sustainability

MDPI

Article

Blueberry Supply Chain in Italy: Management, Innovation and Sustainability

Cristiana Peano, Vincenzo Girgenti, Claudio Baudino and Nicole Roberta Giuggioli *

Department of Agricultural, Forest and Food Sciences (DISAFA), University of Torino, Largo Paolo Braccini 2, Grugliasco, 10095 Torino, Italy; cristiana.peano@unito.it (C.P.); vincenzo.girgenti@unito.it (V.G.); claudio.baudino@unito.it (C.B.)

* Correspondence: nicole.giuggioli@unito.it; Tel.: +39-011-670-8646

Academic Editors: Alessio Cavicchi and Cristina Santini

Received: 9 November 2016; Accepted: 6 February 2017; Published: 13 February 2017

Abstract: The growing trend market of fresh products is driven by a consumer oriented to new lifestyles and environmental issues. The berries market in Europe represents a good example of a consumer driven supply chain, due to the capacity to answer all the sequences of the system. To explore the process developed by fruit growers' associated groups in Italy, the research is organized into four stages. The first stage provides a review of the organization of the fresh fruit supply chain (FFSC) and the need to innovate it in light of the driven demand. The second section focuses on the innovation displayed towards storing, managing and maintaining the quality of fruit during the supply. The third section considers the case study. The manuscript concludes by summarising the main results and discussing the implications for future research. The use of a modified active packaging system (MAP) with "green" films has enabled the maintenance of the quality of the fruits for two months, as well as the presence of the company blueberries market for longer periods, and has finally led to improving the exports, thus reaching new European countries, increasing the turnover of the associated group and better remuneration for the fruit growers as a consequence.

Keywords: blueberry; postharvest; innovation; sustainability; supply chain

---

1. Introduction

In the European Union (EU), just over 2.3 million hectares are devoted to the production of fruit and berries. With 636,000 hectares (or 27.1% of the EU total) devoted to the production of fruit, Spain was the leading EU Member State in 2015 terms of production area of fruit (EUROSTAT 2016). Within the EU, around 17 million tons (T) of EU fruit are shipped among Member States. Germany, France and UK represent the major recipient markets (12 million T, Freshfel 2014). Spain is the main supplier country, accounting for a volume of almost 11 million T shipped to other EU-28 countries. The Netherlands ranks second, with 5.4 million T (including both domestic and re-shipped produce). Italy and Belgium both ship close to 3 million T to other EU countries.

With regard to blueberries, 1.2 billion lbs. are produced worldwide, of which 54.2 million lbs. are produced in Europe: 40% produced in Southern Europe, 34% in Northern Europe and 26% cultivated in Eastern Europe. Around 5.7 million lbs. of this total is produced in Italy, which has experienced important growth in the last five years (3.9 million lbs. in 2010). The growth of the market is higher than 25% per annum, led by the Netherlands, Nordic countries, Germany, Austria and Switzerland [1]. To-date, the growth trend concerns the fresh product to an important extent and is driven in particular by a new, more informed consumer who chooses new lifestyles (consumption outside the home) and often has a higher income [2,3]. Such growth has been furthered to an important extent in the UK, where the berries have been heavily promoted by marketing campaigns. They are seen as a "super food", and their size and consistency make them very easy to pack, sell, buy and eat [4]. The British Summer Fruits board has run public relations campaigns featuring berries all year long. One of the most efficient campaigns was "Eat smart", promoted nationwide with the support of journalists, celebrity food bloggers and influencers [4].

In this positive scenario, there are also numerous signs which indicate that the supply chain does not completely satisfy the requirements of demand such as variety, quality features, food safety, convenience and duration of the presence of the fresh product in the store [5]. Furthermore, the retailers are increasingly being forced to become more demand-oriented; in other words, to continually seek to adapt the supply capacities to the changing needs of the consumers [6,7]. It is, however, important to emphasise that in a demand-driven supply chain, all the operators in the chain are involved and reactive so as to satisfy the various and variable needs promptly and economically [8–10]. It is therefore necessary to implement a system for sharing the information so that the farms and warehouses can rapidly adapt themselves to the changes in demand [11,12].

For the purpose of exploring the process of adaptation to the market requirements with regard to blueberries by a group of farms associated with a fruit and vegetable co-operative operating in Northern Italy, the research is organised into four stages: stage one provides a review of the organisation of the fresh fruit supply chain (FFSC) and its innovation needs in relation to demand-driven aspects; the second stage is focused on the importance of the innovations in relation to the storage and maintenance of the quality features of the fruit during the supply chain; a specific case study is considered in the third stage; and the paper concludes by summarising the main results and discussing implications for future research.

2. Fresh Fruit Supply Chain (FFSC) Characteristics and Innovation Needs

The structure of the Fresh Fruit supply chain (FFSC) (Figure 1) may have different configurations, but the basic elements remain unchanged [13]. FFSC implies reasoning at the same time with regard to field production, storage, packaging, warehousing, transportation, distribution, marketing and consumption, or rather a "farm-to-fork" system [14]. For a satisfactory optimisation of the system, the various sequences must be handled and innovated in an integrated manner [15,16]. With a view to the demand-driven FFSC, the quality of the fresh fruit becomes a fundamental element and parameters such as sweetness, firmness, flavour and their maintenance are basic requirements. These considerations, which go beyond the need to reduce losses due to deterioration to a minimum [13], make the FFSC more complex and more difficult to manage than others [17].

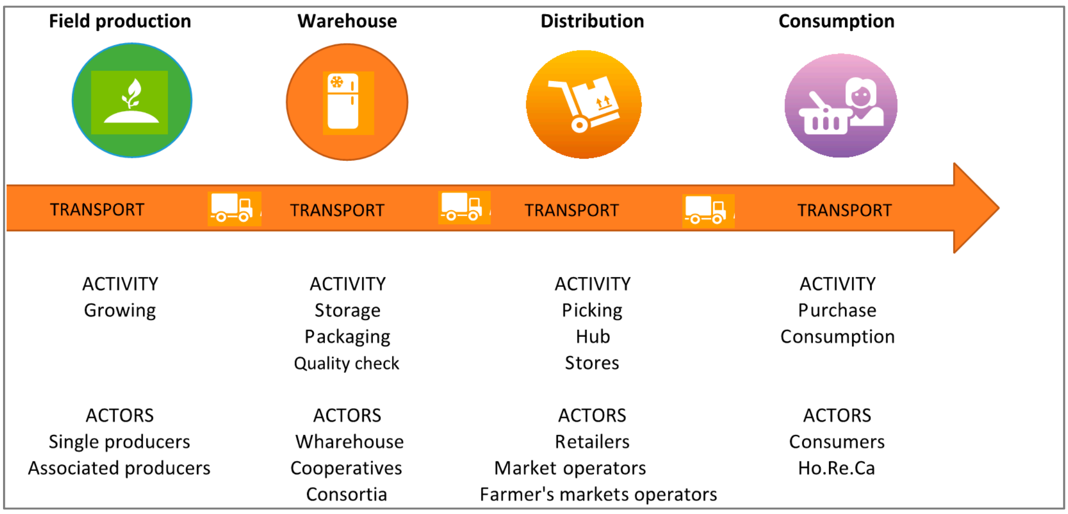

Figure 1. Fresh Fruit Supply Chain (FFSC) conceptual framework.

