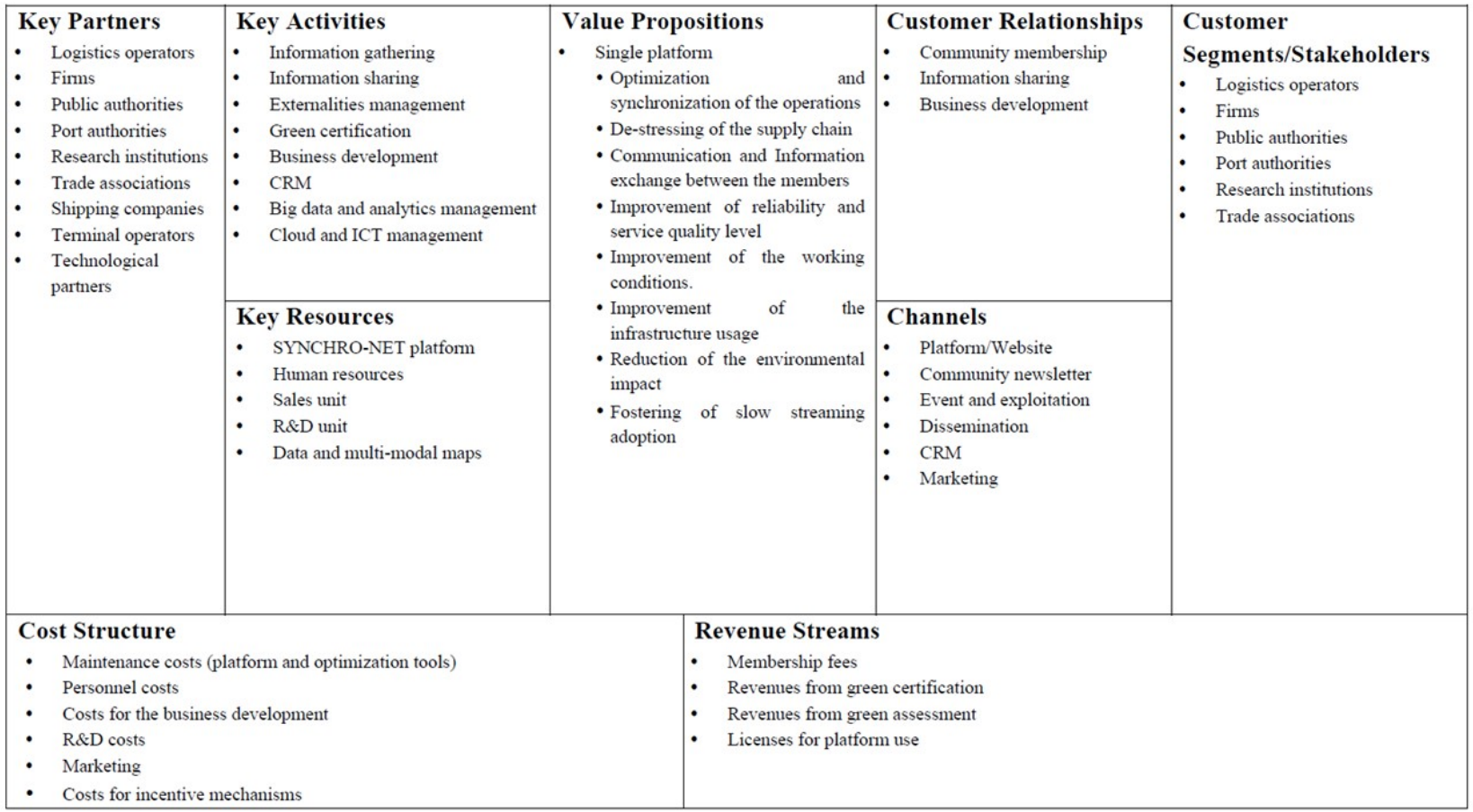

Figure 5. Business model canvas of SYNCHRO-NET project.

Once the stakeholders are engaged, the objective is to get them involved in cooperation and collaboration with the project, with the aim to obtain mutual benefits. These relationships can be grouped in the following categories:

- Community membership and Information sharing among members. The Community represents a powerful tool for the communication and the exploitation of results and thus for the co-creation of value for the stakeholders and end-users. Moreover, the Community can interact through a SYNCHRO-NET web portal, which provides information, training material, discussion groups and networking opportunities for participants.
- Business development. A deliberate process needed to ensure the success of the project and the adoption of the platform by stakeholders.

Due to the business perspective that is adopted throughout the development of SYNCHRO-NET, revenue streams play an important role for the future commercialization and sustainability of the solution in the long term. The main revenue streams identified are the following:

- Membership fees. Different levels of membership can be offered depending on the needs of the participants. "Contributors" or "Champions" pay subscription fees, one-off licenses and consulting fees to the SYNCHRO-NET consortium, in order to access to advanced training programmes or services.
- Revenues from certification of external supply chains.
- Revenues from supporting third parties campaigns to implement a sustainable transportation.
- Licenses for platform use. Payment for use of the platform and the related tools, designed for the business market.

