

# Development of Collaborative and Sustainable Supply Chains

## The Agroindustry By-Products Case Study

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October 2018

### ABSTRACT

The agro-food sector in Portugal corresponds to 4.1% of GDP and involves more than 11,000 companies throughout the supply chain (Federação das Indústrias Portuguesas Agro-Alimentares, Maio 2011). Considering the fragmentation and disarticulation of this industry, as well as the need to develop dependence on direct and inverse flows, collaboration between companies should be studied as this can have a positive impact on the environmental, social and economic performance. In this context, the present work aims to understand how supply chains have been dealing with sustainable objectives, and what is the collaboration potential advantage to the improvement of sustainability in supply chains. A methodology is developed, which proposes a possible path for companies that want to develop a sustainable-collaborative work. Such methodology is applied to a company of ETSA Group, Abapor, that works in the collection of by-products in the retail channel. Considering this, the goal is the Abapor's supply chain optimization considering the exploitation of potential collaboration actions through other entities in their supply chain.

### Keywords

Sustainable-collaborative methodology; Agro-food sector; MobFood project; PPS-7; Abapor.

## 1. INTRODUCTION

In Portugal, the agro-food sector corresponds to around 4.1% of GDP and involves more than 11,000 companies throughout the supply chain (Federação das Indústrias Portuguesas Agro-Alimentares, Maio 2011). This large number of entities reveals a significant fragmentation of resources, starting with producers, following with logistics operators, retailers and ultimately final consumers. However, given the urgent implementation of sustainable measures in this chain, in addition to the direct flow of products (from producers to consumers), the reverse flow has been also explored, which takes into account the recovery and valorisation of the wastes generated in the direct flow. Given the identified fragmentation and disarticulation of this industry, as well as the need to develop dependence between direct and inverse flows, the *PPS-7 - Logistics - Sustainable Collaborative Agro-Food Logistics Chain* was created within the *MobFood project - Mobilization of scientific and technological knowledge in response to challenges*. The companies involved are: ETSA Group with Abapor, as a by-product collector; SONAE as a retailer; and Olano and Greenyard as logistics operators. In addition to these, the *Instituto Superior Técnico* and the

*Faculdade de Engenharia da Universidade do Porto* will also integrate the group of partners, these being non-entrepreneurs and intending to share and exploit scientific knowledge. This project believes that collaboration between companies can have a positive impact on environmental, economic and social performance. It is in this context that this dissertation was developed. Thus, the proposal of approach was the study of the direct interactions between the retail and the processes of collection of by-products, considering the actors' operations analysis to characterize the initial performance situations and to identify possible collaborative opportunities. These are intended to optimize the chains from the point of view of sharing knowledge and resources.

### 1.1. Dissertation objectives

To achieve the aimed result of the overall supply chain optimization will be necessary to: understand the MobFood project, specifically the PPS-7, in terms of goals, partners and other important aspects; study how has been evolving the agro-food industry considering the future challenges; explore supply chains in terms of definitions, structures and other relevant aspects, bestowing sustainability and collaboration as important integrated aspects; find examples of real integration of all these aspects to

achieve sustainable and collaborative supply chains; develop a general methodology to be implemented when a sustainable-collaborative work is considered; and to implement the methodology developed in a real case study, in this case, considering Abapor on the PPS-7 context.

At the end, it leads to the identification of opportunities for the overall supply chain optimization considering not only Abapor but the other PPS-7 partners, aiming the improvement of its sustainable aspects and the construction of collaborative strategies, always with the continuous development perspective.

## **2. THE MOBFOOD PROJECT: THE PPS-7 PERSPECTIVE**

The MobFood project is the result of an open debate between several agents from the agribusiness. With the goal of find the right path to construct an organized and integrated future in the national agro-food industry, it aims to construct a close collaboration between entrepreneur and non-entrepreneur entities to turn the sector totally sustainable, resilient, open, safe and with a resources usage optimization. This project includes 9 PPS (Post-Program Surveillance) and the present work is developed within PPS-7. It aims to characterize different logistics activities of the agro-food sector, integrating sustainable aspects and possible collaborations in the chain. Based on motivations, constraints and requirements of logistics and sustainability, it intends essentially to reduce waste and environmental negative impacts. The general output of PPS-7 will be the development of processes management methodologies to support decisions in the chains in an integrated and collaborative way.