2.1. Field Production

Fruit production involves various types of input, in particular, soil, water, fertilisers and pesticides, and is strictly linked to a series of factors of uncertainty such as diseases, the climate and the market. Producing includes activities such as pruning, thinning out, fertilization and irrigation. One of the aspects which most characterises the sector is that a fruit tree requires years to reach full production and therefore the strategic implementation decisions (choice of the species, the cultivated variety, and the cultivation techniques) must be made long before the demand and the sales prices are known [18]. The current trends towards high quality standards, environmental and social sustainability and work safety norms impose the need for a careful selection of the agricultural technologies to be used [19]. Specifically, over the last few years, the use of precision agricultural techniques (geospatial instruments) has had the aim of furthering agricultural efficiency and environmental sustainability [20–22]. It is important to emphasise that the topic of environmental sustainability is increasingly emerging (see the greening action in the various measures of the CAP European Union) as a question of fundamental importance which must be taken into consideration during the planning and handling of the FFSCs, in particular considering the balance between environmental impacts and profitability [23]. As emphasised by Van der Vorst et al. (2009) [24] in fact, the investment in food design in the future must not be aimed exclusively at improving the performances of logistics, but also at maintaining the quality of the food and the environmental sustainability. In conclusion, the handling of agricultural waste, and in particular the use of by-products from agricultural production with sustainable methods, as proposed by Ajila et al. (2012) [25], must be considered a priority action which could provide not only environmental benefits but economic ones as well.

2.2. Storage, Packaging and Warehousing

The fresh fruit is mostly selected after harvesting (in the field or in the warehouse) according to criteria which concern the dimensions, weight, colour, form and the main qualitative features. Even if it is not equally possible for all fruits, this process is increasingly automated [26,27]. However, with regard to the qualitative features, it is important to emphasise the continual and significant evolution of the quality throughout the supply chain [17,28–33]. In this regard, Verdouw et al. (2010) [34] maintained that the handling of the fresh fruit supply chain requires particular considerations so as to maintain the freshness and quality of the product, which involves more limited delivery times and more greatly controlled conservation conditions (low temperature, post-harvest physical, chemical and gaseous treatments, etc.). Another fundamental step in this stage of the FFSC is packaging and labelling, which today may present numerous opportunities for innovation. Public opinion considers packaging to be surplus and often fails to comprehend the role which it has in limiting decay and therefore waste with regard to the product it contains. The measures undertaken to reduce these losses are not just for the sake of it but must be considered within a wider spectrum of action aimed at reducing the environmental impacts. Quested et al. (2011) [35], in fact, highlighted how each ton of generic food product taken away from waste corresponds to 4.2 tons of CO_2 emissions saved. In particular, the materials used for the packaging can be increasingly sustainable and the introduction of intelligent and functional packaging may lead to further guarantees for the maintenance of the shelf-life of the fruit [36,37]. The consumers' attention with regard to the nutritional features of the fruit and the increasingly pressing request for nutritional information may then be satisfied by means of the innovation of the labelling, particularly useful in the off-the-shelf markets. This latter action is closely connected to the consumer-driven market and the consequent marketing strategies [38].

2.3. Transportation, Distribution and Marketing

The purpose of the distribution network is to optimise the transfers of the products from the production centres to the stores [39]. Transportation plays an important role since without suitable transport the goods cannot be delivered to the customer at the right time and in the correct quantity.

There are many distribution methods, although they can be summarised in three basic types: direct consignment, consignment via intermediaries using a storage system in a central distribution centre (CC) and cross-dock trans-shipment. In all three cases, the correct handling of the decline of the quality features is a crucial factor. In particular, it is necessary to consider the need for frequent deliveries and using a very brief order-to-delivery system due to the freshness of the product. It is also important to remember that in the case of the FFSC, the quantity and the quality of the supply is also unforeseeable over the mid-term being influenced by seasonal aspects, by the production areas and by the conservation period. Furthermore, in the last few years, a sharp differentiation of the product requested has been observed in terms of sizes, quality features and packaging, in addition to an important validation of the quality management systems (traceability) and certification.

2.4. Consumption

Consumption represents an important sequence within the FFSC and is a variable influenced by a complete series of factors, including the availability, the accessibility and the choice [40]. In general, retailers offer consumers a vast range of differentiated products, with an increasingly greater number of attributes linked to both the intrinsic quality features of the fruit and to other environmentally and socially desirable characteristics, such as the sustainable production and distribution methods [41–43]. This great differentiation of fruit proposed and the growing availability of information on health and the increasing risk of disease in relation to lifestyle, is resulting in a new, much more informed consumer who discloses the intention to purchase sustainable foodstuffs [44]. Therefore, the new role of the consumer must be highlighted, no longer a passive target of marketing but a driver in food production and a significant sequence in the FFSC [40,45]. In 2002, Feenstra [46] rightly highlighted the need to create models in which sustainable production, transformation, distribution and consumption are integrated, permitting the development of coherent policies which will lead to benefits for agriculture, human health and the environment.

3. Post-Harvest Innovation Needs

Technological innovation is present today in the fruit production process on several fronts, but finds focus and is made functional in an important manner in the warehousing stage, which therefore emerges as the key point through which the fresh product can reach the table of the consumer, satisfying the quality requirements [44]. Today, the warehouse is the perfect interpreter of the needs of the fruit and vegetable sector and, in particular, permits the implementation of technologies and/or processes which are destined to maintain the quality and at the same time minimise the environmental impact of the market activities and improve the efficiency in the use of materials and of energy itself. It is in fact possible to influence the evolution of the quality features of the fruit products by means of the environmental conditions during storage, transportation and the duration of these operations [47,48]. Often, the cold chain in the warehouse and in the distribution channels can be changed at a cost which is offset by the benefits of greater duration and safety. Consequently, it is important to establish the duration of the storage and transportation together with the temperature so as to obtain a compromise between the logistics and quality conservation costs on the one hand, and the costs for the scrap on the other. Accordingly, a number of authors have combined the food quality decline models with the logistics models [49,50]. This type of approach makes it possible to consider the heterogeneity in terms of quality of the lots of product in the planning of the logistics operations. Many varied physical and chemical treatments exist for maintaining and extending the shelf life of the fruit products. Post-harvest treatments, such as CA (Controlled Atmosphere) and MAP (Modified Atmosphere Packaging), in combination with the control of the appropriate temperature are, for many products, the basis for the maintenance of the physical, nutritional and sensorial features of the fruit. The storage under CA refers to the monitoring and regulation of the CO_2 and O_2 levels within the gas tight cold storage units with an optimum conservation temperature, in the absence of ethylene in the air [51–53].