The most important assets required to make the SYNCHRO-NET business model work are:

- SYNCHRO-NET platform. This single tool is the main resource due to its role in realizing the project and guaranteeing the usability of the services in the long term.
- Human resources. They are the members of the Consortium that automatically become SYNCHRO-NET partners. They have commercial and voting interests, together with other external participants of the Community, which are at the same time sources of information.
- Sales unit. It is composed by the personnel directly involved in the realization, improvement and commercialization of the project solution.
- Research and Development (R&D) unit. A key resource to maintain SYNCHRO-NET in a competitive and useful position in the market and to increase its value added by improving its knowledge content.
- Freight transportation data and multi-modal maps.

The key activities required for the implementation of the value proposition are the following:

- Information gathering on the freight transportation environment, in order to implement a solution taking into account the specific policies, rules, constraints and methods for the freight management of each country involved and to create a sustainable freight transportation system.
- Information sharing. It is the most important activity to achieve a common tool useful for all the partners.
- Planning of freight deliveries. This activity concerns all the operations needed to provide real-time planning of the routes and synchro-modal logistics optimization.
- Externalities management. Activities related to the management of risks and externalities, and the revision of the previous solutions if necessary.
- Green certification. Provides assessment and certification of the eco-sustainability of logistics operations.

- Business development. Business support to recruit new Community members and to disseminate platform developments among existing members to ensure the sustainable success of the project in the long term.
- Customer Relationships Management (CRM). It includes all activities to communicate with, assist and take care of existing Community members.
- Big data and analytics management. Includes the collection of information by the SYNCHRO-NET platform, which can be used for further research and development.
- Cloud and ICT management. This activity concerns the management and maintenance of the technical environment in which the SYNCHRO-NET platform works, in order to guarantee the performance of the different functionalities.

Concerning the key partnerships of the SYNCHRO-NET business model, the stakeholders are at the same time both users of the project solution and partners. Besides them, there are other key partners involved in the project to guarantee the usability of the services:

- Shipping companies. They perform regular transportation of goods overseas.
- Terminal operators. They ensure the safety and the efficient movement of goods in the terminals.
- Technological partners. They are responsible of the maintenance and the updating of the technology, providing also support to the parts in the long term.

Finally, to implement the project and the business model, the main costs that SYNCHRO-NET incurs are related to the key resources and key activities such as maintenance costs for the platform and the optimization tools, personnel costs, and expenditures on business development, R&D and marketing activities. The cost structure includes also the implementation of incentive mechanisms, in order to increase the interest of potential users and thus to reach a critical mass.

7. Conclusions

In this paper, the project SYNCHRO-NET, funded by the European Commission under the Horizon2020 Programme has been analyzed from a managerial perspective. The objective of the project is the de-stressing of the supply chain. The most important output of SYNCHRO-NET will be the demonstration that slow steaming, coupled with synchro-modal logistics optimization, delivers substantial benefits to all stakeholders in the supply chain: reductions in emissions for shipping and land-based transport due to modal shift to greener modes and optimized planning processes leading to reduced empty kilometers for trucks and fewer wasted repositioning movements [10]. After a first analysis of the state of the art in the domain of supply chain optimization and slow steaming, we focused the discussion on the innovative approach adopted by SYNCHRO-NET compared with previous projects: the business orientation of SYNCHRO-NET, aimed at increasing the acceptance by stakeholders and supporting new collaborative business models. The approach of the SYNCHRO-NET project is based on a holistic vision that uses an innovative stakeholder-engagement component, integrating both business and operational models and including the stakeholders' requirements throughout the development process. We presented the implementation of this stakeholder-driven methodology using the example of the initial assessment of stakeholder requirements by means of a survey. Based on the survey results, we discussed the value proposition and the business model of the project using the canvas provided by [13,14]. This approach illustrates the high operational value of knowing stakeholders' requirements in order to develop a solution that meets their needs. Thus, this strategic fit, together with the integration of the operational models with a managerial perspective provided by the business model, facilitates the market acceptance of SYNCHRO-NET as well as the economic sustainability of the project in the long run. A further interesting outcome of the project lies in the opportunity to use the resulting tool by the logistics providers for green certification of their activities. In particular, the SYNCHRO-NET tool can highlight environmental benefits of using a slow steaming strategy, coupled with synchro-modal logistics optimization, by the actors involved (mainly

by the shipping agencies). In [24], interviews with global shipping companies were carried out with the aim of examining the environmental upgrading in maritime shipping. The article deals with the emergence of industry-led initiatives on sustainable shipping, leading to a variety of green rating schemes. In particular, shipping companies and cargo owners expect that environmental demand will continue to develop, but, for further improvements, it is essential to have a closer alignment between the different initiatives. As emerged in [25], currently there is a lack of international instruments holding shipping companies accountable for their vessels' performance in the reduction of emissions. In this context, an industry-driven approach to the reduction of vessel-sourced emissions is very important, since a comprehensive international instrument is unlikely to be implemented soon.