As said before, this project is composed by 4 entrepreneur companies: ETSA with Abapor, SONAE, Olano and Greenyard. In this line, some aspects can be mentioned regarding them. ETSA is a specialized company in the transformation of by-products, extremely focused and supported by sustainability with the waste revaluation activities. It is a company with history, structured and integrated in the Semapa Group, that has an important paper in the national economy. Through the core business ETSA is focused in innovation and development, that aims to consider collaborative processes, not only internally but also externally, taking into account the synergies into Semapa. Considering both the experience in operations related to the revaluation of by-products, and the availability and knowledge about the establishment of collaborations and synergies, ETSA was identified as a potential good collaborator. SONAE is a Portuguese multinational company very recognized, being a well-structured, diversified and consolidated organization. Due to its success, antiquity and

interventional areas, as well as its national and international presence, it is a company with experience and knowledge. In the sustainability context has already developed some projects and gain some awards. Considering the experience in several businesses, the food retail flow in a quantitative and qualitative perspective, and its interest in the sustainability improvement, SONAE is a potential good collaborator. Greenyard is a multinational company specialized in the distribution of fresh, prepared and frozen products and other horticultures, having also a group of jointed companies with strong relationships, valuing communication. This company has established a set of strategical goals towards sustainability considering environment, sustainable development, products and employees. With this, Greenyard turns a potential good collaborator due to the quantitative and qualitative flows of its products and the establishment of strategic-sustainable goals, suggesting an organized and targeted perspective. Lastly, Olano works specifically in the cold chain, being composed by a familiar and structured group that turns possible the international intervention. This company has also experience in the establishment of partnerships and synergies, constituting it at a potential good collaborator, not only due to this experience but also due to the core business be specific, which leads to a focused perspective.

Regarding this, each company will help in the project with a distinct approach, potentializing the success through new ideas and perspectives.

## **3. LITERATURE REVIEW**

The present chapter consists on the review of the existing literature, aiming to provide knowledge and approach to the problem under study. In view of this, it intends to analyse the agro-food industry, identifying the major challenges and opportunities to the future; explore the concepts of sustainability and collaboration; and the presentation of methodology's approaches to the integration of sustainability and collaboration in supply chains.

### **3.1. Agro-food industry**

This industry goes from the supply of agricultural inputs to the consumption. It is characterized as a set of activities related to the transformation of raw materials into final products, guaranteeing their availability to the final consumer. This industry is the central entity between the primary sector (agricultural production, livestock and fisheries) and the distribution (retail, wholesale market and HoReCa - Hotels, Restaurants, and Cafes - channel), generating around 3,000 million euros and employing about 110 thousand workers (Deloitte Consultores, S.A., 2012). In this line, the agro-food industry was identified as the most important sector

in the national economy (Ginting, 2015), the most regulated European activity sector and as a chameleon industry due to its adaptation need (Yakovleva, 2008). These characteristics will support and help the sector's continuous development. Regarding this, we identified some development perspectives considering the market trends and the world needs, resulting essentially in the development of sustainable products and chains to face the future world supply (ENEI; IAPMEI; FCT; ANI; COMPETE, 2014).

Through this, it is important to understand the supply chains and its management, defining concepts and explore how it is functioning.

### 3.2. Supply chain and its management

Supply chain is a set of combined processes that produces value, including all the entities in an organization's network, aiming to fulfil the requirements of the customers. The management of these processes is named supply chain management, including the planning, implementation and control of all supply chain in terms of e.g. operations, resources and information. The supply chain control is a critical activity into supply chain management and must be performed to guarantee the continuous development of the chain. In view of this, a set of approaches were explored considering the implementation of key performance indicators (KPI), the development of a total cost ownership (TCO), the construction of a balanced scorecard (BSC) or the development of a maturity assessment

(Liebetruht, 2017). KPI are important strategic metrics that often represent a balanced set of aspects, as productivity, utilization, or performance in general. To study the general perspectives implemented, 3 authors were analysed. For Keebler (1999) it focuses on external and internal metrics, as metrics of cost and logistics operations control, with areas as: involved trading partner; internal focus; cost; and productivity. In the point of view of Liebetruht (2005) the focus should be on supply chain classical logistics performance elements, such as, inventory, delivery reliability, and accuracy of planning systems, with areas as: financial metrics; strategic level; and operative level. To Webber et al. (2012) the companies achieve better results through the establishment of a consistent system, where KPI are integrated into operations and strategic levels, as well relating its own performance to their most important external partners. This author includes areas as: logistics cost metrics; customer metrics; process metrics; and financial metrics (Liebetruht, 2017). TCO is a method to analyse how other quantitative and qualitative factors, not only the purchasing price of a product, can affect the cost of a product over its acquisition process, or even, its lifetime (Liebetruht, 2017). On the other side, BSC is a top down instrument for defining organization's goals, with the key notion that firms must go beyond financial measures. It is constructed through a strategy map, including 4 key performance measurement areas: financial, customer, internal operations and innovation (a learning perspective).