Each product has an optimum O_2 and CO_2 concentration range to maintain the quality and extend the duration of the conservation [54,55].

Today, much research is aimed at the optimisation of the use of the MAPs (active and passive) in the packaging phase. In the passive MAP, the O_2 and CO_2 balance concentrations are in relation to the weight of the fruit and their respiratory frequency. The latter is influenced by the temperature and the permeability of the gas of the films used in the packaging [56,57]. In the active MAP, the desired atmosphere is introduced in the head space of the packaging, but the final atmosphere will be a function of the same factors which influence the passive MAP [58]. The correct balance atmosphere may delay the respiration and the senescence, and slow down the rate of deterioration, thus prolonging the storage-life of the product [59]. More recently, the active MAP also includes technologies for absorbing substances, such as O_2, ethylene, humidity, CO_2, flavours/smells and releasing substances such as CO_2, antimicrobial agents, antioxidants and flavours [60]. In the case of the MAPs, a certain number of respiration forecast models have been developed, for example, that of Mahajan et al. [61] by means of which the Pack-in-MAP software (2009, Cork, Eire) was developed for optimal packaging solutions.

The majority of the polymeric materials (polyethylene, polypropylene or polyvinyl chloride) used in the MAP have a low permeability to water vapour and therefore the majority of the water molecules evaporated from the fruit do not escape via the film and remain inside the container. In such conditions of saturation, minor temperature changes may also cause the formation of condensation inside the container with consequent microbial growth and the decay of the products [62]. Therefore, the challenge of packaging in a modified atmosphere is to find a solution for creating an optimum atmosphere, reducing the risk of condensation of the water while maintaining the lowest loss in weight possible. The materials used therefore become an element of fundamental importance within the process, considering that the same materials can be processed using different shrink-wrapping technologies (single-layer extrusion or multi-layer extrusion) and thus adopt a different conduct during conservation [63]. Furthermore, the majority of the materials used today are derived from oil and therefore it is necessary to end the debate currently underway on the environmental sustainability of the packaging by means of the introduction of bioplastics or other more sustainable materials [64].

4. Case Study: AGRIFRUTTA and Blueberry Demand-Driven Supply Chain

4.1. Conceptual Framework and Aim of the Study

It is therefore necessary that all players in the supply chain, from primary producer, are involved in processes related to innovation's research and implementation, possibly in a proactive manner and not just as part of a gear. To achieve this end, it is important to identify appropriate tools capable of reaching a compromise between the market demand and the sustainability of FFSC.

The objective of this paper is to highlight how the accomplishment of a demand-driven supply chain implies the activation of innovation processes throughout the FFSC. In particular this study is a virtuous example of the integration between a business firm and a research centre for the territorial development with important repercussions on the employment side [65]. This experience create a new consumer-centred dialogue with the market and it can be a good example for similar territories and for the construction of a demand driven supply chains for "specialty" market such as raspberry.

In terms of the blueberry chain, characterised by high perishability and limited shelf life, this study aims to highlight the innovation path FFSC undertaken by a North Italy cooperative in terms of the involvement of the actors in the supply chain and technological innovation.

4.2. Methods

To achieve this aim, the study has followed two steps, starting from 2007.

The first considered a qualitative analysis of the path taken by the cooperative over the last 10 years, through semi-structured interviews. To diagnose the performance of FFSC activities, farmers and warehouses were visited. In total, 14 questionnaires were filled out during face-to-face interviews and an on-site visits. The sample selection occurred by randomly choosing berry farmers from the member list of cooperative (10), two technicians of the cooperative and two sales managers. The 10 farmers were selected among "historical" blueberry producers (five) (even before the creation of the cooperative) and five new producers of blueberry (last five years).

These interviews were aimed at collecting information about decisions of the cooperative on the supply management activities such as logistics, supplier relationships and support activities to the members. The interviews included questions about data on fields productions (field area covered in the years, number of farms, number of cultivated varieties, use of sustainable tools for the productions, presence of biological systems, number and type of workers employed in the farms), on warehouse management (infrastructure and equipment used for storage, management of the quality and food safety control of the products) and finally on sales management. The structure of the questionnaire corresponds with the developed conceptual model.

The data analysis started aggregating the interview reports and recognizing the specific characteristics of business processes in the Blueberry supply chains that are the object of this study. Finally, we compared these with cases reported in the literature.

The second step was performed through a quantitative analysis evaluating the post-harvest innovation in the blueberry supply chain and more specifically the use of MAP for the storage and the efficiency of the storage system in terms of sustainability with the life cycle assessment analysis (LCA) approach.

The advantages of the MAP tool (from 2011 to 2016) were quantified, focusing primarily on the extension of the conservation of blueberry in terms of time; containment of the weight losses; improvement of the shelf life; maintenance of the quality (total soluble solid content, hardness and acidity); and finally on the nutraceutical aspects (total anthocyanin, phenolic contents and antioxidant activity). Quality changes of blueberries during storage were performed according to the most common analytical methods [66–68].

The LCA was used to assess the consumption of natural resources and the environmental impacts associated with the production and storage of blueberries [65,69–71].

Values from the LCI were aggregated and translated into categories to make the inventory analysis more comprehensible and easier to communicate. The Global Warming Potential (GWP) according to the midpoint method of the International Panel of Climate Change (IPCC) and the Non-Renewable Energy (NRE) were used due to their common use in main research and studies in the agrifood sector, [69] in particular:

IPCC GWP 100a: Weighted sum of the amount of greenhouse gases emitted by the system (kg CO_2 eq);
NRE e Impact 2002 þ v. 2.04: The primary energy demand for the entire life cycle of a product resulting from non-renewable sources (primary MJ).

Blueberries are multi-year crops, the collected data refer to the harvest of 2014 that was considered as the base year; however, the inputs of the system have been set by the number of the hypothetical length of the production cycles. The system boundaries, defining the unit processes and the inputs included in the LCA study, take into account, with the approach from cradle to grave, all the impacts of processing, starting from the production of raw materials (nursery) to the final disposal of wastes (consumer) and is the same method used in previous works [69]. To analyse the data, Sima Pro 7.3.3 software (PRé Consultants Amersfoort, 2010, Amersfoort, The Netherlands) has been used, produced by Pre Consultants. The databases used for the inventory were Ecoinvent 2.2 and LCA Food.

For the blueberry supply chain, the data were then normalised through mass balance as a function of the initial assumptions and finally processed according to the two categories of impact.