Acknowledgments: Funding for this project was provided by the SYNCHRO-NET project, H2020-EU.3.4.—Societal Challenges —Smart, Green and Integrated Transport, Ref. 636354.

Author Contributions: Authors contributed equally to design the research and writing the paper. All authors proofread and approved the final manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. WTO. Trade Recovery Expected in 2017 and 2018, Amid Policy Uncertainty. 2017. Available online: https://www.wto.org/english/news_e/pres17_e/pr791_e.htm (accessed on 10 October 2017).
2. Halim, R.A.; Kwakkel, J.H.; Tavasszy, L.A. A strategic model of port-hinterland freight distribution networks. *Transp. Res. Part E* **2016**, *95*, 368–384.
3. Bonney, J. Carriers Move Full Speed into Slow Steaming. *JOC* **2010**. Available online: http://www.joc.com/maritime/carriers-move-full-speed-slow-steaming (accessed on 10/10/2017).
4. Lee, C.Y.; Lee, H.; Zhang, J. The impact of slow ocean steaming on delivery reliability and fuel consumption. *Transp. Res. Part E* **2015**, *76*, 176–190.
5. Crainic, T.; Perboli, G.; Rosano, M. *Simulation of Intermodal Freight Transportation Systems: A Taxonomy*; Technical Report, CIRRELT-2017-51; CIRRELT: Montreal, QC , Canada, 2017.
6. Perboli, G.; De Marco, A.; Perfetti, F.; Marone, M. A new taxonomy of smart city projects. *Transp. Res. Procedia* **2014**, *3*, 470–478.
7. Bol Raap, W.; Iacob, M.E.; van Sinderen, M.; Piest, S. An architecture and common data model for open data-based cargo-tracking in synchromodal logistics. In Proceedings of the OTM Confederated International Conferences "On the Move to Meaningful Internet Systems", Rhodes, Greece, 24–28 October 2016; Springer: Cham, Switzerland, 2016; pp. 327–343.
8. Li, L.; Negenborn, R.R.; De Schutter, B. Distributed model predictive control for cooperative synchromodal freight transport. *Transp. Res. Part E* **2017**, *105*, 240–260.
9. Kapetanis, G.N.; Psaraftis, H.N.; Spyrou, D. A simple synchro—Modal decision support tool for the piraeus container terminal. *Transp. Res. Procedia* **2016**, *14*, 2860–2869.
10. SYNCHRO-NET. Project Web Site. 2016. Available online: http://www.synchronet.eu (accessed on 10 October 2017).
11. The GUEST Initiative. 2017. Available online: http://www.theguestmethod.com (accessed on 10 October 2017).
12. Perboli, G. The GUEST Methodology. 2017. Available online: http://staff.polito.it/guido.perboli/GUEST-site/docs/GUEST_Metodology_ENG.pdf (accessed on 10 October 2017).
13. Osterwalder, A.; Pigneur, Y. *Business Model Generation. A Handbook for Visionaries, Game Changers, and Challengers*; John Wiley and Sons, Inc.: Hoboken, NJ, USA, 2010.
14. Osterwalder, A.; Pigneur, Y. *Value Proposition Design: How to Create Products and Services Customers Want*; John Wiley and Sons, Inc.: Hoboken, NJ, USA, 2014.
15. ALICE. Alliance for Logistics Innovation through Collaboration in Europe Web Site. 2017. Available online: http://www.etp-logistics.eu (accessed on 4 October 2017).
16. Chen, L.; Yip, T.L.; Mou, J. Provision of Emission Control Area and the impact on shipping route choice and ship emissions. *Transp. Res. Part D Transp. Environ.* **2017**, in press, doi:10.1016/j.trd.2017.07.003.

17. Cariou, P. Is slow steaming a sustainable means of reducing CO_2 emissions from container shipping? *Transp. Res. Part D* **2011**, *16*, 260–264.
18. FLAGSHIP. Project Web Site. 2016. Available online: http://www.flagship.be (accessed on 4 October 2017).
19. e-Freight. Project Web Site. 2016. Available online: http://www.efreightproject.eu (accessed on 4 October 2017).
20. e-Mar. Project Web Site. 2016. Available online: http://www.emarproject.eu (accessed on 4 October 2017).
21. CORE. Project Web Site. 2016. Available online: http://www.coreproject.eu (accessed on 4 October 2017).
22. Roso, V.; Piquer, S.; Teraphongphom, N.; Stefansson, G. Drivers and barriers to innovative logistics practices. In Proceedings of the 1st Logistics International Conference, Belgrade, Serbia, 28–30 November 2013.
23. SYNCHRO-NET Consortium. *Grant Agreement*; EU Commission, Bruxelles 2015.
24. Poulsen, R.T.; Ponte, S.; Lister, J. Buyer-driven greening? Cargo-owners and environmental upgrading in maritime shipping. *Geoforum* **2016**, *68*, 57–68.
25. Rahim, M.M.; Islam, M.T.; Kuruppu, S. Regulating global shipping corporations' accountability for reducing greenhouse gas emissions in the seas. *Mar. Policy* **2016**, *69*, 159–170.