**Table 1 – Measurement approaches evaluation regarding the fulfillment of the indicated criteria. Adapted from (Liebetruht, 2017)**

Aspects	KPIs	TCO	Balanced Scorecard	Maturity Assessments
Multidimensionality	Yes, KPIs can be very diverse	No, only focus on cost and cost-evaluated effects	Yes, idea of instrument	Yes, instrument is flexible enough to cover many dimensions
Understandable and evidence-based cause-effect-relationships	Not necessarily	Only with focus on cost and cost-evaluated effects	Yes, possibly based on empirical evidence	Yes, possibly based on empirical evidence
Free of redundancies and inconsistencies	High risk	Limited risk as only costs are calculated	Preparation of strategy map limits the risk	Possible, but it must be addressed in the process of designing
Consistency with goals, business strategy and incentive system through the capture of SCM and sustainability aspects	Special KPIs on SCM and sustainability can be defined. Consistency must be assured for each KPI, outside the system	Instrument can be used to support SCM and sustainability but is not comprehensive; TCO can be one aspect to align actions with goals, strategy and incentives.	Alignment with incentive system can be established and aspects of SCM and sustainability actively integrated	Instrument is very flexible but time-consuming, it can be linked to the incentive system
Reliability of measurement process and acceptance by users	Originally no reference on the measurement process. Must be established for each KPI separately	Originally no reference on the measurement process and thus on the acceptance	The process of designing the Balanced Scorecard ensures a high acceptance of stakeholders and users	The process of designing the structure, content and process ensures high acceptance of users; measurement process should be well defined
Action orientation, usefulness and economy	Depends on the fulfillment of the above stated guidelines	Should be able to support decisions on sourcing and logistics	Due to consistency a good chance to induce actions; risk of dilution	Good chance of a high usefulness as processual aspects integrated; risk of over engineering.

The maturity assessment is a comprehensive methodology for measuring and managing performance in a specific field, offering a framework to assess the effectiveness and efficiency of that field. To choose an approach there exist some criteria that should be considered. In view of this, the approach must be: validated, robust, available of information, controllable, control-span adherent, multidimensional, understandable, free of redundancies and inconsistencies, reliable, action-oriented, useful and economic. Considering some of these criteria in is provided an evaluation of the above presented approaches in order to choose the most appropriated tool. The chosen approach can be applied to several subjects. Considering this project, the awareness about the on-going and rapid worldwide industrialization indicates the importance of implement sustainable manufacturing and processing. With this, sustainability has been studied and some aspects will be presented in the next section.

### **3.3. Sustainability**

The perspective inherent to the development that meets the needs of the present, without compromising the needs of the future, is viewed as the sustainable development. The Brundtland report in 1987 leads to the emergence of eco-innovation and sustainability-oriented innovations, as the integration of ecological and social aspects into products, processes and organizational structures ((WCED), 1987). In this line, FoodDrink Europe (FoodDrink Europe - Official Site, 2018) is an organization that helps the industry and is working on the implementation of the UN SDGs (United Nations Sustainable Development Goals), that are 17 with 169 targets, which guide companies towards more and more sustainable measures. To achieve it, all companies must be aligned and invest in innovation due to the need of products, processes or services improvements. The innovation development can be done in terms of processes, organization and product levels (Organization for Economic Co-operation and Development (OECD), 2005). It requires management efforts that balance the environmental, social and economic goals, that lead to the concept of sustainable supply chain management. This type of management is viewed as a strategic and transparent integration of sustainability, associated to the procurement, production and distribution activities, to achieve the stakeholders' requirements and improve the profitability, competitiveness, and resilience of the supply chain (Ahi, 2013). Considering this, the development of sustainable supply chains creates an opportunity to competitive advantage that is being very important nowadays. This sustainable supply chain development requires the knowledge of the supply chain current state. From a sustainability perspective KPI is the most used approach, aiming

to summarize data related to environmental impact, to the workers in their work environment and to the economic perspective. When well-defined KPI can create evolutionary expectations and lead to actions. However, all these developments and innovations require economic, social and environmental responsibility from companies. And, due to the legal obligation, it is also important to take knowledge and construct the sustainability plan aligned to the sustainable goals and strategies and the imposed legislation (Fernandes, 2008).

In that point of view, Hockerts and Wustenhagen (2010) said that the transformation of industries requires the interplay between new entrants and with all stakeholders involved, turning collaboration as a way for sustainable success.

### **3.4. Collaboration as a competitive advantage**

The required transformation of industries needs the interplay of all stakeholders, so collaboration is viewed as a strategic solution for companies to accomplish the new world trends. In supply chain it can be viewed as a partnership process between two or more entities with the overall goal of adding value to the chain. This value creation requires the establishment of a trust base to achieve the complete capacity of entities to collaborate, cooperate and acquire, capture, exchange and assimilate knowledge. In terms of perspectives, 2 types of collaboration were identified: in-in collaboration and in-out collaboration. The first one is related to the establishment of collaborative processes inside of a supply chain or company, between departments or operational areas. The second perspective consists in the definition of collaborative processes between the company or supply chain with external entities. Regarding this, the collaboration process requires information sharing, joint and non-individual conflict planning and resolution, collaborative performance measurement and sharing of resources and capabilities. The benefits of stablishing collaboration are related to the cost reductions, sharing of risks, resources complementing, faster response processes, knowledge transfer, and the improvement of service delivery. However, the scenario can be also negative due to lacks that can be crucial into the overall collaboration process. In conclusion, to achieve a successful collaborative supply chain is important to align goals at a strategic level but also understand the processes, at an operational level.