4.3. Contextualisation of the Study

The Cooperative involved in the study was selected to represent an important realty for the production of berries in Italy, whose production is actually increasing due to the national and international needs of the market. In Italy the blueberry crop is concentrated in the northern areas of the Alps. The necessity of acidic soils has further reduced the suitable area of production. The main blueberry areas are Valtellina in Lombardy, very limited areas of the province of Trento and the foothills of the wedge provinces of Turin in Piedmont. In particular, in this area over the last few years, we have seen a significant increase in the production, due to the market crisis. This increase with the aim of reaching new market led to the search of new organizational forms. The cooperative, selected as case study, has registered the greatest increase in surface planted to blueberry and it had inserted, together with research organizations, innovation all inside of the chain. It can be a good example for the improvement of the sector.

The context is that of the management of the fruit and vegetable warehouse of Agrifrutta srl (Cuneo, Piedmont, Italy), a co-operative of 130 farms of different size and composition, located in the foothills and plains of agro-ecosystems. Agrifrutta srl produces over 52 types of fruit and vegetables, whose main target is large-scale retail distribution. Agrifrutta comprises two warehouses (one in the foothills areas and one in the plain areas) covering around 15,000 m^2, with a cooling capacity of around 6500 m^3 each, in which 72 employees work during the summer, including fixed and seasonal workers. The structures are also equipped with three optical sorting machines for blueberries, tomatoes, peaches and apples. As of 2007, the Agrifrutta srl represents one of the most significant structures of the Ortofruitalia Producers' Organization (OP) which carries out sales office, technical assistance and marketing functions as laid down by the Common Organization of Markets (OCM) of the EU. Ortofruitalia is a producers' association that was founded in 2003 by farmers and business people both inspired by a willingness to innovate and work jointly in the Piedmont fruit and vegetable market. It is made up of 300 farmers coordinated by cooperatives, reaching a total turnover of around Euro 24 million (2015). Thanks to sustainable guidelines, the production of Ortofruitalia complies with certification programmes such as GlobalGAp, BRC Global Standards and Organic Production widely recognised at global level [72]. Ortofruitalia supplies the market chains with Private Labels and with the Ortofruitalia brand [73].

The drivers of the process for the evolution and development of the warehouse management system are located in a chain strategy, in which important partnerships with Italian and North European organised distribution has made it possible to by-pass the market speculations and reach a consumer aware of the health and environmental questions. The management of the Agrifrutta warehouse has, for the last ten years, been characterised by an on-going search for solutions which permit the qualitative improvement of the product. The blueberry has represented, for the entire Ortofruitalia system, a kind of guiding role from which it has been possible to start the process for the technological transfer of the post-harvest phase to other products managed by the cooperative.

5. Results

5.1. Qualitative Analysis of the Innovation in the Blueberry Supply Chain Management and Market in 10 Years

In their 2010 research, Verdouw et al. [13,34] describe two distinctive characteristics of the FFSCs analysed. It is possible to state that the FFSC of the Agrifrutta srl has passed over a period of 10 years from type I, where the blueberries were packaged during the harvest directly by the producers and the product was straightaway placed on the market with very reduced storage and conservation periods, to a type II FFSC. This latter order/consumer-driven type avails itself of the use of refrigeration and modified atmospheres so as to have the presence of the product on the market for certain months of the year. In this case, the availability of long-term agreements means that the specific needs of the consumer made it possible to also adapt production to specific customer orders as well as an intense exchange of information. In particular, it is possible to observe in the timeline (Figure 2), how there have been some system changes in the last nine years, both in the field production sequence and in the warehouse and market sequence.

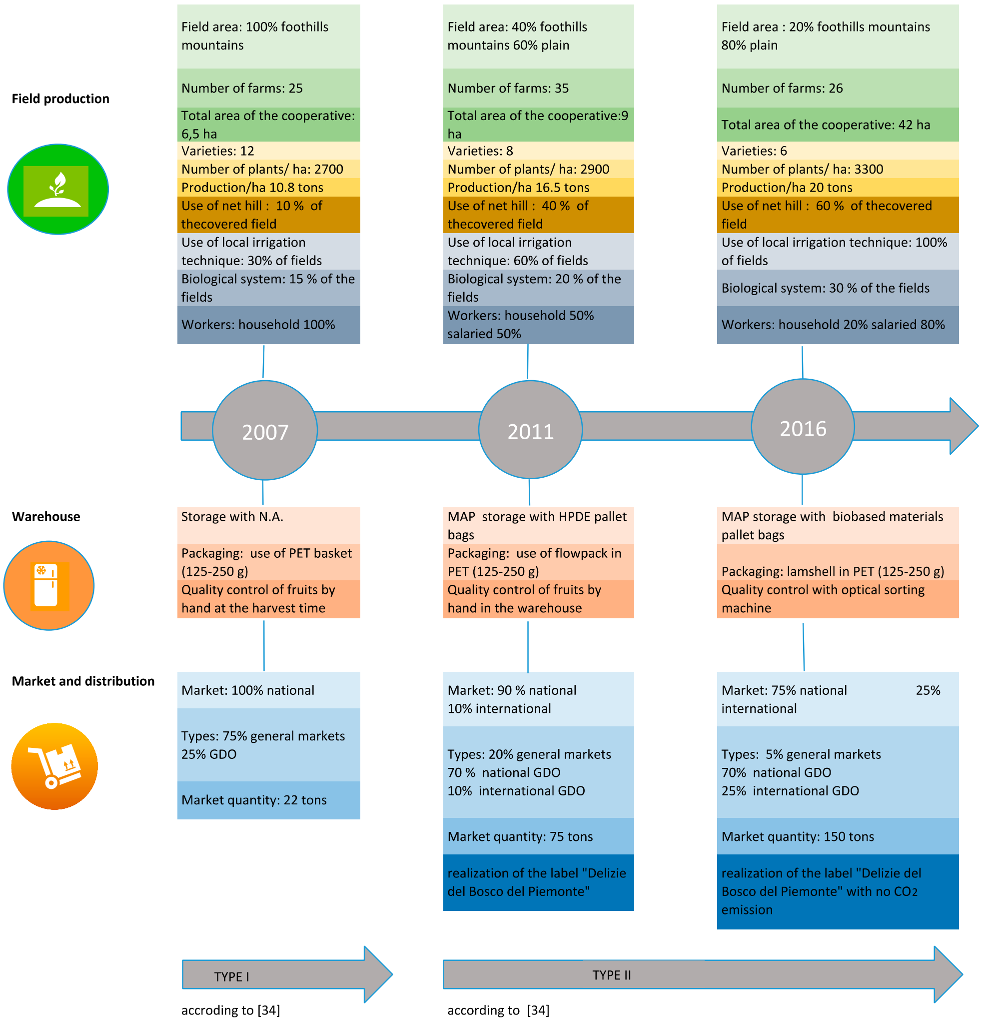

Figure 2. Timeline of the supply chain system of Agrifrutta srl.