The research project has the goal of developing sustainable and collaborative supply chains and it is important to mix the information presented before and explore strategies to apply on supply chains to create collaborative strategies to improve the sustainable performance.

### 3.5. Development of sustainable and collaborative supply chains

Through the integration of sustainability and collaboration in supply chains were identified 2 approaches: one to integrate sustainability and other to integrate collaboration. With this, was identified a lack of literature considering the development of methodologies both sustainable and collaborative to be integrated in supply chains. In view of this will be presented both approaches. To the development of sustainable supply chains, it must be aligned with the business strategic plan. Considering the methodology proposed by the International Institute for Sustainable Development (IISD) (Fernandes, 2008), to integrate sustainability must be: developed a stakeholders' analysis; established a set of goals and policies; constructed an implementation plan; chosen the performance criteria to evaluate the overall performance, wrote reports and control all the processes. An area that has been developed through the sustainability implementation is the reverse logistics, an important structure incorporated in supply chains to achieve closed-loop chains. It leads to several advantages as the reduction of inputs of energy and outputs of emissions, implementation of energy recovery and materials cycles, development of market opportunities, reduction of costs and resources utilization, employment growth or the achievement of community improvements. However, the purchase costs and habits of the consumers or the lack of business compromise can be limitative.

To implement collaboration, the chosen methodology was proposed and developed by Ivo de Carvalho (2017) and aims to map all physical, administrative and temporal flows, establishing a strict relationship between supplier and retailer, promoting the identification of opportunities and the optimization of the operational processes. It can provide higher efficiency, the development of business synergies, higher quality or the more predisposition to implement innovation in the chains. However, it is important to consider that the collaborative process not only be positive and has limitations which can compromise the overall process, as trust, lack of real knowledge, cultural barriers or unfitted interventional plans.

## 4. SUSTAINABLE AND COLLABORATIVE METHODOLOGY

The proposed methodology (see Figure 1) is a general and operational path for companies to establish collaborative actions, achieving a more sustainable performance. It is a continuous plan and must be carried out through a continuous development perspective, triggering improvement measures, as the resources allocation optimization or an implementation plan review, to address possible failures in the implementation plan. To resume this

methodology, all the steps will be described in a briefly way:

**1<sup>st</sup> step – Company's alignment:** This step provides a full internal knowledge of the company interested in beginning a collaborative work to promote a sustainable supply chain with their partners. This holistic knowledge includes (1) the validation of the intention to develop the project considering the strategic and sustainable goals of the company; (2) the construction of a physical, administrative and temporal mapping, important to understand the current state operations and flows, developed in an Excel standard sheet; (3) the identification of relevant sustainable parameters and issues; and, lastly, (4) the identification of opportunities. Into this step, considering the identification of sustainable parameters, a set of KPIs was defined. Such KPIs includes operational, environmental, economic and social indicators. The operational indicators are related to the processes and operations, considering the products flow, the operations' time and the resources utilization. It aims to identify optimization opportunities in terms of processes and operations. The environmental indicators consider the resources, wastes, emissions and the consumption of water and energy. This analysis pretends to provide to the team work a tool to the identification of opportunities, aiming the reduction of the company's environmental impact. The economic indicators are indicators of control. This means that they will serve as a basis for sustaining collaboration and development activities. By implementing these measures, they help to ensure that there are no significant financial impacts that put the company at risk. On the other hand, good economic indicators show a company consolidated financially, and can thus develop sustainably. The social aspects are, mainly, related to the human resources, considering their health and safe, as well as the discrimination factors. It pretends to increase the employees' value and to reduce the discrimination potential.

**2<sup>nd</sup> step – Stakeholders' analysis and selection:** Since the goal of the present methodology is the promotion of collaborative processes, the selection of the stakeholders is a crucial step. This step considers: (1) the identification of stakeholders that have influence in the identified opportunities; (2) a stakeholders' analysis to understand their behaviour and influence on the company; and, finally, (3) the stakeholders' selection and prioritization.

**3<sup>rd</sup> step – Kick-off meeting:** The identified stakeholders are invited to a meeting with each of them, where the project is presented to the company understand if the stakeholder is available to collaborate in a sustainable-collaborative work.

**4<sup>th</sup> step – Integrated mapping:** This step consists on a construction of an integrated mapping to identify the common lacks and to study the

interactions between the entities. Through the developed Excel standard sheet, the entities must design its own supply chain mapping. Considering this, the final product will be a holistic mapping where a set of opportunities must be identified and well-characterized.

**5<sup>th</sup> step – Implementation plan:** A final list of sustainable and collaborative goals is made considering the characterization of each opportunity through 5 parameters: (1) current state; (2) methodology; (3) requirements; (4) solution and (5) KPI. After must be developed a schedule of each opportunity. This step ends with a top management meeting alignment where the relevant decision-making entities of each company sign a compromise document.

**6<sup>th</sup> step – Control:** This step occurs to ensure the monitorization of the KPI previously defined in the step 5. It is important to mention that is essential the information sharing through all the entities involved and the book of control meetings.

In short, the development of this methodology fills a gap in the literature, identified before, in terms of methodologies that integrate both the collaboration between different entities and the optimization of the sustainable performance of the chains. The dissertation thus creates a simple and operational work tool that can be applied to any company that aims to increase sustainability and intends to work in partnership.

Considering the MobFood project, in the next chapter this methodology will be implemented with Abapor as the applicant company.

## 5. CASE-STUDY: METHODOLOGY APPLICATION

After implementing the entire methodology, even though it has not been completely implemented in the last two steps, the results obtained can be summarized mentioning the positive points and limitations of the implementation. It is recalled that these limitations are due to the time horizon stipulated for the conclusion of the dissertation and that the methodology consider only the meat chain in the SONAE-Abapor relationship. To present this work it will be divided in 2 phases: the Abapor's contextualization; and the methodology implementation.

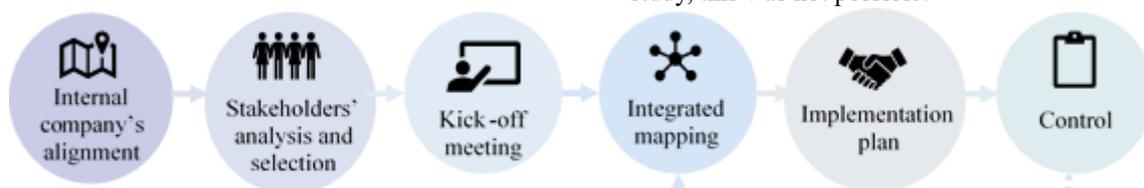


Figure 1 - Proposed sustainable-collaborative methodology.

### 5.1. Abapor's contextualization

As a contextualization of the case study, an overview of Abapor, an animal by-products collection entity, was presented, considering the products with which it deals, its infrastructures and the SWOT analysis developed. It was concluded that: (i) Abapor deals mainly with an M3 by-product, characterized by a negligible risk of disease transmission (low risk); (ii) it has 4 infrastructures in the territory of Continental Portugal to centralize the collections by zones given the decentralization of the collection points. This has collection and sorting centers in Vila Nova de Gaia, Coruche and Loures and a collection center in Tunes; (iii) and SWOT analysis supports the implementation of the methodology as well as the development of PPS-7. This is given the intention of exploring new markets, optimizing operations in the meat chain and improving relations with stakeholders.

### 5.2. Methodology implementation

With the objective of developing a collaborative-sustainable work, the methodology developed was implemented in this case study. With this implementation it was possible to draw some conclusions and also limitations, both at the methodology and implementation level.

In the **first step**, (i) the methodology was validated considering the strategic and sustainable objectives of Abapor; (ii) the work team was assigned to Abapor consisting of a member working full time with direct collaboration with the Logistic Director; (iii) the macro and micro mappings were built taking into account the global chain of Abapor; (iv) the analysis of Abapor's sustainable performance was developed; (v) and with the data related to mappings and the analysis of sustainable performance were identified opportunities for improvement in the chain (see Table 2). The limitations identified at the methodology level include the non-adequacy of all proposed KPIs for this specific analysis, and the identification of opportunities to be addressed both internally and collaboratively. Internal ones will not be considered regarding the collaborative basis inherent to the implementation of the methodology. In terms of limiting the application of the methodology, conclusions were drawn regarding values taking into account the ETSA Group and an individual analysis of Abapor should have been achieved. However, given the time horizon of this study, this was not possible.