Over the years, production has moved from the foothill areas to the plains, with a reduction in the number of businesses involved but an increase in the total farmed surface area (from 6.5 to 42 hectares). The number of varieties cultivated has fallen from 12 to 6, the result of a selection made by the technical and sales units towards types of fruit which more fully meet the expectations of the consumer from the standpoint of taste as well as high productivity and greater propensity towards conservation. The increase in the surface areas intended for blueberry cultivation in the farms has generated a need for seasonal workers, which over the years has reached 90% of the requirement in the harvesting period. Again, on the basis of the demand-driven type [41], the number of companies which produce according to the specifications of organic agriculture have also expanded, reaching a 30% coverage of the product marketed in 2016. In general, the agricultural techniques have considerably improved and, together with the coverings using anti-hail nets and or anti-rain sheets, have permitted a consistent increase in the productivity per hectare (from 10.8 to 20.0 tons/ha) and as a consequence of product marketed (from 22 to 146 tons). The increase in the quantity of product marketed was also affected by the innovations introduced in the warehouse sequence. The transition from the normal atmosphere storage to MAP conservation has achieved a considerable reduction in waste, with a lengthening of the sale period by around 1.5 months. Furthermore, the introduction of new packaging, such as clamshell, has also brought considerable benefits in the distribution and consumer sequence of the FFSC for the reduction of fruit with mechanical damage and reduction of the waste.

One of the most interesting aspects of the innovation throughout the blueberry supply chain adopted by Agrifrutta srl is the repercussion on the target market. In fact, there has been a change from the mainly local and national market which based itself on the presence of intermediaries and general markets, to the possibility of entering into agreements with the Italian and northern European large-scale retail chains, considerably expanding the sales possibilities. It is also important to note that, despite the introduction of innovation, the fixed costs have increased (machines and plants) along with the variable costs (workforce and packaging) throughout the supply chain, though the prices paid to the producers have remained more or less unchanged demonstrating a chain optimisation from an economic standpoint. This aspect aligns itself with the properties of the OP, understood to be instruments aimed at concentrating the agricultural supply, regulating the market co-ordination and increasing the contracting power of the farmers so as to contain the imbalances that derive from the potential dominant position of the operators downstream [74]. Another aspect to emphasise is the creation in the 2011–2012 season of the Delizie del Bosco del Piemonte brand which has continued to evolve over the years, thanks to a research project funded by the Piedmont Regional Authority which led to the calculation and divulgation of the environmental impacts on the supply chain [69].

5.2. Post-Harvest Innovation in the Blueberry Supply Chain

5.2.1. Evaluation of the Performances of the MAP Innovation System

The process innovations adopted as from 2011 in the warehouse sequence emerge in the innovative methods by means of which the conservation atmospheres are managed and applied. These conservation systems can be defined as "*active modified atmosphere pallet bags*". Even though the drop in heat and its maintenance in the conservation/storage environment have always represented an indispensable condition in the Agrifrutta system for the handling of small fruit, the experience of the technical management of the coop has revealed how this alone was not sufficient for satisfying the requirements relating to:

- ✓ extension of the conservation in terms of time;
- ✓ containment of the product losses;
- ✓ improvement of the shelf life;
- ✓ maintenance of the quality; and
- ✓ nutritional aspects.

These represent fundamental elements for the organisation of a demand-oriented FFSC. In fact, the fruit appearance, the flavour of fruits and the high nutraceutical properties of blueberries are keys to successfully gaining the acceptance of consumers [75] and their perceived status as wholesome and healthy fruits.

Even though the principles of the MAP technology have been used for some time within the sphere of the post-harvesting of the fresh product [76–78], the innovation adopted by the Coop Agrifrutta (Figure 3) in using pallet bags, is related to the fact that from the sole transportation of small quantities of fresh product (conservation lasting a short time for coast to coast transportation) the units have been used for the handling of large quantities of product for a long period of time in cold storage units in the warehouse [58]. During the period of greatest production and convenience of the blueberries within the fruit and vegetable warehouse, the adoption of the MAP ensures the independence in the conservation of each single pallet, which is handled in a specific manner according to the cultivated variety harvested and the stage of ripening.

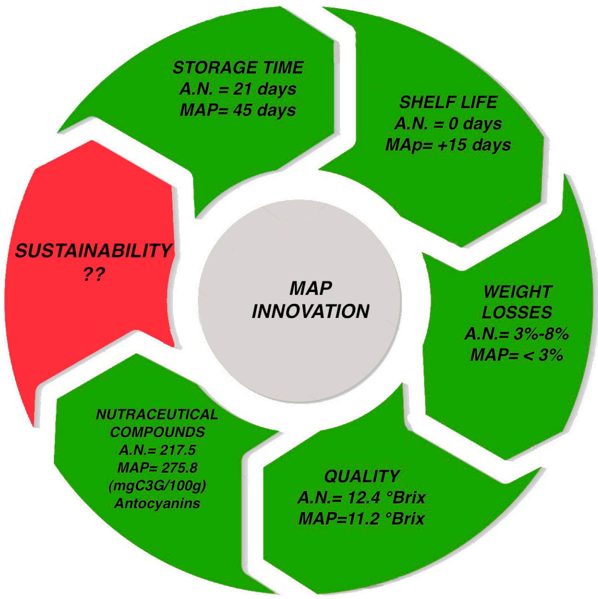

Figure 3. Main synthesized data of the performances of the MAP innovation system adopted by Agrifrutta srl.

Before the introduction of the MAP in 2011, the conservation of the blueberries in a normal atmosphere (N.A.) (20.8% O_2 and 0.02% CO_2) at low thermal regimes (+2 ± 1 °C) was the storage technique used. Variety and stage of ripening represented the only variables that could be considered for preserving the product for a maximum period of 21 days. Increasing the quantities of CO_2 within the high-density polyethylene pallet (HPDE) and decreasing the quantities of O_2 so as to reach values in a range of 10%–12% for both gases, it was possible to induce a slowdown of the respiratory metabolism of the fruit. This slowdown made it possible to increase the conservation period up to 45 days. Upon conclusion of the conservation using MAP, it was also observed that the blueberries could be kept for another 15 days under N.A. conditions, therefore achieving an overall period of conservation of 60 days. Such long conservation times for a highly perishable product such as the blueberry have had the effect of diluting the supply of fruit over time, guaranteeing supplies to the market also beyond the normal seasonal calendar and expanding the commercial supply in a competitive manner, reaching markets which before were not easy to access (the UK and Germany in northern Europe). The system also made it possible to contain the product losses in terms of food waste specifically eliminating those losses due to handling criticalities in the conservation. In fact, if the blueberries kept under N.A. produced on the related pallet unit waste in the range of 6%–10%, the introduction of the MAP contributed significantly to containing these losses under 1.5%. The considerable drop in waste is related to the fact that the CO_2 used, which, besides slowing down the respiratory metabolism of the fruit, can control the proliferation of the bacterial flora during post-harvesting since it has bacteriostatic and disinfectant action.