**Table 2 - Identified opportunities considering Abapor's supply chain analysis.**

Operational opportunities	Chain phase
<b>Plastic reduction:</b> Find alternatives to plastic for the packaging of products and deposition of by-products. This will improve the environmental sustainability performance, reducing the amount of plastic in the process.	<b>Suppliers (1)</b> <u>Intervenients:</u> Retail Abapor
<b>Improving accessibility:</b> Improvement of the collection operation by facilitating access to Abapor's freezers or the chambers where the by-product is located. This will reduce the lead time related to the collection process, improving Abapor's performance.	<b>Suppliers (1)</b> <u>Intervenients:</u> Retail
<b>Better retail waste control:</b> Quantification of waste to ensure that no waste is sent to the organic waste that can go to Abapor.	<b>Suppliers (1)</b> <b>Collection operation (2)</b> <u>Intervenients:</u> Retail Abapor
<b>Look at alternatives to products conditioning:</b> Given that there are some problems detected with the coffers and given that the coffers are expensive to maintenance or replacement, it is important to consider other options for storing the by-product in store.	<b>Suppliers (1)</b> <u>Intervenients:</u> Retail Abapor
<b>Reduction of by-products' bags weight:</b> Given the identified problems arising from the excessive weight of bags of by-products during the collection process, it is important to find alternatives to make this process more comfortable for the human resources. This will increase the operational performance, also avoiding work accidents.	<b>Suppliers (1)</b> <u>Intervenients:</u> Retail Abapor
Tactical opportunities	Chain phase
<b>By-product weight information:</b> Obtain by-product weighing by collection point. This will improve the route optimization collection process. Although a guide is delivered to the pick-up point, the real weight of the by-product is not discriminated against and is derived from a weigh-in made by the operator of the collection.	<b>Suppliers (1)</b> <u>Intervenients:</u> Retail
<b>Scheduling of by-product collection:</b> To avoid collision of the delivery time of goods in store and collection of by-products, there should be a schedule of by-product collection for each collection point. This improve the collection process performed by Abapor, avoiding also the crossing of the by-product with products reception.	<b>Suppliers (1)</b> <b>Collection operation (2)</b> <u>Intervenients:</u> Retail Abapor
<b>Collection price optimization:</b> Taking into account the increasing costs of resources, an analysis of these costs is necessary for financial sustainability in order to understand whether Abapor is practicing the appropriate price for the by-product collection process.	<b>Collection operation (2)</b> <u>Intervenients:</u> Abapor
<b>Routes optimization:</b> Taking into account the history of by-product flow collected at each collection point, it is possible to optimize routes. However, the sharing of retail information with Abapor, taking into account the lack of a by-product in the collection process or the exceedance of by-products that require the urgent collection of the same, are also important factors for this optimization.	<b>Collection operation (2)</b> <u>Intervenients:</u> Abapor
Strategical opportunities	Chain phase
<b>Increase in the portfolio of products collected:</b> Looking at the retail there are many by-products that are not yet collected and therefore sent to landfill. Regarding this, Abapor should explore these opportunities in order to increase the range of end-of-life products.	<b>Collection operation (2)</b> <u>Intervenients:</u> Retail Abapor
<b>Find options to the revaluation of dry and dairy products:</b> Although the processing is not within the competence of Abapor, the meeting of options for the valorization of dry and dairy products other than incineration can bring economic benefits during the referral process.	<b>Operations unit processes (3)</b> <u>Intervenients:</u> ETSA Group
<b>Find options to the plastic wastage:</b> If it is not possible to drastically eliminate plastic, it is necessary to find solutions for the revaluation or disposal of wasted plastic. This is an important factor in increasing Abapor's sustainable performance.	<b>Operations unit processes (3)</b> <u>Intervenients:</u> Abapor

In the **second step**, the project partners were analysed and prioritized through three criteria: (1) the allocation of partners to the opportunities; (2) the study of their contribution, influence and need for involvement; (3) and the evaluation of the partners considering the power/influence matrix. With this, SONAE was the chosen partner for the development of the remaining methodology since this company has achieved the best results. In terms of limitations of the methodology, we can consider (i) the development of the same to think only in collaboration with stakeholders of the base company and not with external entities; (ii) the difficult measurement of factors such as legitimacy and willing to engage; (iii) and the limitation of the power/influence matrix considering the historical performance evaluation. Considering the limitations of implementation, it is possible to mention that the

partners of the project, Olano and Greenyard, are external partners, that is, an adaptation had to be made to be possible to implement this step; and, given the time horizon, only the remaining methodology was developed with SONAE, leaving Olano and Greenyard for future work.

In the **third step**, Abapor performed a meeting with SONAE to initiate the project. In this one, the PPS-7 was remembered and presented the collaborative-sustainable work to be developed with the interaction SONAE-Abapor. In addition to these entities, FEUP and IST were also mentioned as partner entities, in order to promote the sharing of academic information in the development of new knowledge. As a final product of this step, the work to be developed was realized and a SIPOC analysis of SONAE was constructed taking into account the meat chain. No methodological limitations were

identified, however taking into account the implementation from this stage only the meat chain will be explored in detail given the stipulated time horizon.

In the **fourth step**, the integrated SONAE-Abapor mapping of the meat chain was constructed and described (see Figure 2). This step should include the sustainability analysis of SONAE, but this was not possible given the lack of data, which constitutes a limitation of implementation. The methodology has as a limitation the lack of operability of this phase when dealing with large and complex chains, and it is necessary to separate the overall processes into specific operations.

In the **fifth step**, the implementation plan for the opportunities was built. Taking into account each of them has been described their initial state, the methodology that involves their approach, the

requirements, the solution that can be addressed, and the KPIs that can be used to monitor progress. The limitations of the methodology take into account the inexistence of a framework that integrates this plan and its schedule in an effective way and with control and share of adjustments in real time. In the implementation, given the stipulated time horizon, the design approach of the implementation plan was simple having as main limitations the suggested solutions that are not studied in terms of operational and sustainable impact with concrete values, the absence of some operational and sustainable KPIs to measure performance, as well as their measurement in the initial situation. On the other hand, it was also not possible to build a schedule for scheduling activities.