Furthermore, the quality control and selection stage after conservation also emerged as simpler to implement thanks to the attainment of a more standardised product lacking surface damage [79]. The handling of the blueberries using CO_2 has made it possible to maintain fruit with high quality standards in terms of total soluble solids (°Brix) nutraceutical components (total anthocyanins and total polyphenols) and maintenance of the colour of the fruit ensuring a product with the profile sought by the consumers. The consumer, present today in the FFSC with the role of driver and the production and distribution of foodstuffs, besides the nutritional aspects, show a positive attitude and the intention to purchase sustainable food products. To meet these requirements, Agrifrutta's technical management has introduced the use of materials originating from green chemistry (biodegradable and compostable) in order to replace the HPDE pallet bags used for the accomplishment of the MAP.

This replacement was induced by the positive results of certain experiments [57,80,81] using bio-based materials for the preservation of raspberries and blueberries.

5.2.2. Evaluation of the Sustainability of the MAP Storage System

In order to assess the efficiency of the replacement of the pallet bag in environmental terms, life cycle assessment analysis (LCA) was used. For the application of LCA, the study followed the norms and standardised steps of the International Organisation for Standardization (ISO 14040, 2006; ISO 14044, 2006). With regard to the impacts of the field stage, reference was made to bibliographic data [71]. The impact of the analysis shows the greatest impact associated for all the blueberry supply chain scenarios considered (N.A. storage, HDPE storage, Bio based MAP storage) to the field phase where soil preparation, mulching, fertilisation and irrigation (data not showed) are the main operations involved. The combined effect of this phase with the impact associated to the electricity consumption involved in the production of blueberries contribute for more than 80% to the use of resources considering all the category of impact used in this study and expressed with different indicators such as the global worming potential in kg CO_2 eq (GWP) (Figure 4), non-renewable energy primary in MJ (NRE) (Figure 5) and the IPCC global warming 100a in kg CO_2 eq (Figure 6).

Relating to the handling of the fruit during the post harvest chain, it is possible to show how the three scenarios differ in terms of impact associated to the storage phase processes. Among the MAP storage scenarios (HDPE storage and Bio based MAP storage), which is resulting more advantageous to improve the blueberries shelf life against the normal atmosphere storage (N.A.), it is possible to observe that the conservation in Pallet Bags using bio-based materials has the least impact considering all the indicators used: GWP (0.1731 kg CO_2 eq), NRE (3.4385 MJ primary) and IPCC WP (Figures 4–6). This result is not only determined by the use of a "green" material [82] but also by the minor waste production due to the MAP rather than the N.A.

In fact, a longer conservation period obtained thanks to the replacement of the packaging material leads to a reduction in food waste.

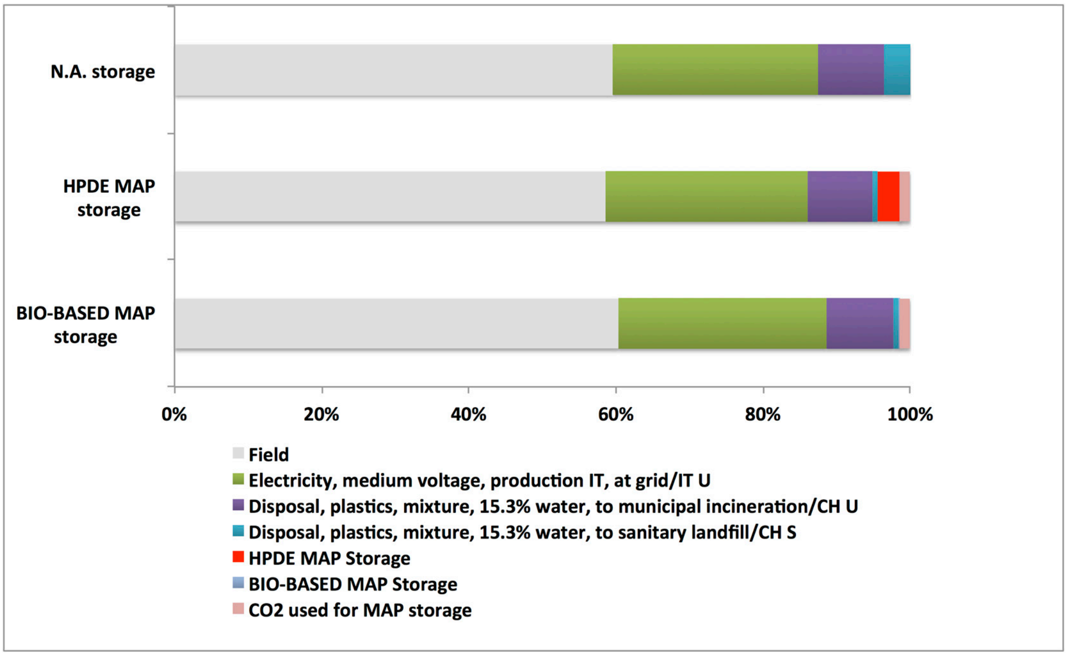

Figure 4. Characterization of the main impacts of the three different blueberries storage system (Normal atmosphere -N.A.- storage, High density polyethylene modified atmosphere packaging -HPDE MAP- storage, and biodegradable modified admosfere packaging-BIO-BASED MAP- storage)) using the GWP indicator.