In the **sixth and final step** of the methodology there was no implementation since the work has not yet been developed. Thus, there are no limitations of

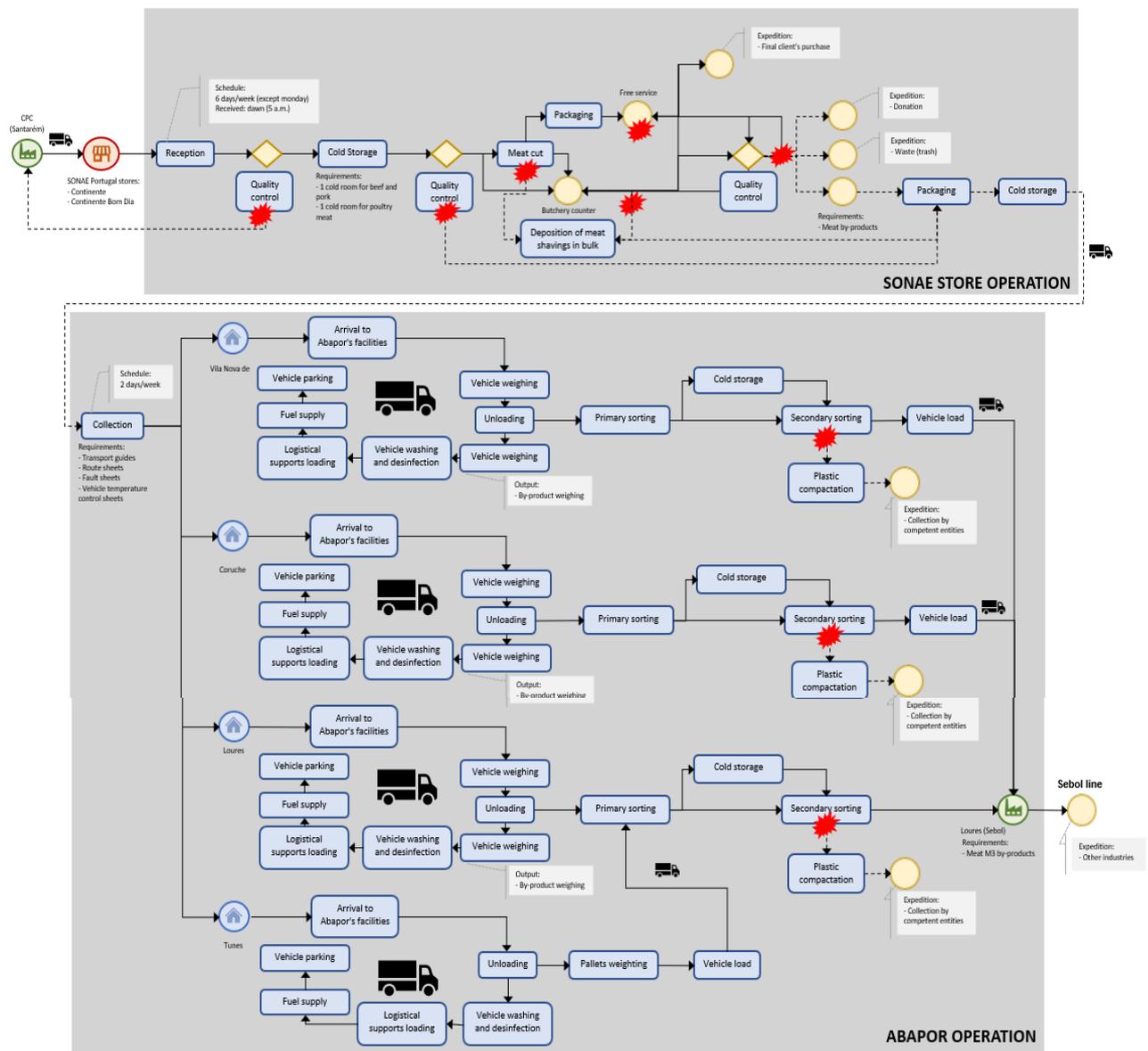


Figure 2 – SONAE/Abapor integrated mapping.

implementation, but in terms of methodology fails to develop a collaborative platform for real-time control of these activities, accessible to all partners.

The application of this methodology promoted the collaborative work with a view to improving the sustainability of the SONAE and Abapor chains. An initial link was established for the companies in the work to be developed in PPS-7.

## 6. CONCLUSIONS AND FUTURE WORK

The challenges of the agro-food chain are related to the fragmentation of the entities involved and the lack of synchronization between the direct and inverse flows led to the elaboration of the PPS-7. It aims the collaboration into the chain, guided by the sustainability pillars. The partners involved – SONAE, Abapor, Olano and Greenyard – are present in different logistics activities of the chain that promotes different levels of collaboration and intervention for the improvement of the global sustainability. In addition, two non-business partners – IST and FEUP – are involved in developing and mastering state-of-the-art investigations, adapting the application to the case study more easily.