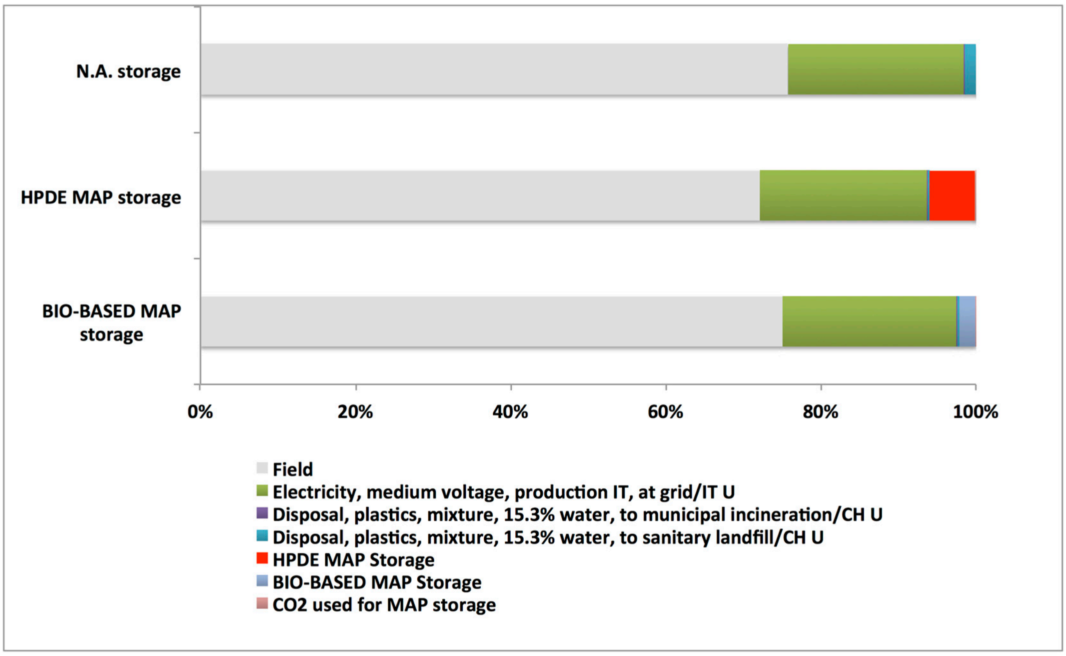

Figure 5. Characterization of the main impacts of the three different blueberries storage system (N.A. storage, HPDE MAP storage, and BIO-BASED MAP storage) using the NRE indicator.

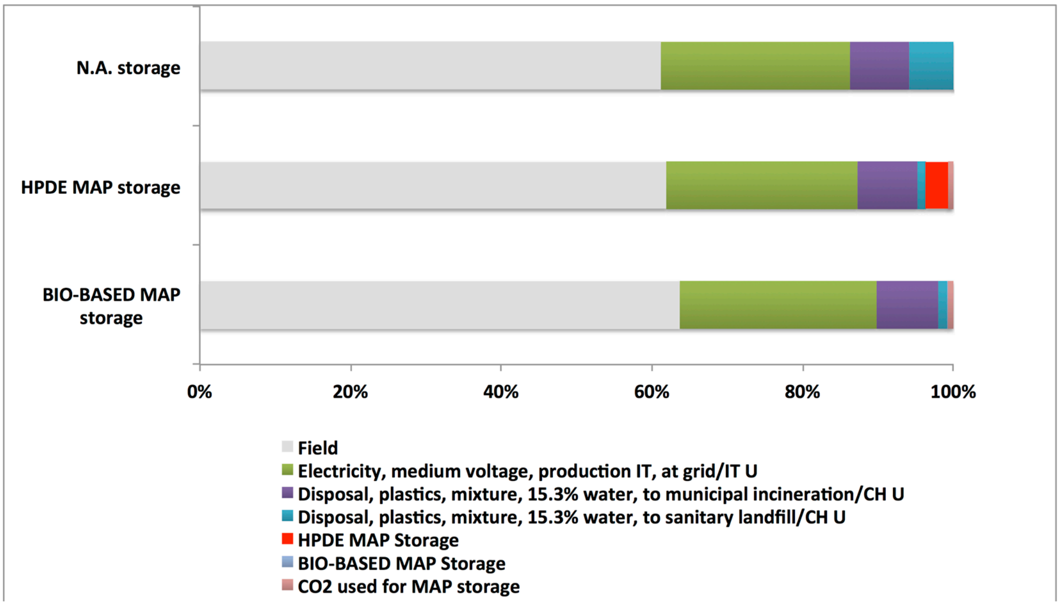

Figure 6. Characterization of the main impacts of the three different blueberries storage system (Normal atmosphere -N.A.- storage, High density polyethylene modified atmosphere packaging -HPDE MAP-storage, and biodegradable modified admosfere packaging-BIO-BASED MAP- storage) using the IPCC 100a indicator.

6. Conclusions and Discussing Implications for Future Research

Achievement and handling of the demand-driven supply chain are very complex (given that any change implies a reorganisation of the majority of the sequences). If this is true for the majority of the food supply chains, for fruit and for highly perishable products in particular, it is necessary to deal with a series of important aspects such as long production timescales, the seasonal nature, the quality changes between producers and lots, short delivery times and the need for special packaging [83–85].

In the future, it will be necessary for the coop to proceed with the innovation process in all the sequences of the FFSC (Figure 7) to maintain and possibly expand Agrifrutta's position on the Italian and international markets. In particular, in order to further increase the period of presence of the product on the market, without losing the high-quality properties of the fruit, it will be interesting to identify production entities in new areas with climate and soil characteristics which permit advanced and deferred ripening. It will then be interesting to explore new products (for example fresh cut products) more in keeping with the new habits of the consumers as well as new sales channels (e-commerce) [86].

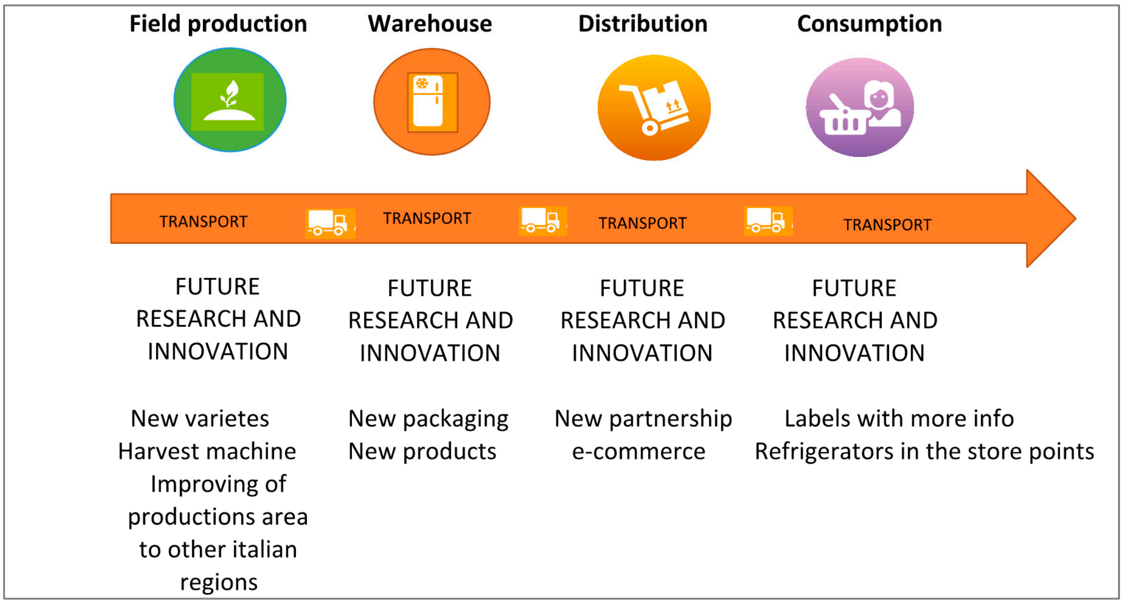

Figure 7. Future framework in the innovation process for Agrifrutta srl.