Considering the objective of developing a collaborative-sustainable work, a methodology for its implementation was constructed. It promotes the collaboration of the entities involved, aiming at identifying opportunities for joint improvement so that, through their implementation, the processes of both entities can be optimized. According to this, the methodology developed consists of six steps: internal company's alignment; stakeholders' analysis and selection; kick-off meeting; integrated mapping; implementation plan; and control. In the course of these steps it is intended: (i) identification of opportunities taking into account the mapping of the company's based- study as well as the analysis of its sustainable performance; (ii) the selection of stakeholders to collaborate through evaluation criteria, including factors such as allocation with identified opportunities, contribution, legitimacy, willingness to engage, influence and need for involvement, as well as the power/influence matrix; (iii) with selected stakeholders, the methodology foresees the investigation of their interest to collaborate by calling them to a kick-off meeting of the collaborative-sustainable work. At the end of this, the partners will confirm their interest in collaborating; (iv) the construction of an integrated mapping, considering the integration of the operations of the different entities involved and analyzes of sustainable performance. This will

provide a holistic mapping of the integrated chains as well as a final list of the opportunities to be addressed; (v) the development of an implementation plan considering aspects such as the initial state of the opportunity, implementation methodology, requirements for such, solutions to achieve the opportunity and KPI for process monitoring. Additionally, an intervention schedule is also made at every opportunity; (vi) the commitment between the collaborating entities in order to guarantee the commitment in the course of the implementation of the opportunities; (vii) and the control the implementation of opportunities by monitoring the implementation plan by measuring KPI and sharing performance information among partners.

After the methodology delineated, this was applied taking into account the actual case-study, required by Abapor in the context of PPS-7. As final product we obtained: (i) the mapping of Abapor as well as the analysis of its performance in terms of sustainability; (ii) the mapping of meat retail operations on SONAE stores; (iii) the integrated mapping of both entities; (iv) identification of opportunities to improve the global meat chain, taking into account the operations of SONAE and Abapor; (v) the implementation plan of identified opportunities.

After completing the work developed in the dissertation it is possible to verify not only the contribution of this to the academic community for the development of the methodology presented, but also the contribution to the PPS-7 with the characterization of the meat SC through the data presented, the mappings developed, as well as the KPIs proposed for monitoring the chain.

As future work it is necessary to continue with the work stipulated in PPS-7, considering: (i) the optimization of the application of the methodology to the interaction SONAE-Abapor presented; (ii) the application of the methodology to the other PPS-7 partners; (iii) the construction of a framework and dashboard to support implementation management by monitoring identified opportunities.

Taking into account the base company of the case-study and considering that the opportunities exclusively related to Abapor were not approached by limitation of the methodology and recommended as future work the approach of the same ones internally.

In relation to academic knowledge it is important to promote the sharing and consequent publication of the implementation of this methodology in other case studies. This will lead to the optimization of the

presented methodology promoting the collaboration among different companies for the improvement of global sustainability. As a general approach, this can be applied not only to the food industry but also to other areas or industries.

## References

- (WCED), W. C. (1987). Report of the World Commission on Environment and Development: "Our Common Future". *General Assembly Document A/42/427*. Retrieved from <http://www.wbcsd.org>
- Ahi, P. S. (2013). A comparative literature analysis of definitions for green and sustainable supply chain management. pp. 329-341.
- Brown, C., Longworth, J., & Waldron, S. (2002). Food safety and development of the beef industry in China. pp. 269-284.
- Deloitte Consultores, S.A. (2012). Enquadramento Macro-económico da Indústria Agro-alimentar em Portugal. Retrieved 2018, from <http://www.anilact.pt/documentos/deloitte001.pdf>
- ENEI; IAPMEI; FCT; ANI; COMPETE. (2014). Estratégia de Investigação e Inovação para uma especialização inteligente.
- Federação das Indústrias Portuguesas Agro-Alimentares. (Maio 2011). *Políticas de Competitividade para o Setor Agro-Alimentar*.
- Fernandes, M. (2008). Logística e Sustentabilidade: Análise de casos de estudo e tendências.
- FoodDrink Europe - Official Site*. (2018). Retrieved from <http://www.fooddrinkeurope.eu/>
- Ginting, G. (2015). Open Innovation Model: Empowering Entrepreneurial Orientation and Utilizing Network Resources as Determinant for Internationalization Performance of Small Medium Agroindustry. pp. 56-61.
- Hockerts, K., & Wustenhagen, R. (2010). Greening Goliaths versus emerging Davids - theorizing about the role of incumbents and new entrants in sustainable entrepreneurship. pp. 481-492.
- Ivo de Carvalho, M. (2017). Gestão Colaborativa de fornecedores como variável de eficácia e eficiência na cadeia de abastecimento do retalho alimentar.
- Liebetruth, T. (2017). Sustainability in performance measurement and management systems for supply chains. pp. 539-544.
- Organization for Economic Co-operation and Development (OECD). (2005). Guidelines for Collecting and Interpreting Innovation Data. *Oslo Manual*.
- Yakovleva, N. (2008). Measuring the sustainability of the food supply chain: a case study of the UK. pp. 75-100.