The approach to innovation will always be driven by the governance of Agrifrutta srl and, as indicated by Capitanio et al. (2010) [87], it will also be the result of comparison with external factors and in particular with the market conditions and the requests of the consumers. In conclusion, this study highlights how a FFSC associated with modern distribution channels requires greater co-ordination to satisfy the logistical, product quality and sustainability needs. This greater co-ordination between sequences of the FFSC, previously investigated by another study [88], was facilitated in the case study presented here by the fact that the producers are associates in a coop, which in turn is a member of an OP. Despite the many difficulties due to the negotiation regulations, the type of supply chain and the structure of the markets, the OPs in fact represent a rebalancing of the contractual power within the supply chain and a driver for the innovation of the agricultural sector, as hoped for by EU Regulation No. 1308/2013.

This study was an initial exploration of the factors affecting the introduction of innovation in FFSC as linked to storage and the role of cooperatives and OP. The case study approach allowed us to investigate the actual blueberry production in Italy, but did not permit us to include different product groups and also limits the generalizability of the conclusions towards other parts of the world. Further research should address a larger sample of cooperatives and farms of different production sizes and product groups.

Acknowledgments: We would like to thank all of the producers, professionals, operators, colleagues and collaborators that actively participated in the research project. In particular, Domenico Paschetta Ortofruititalia OP chairman, Ezio Giraudo technical manager of Agrifrutta srl and Romualdo Riva sales manager of Ortofruititalia for having provided the data relating to the two structures. This article summarises an innovation process funded over the years per certain projects of the Piedmont Regional Authority, Agrifood Innovation Hub and Agrifood platform.

Author Contributions: Cristiana Peano and Nicole Giuggioli designed the research, interpreted results and wrote the paper. Vincenzo Girgenti and Claudio Baudino collected data, collaborated in the literature review and checked results. All authors read and approved the final manuscript, analysed the data and participated jointly in the discussion. All authors have read and approved the final manuscript.

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

References

1. Brazelton, C. 2016 Keeping Up with Blueberry Demand Global Berry Congress. 2016. Available online: http://www.berrycongress.com/resources/documents/1458226222GBC2016_Cort_Brazelton.pdf (accessed on 3 October 2016).
2. The State of Food and Agriculture. Available online: http://www.fao.org/docrep/008/a0050e/a0050e00.htm (accessed on 4 October 2016).
3. Reynolds, C.J.; Buckley, J.D.; Weinstein, P.; Boland, J. Are the dietary guidelines for meat, fat, fruit and vegetable consumption appropriate for environmental sustainability? A review of the literature. *Nutrients* **2014**, *6*, 2251–2265. [CrossRef] [PubMed]
4. Record Sales for European Berry Market. Available online: http://www.eurofresh-distribution.com/news/record-sales-european-berry-market (accessed on 12 October 2016).
5. Trienekens, J.; Van Uffelen, R.; Debaire, J.; Omta, O. Assessment of innovation and performance in the fruit chain: The innovation-performance matrix. *Br. Food J.* **2008**, *110*, 98–127. [CrossRef]
6. Day, G.S. The capabilities of market-driven organizations. *J. Mark.* **1994**, *58*, 37–52. [CrossRef]
7. De Treville, S.; Shapiro, R.D.; Hameri, A.P. From supply chain to demand chain: The role of lead time reduction in improving demand chain performance. *J. Oper. Manag.* **2004**, *21*, 613–627. [CrossRef]
8. Kohli, A.K.; Jaworski, B.J. Market orientation: The construct, research propositions, and managerial implications. *J. Mark.* **1990**, *54*, 1–18. [CrossRef]
9. Vollmann, T.E.; Cordon, C.; Heikkila, T. Teaching supply chain management to business executives. *Prod. Oper. Manag.* **2000**, *9*, 81–90. [CrossRef]
10. Cecere, L.; O'marah, K.; Preslan, L. Driven by Demand. *Supply Chain Manag. Rev.* **2004**, *8*, 15–16.
11. Lee, H.L.; Whang, S.J. Information sharing in a supply chain. *Int. J. Technol. Manag.* **2000**, *20*, 373–387. [CrossRef]
12. Li, G.; Lin, Y.; Wang, S.; Yan, H. Enhancing agility by timely sharing of supply information. *Supply Chain Manag.* **2007**, *12*, 139–149. [CrossRef]
13. Verdouw, C.N.; Beulens, A.J.M.; Trienekens, J.H.; Wolfert, J. Process modelling in demand-driven supply chains: A reference model for the fruit industry. *Comput. Electron. Agric.* **2010**, *7*, 3174–3187. [CrossRef]
14. Iakovou, E.; Vlachos, D.; Achillas, C.; Anastasiadis, F. A Methodological Framework for the Design of Green Supply Chains for the Agrifood Sector. In Proceedings of the 2nd Olympus International Conference on Supply Chains (2nd Olympus ICSC), Katerini, Greece, 5–6 October 2012.
15. Zuo-Jun Max, S. Integrated supply chain design models: A survey and future reserach directions. *J. Ind. Manag. Optim.* **2007**, *3*, 1–27.
16. Mula, J.; Peidro, D.; Díaz-Madroñero, M.; Vicens, E. Mathematical programming models for supply chain production and transport planning. *Eur. J. Oper. Res.* **2010**, *204*, 377–390. [CrossRef]
17. Ahumada, O.; Villalobos, J.R. Application of planning models in the agri-food supply chain: A review. *Eur. J. Oper. Res.* **2009**, *196*, 1–20. [CrossRef]
18. Zhang, W.; Wilhem, W. OR/MS decision support models for the specialty crops industry: A literature review. *Ann. Oper. Res.* **2011**, *190*, 131–148. [CrossRef]
19. Søgaard, H.T.; Sørensen, C.A.G. A model for optimal selection of machinery sizes within the farm machinery system. *Biosyst. Eng.* **2004**, *89*, 13–28. [CrossRef]
20. Aubert, B.A.; Schroeder, A.; Grimaudo, J. IT as enabler of sustainable farming: An empirical analysis of farmers' adoption decision of precision agriculture technology. *Decis. Support Syst.* **2012**, *54*, 510–520. [CrossRef]
21. Isgin, T.; Bilgic, A.; Forster, D.L.; Batte, M.T. Using count data models to determine the factors affecting farmers' quantity decisions of precision farming technology adoption. *Comput. Electron. Agric.* **2008**, *62*, 231–242. [CrossRef]

22. Hameed, I.A.; Bochtis, D.D.; Sørensen, C.G.; Nøremark, M. Automated generation of guidance lines for operational field planning. *Biosyst. Eng.* **2010**, *107*, 294–306. [CrossRef]
23. Hassini, E.; Surti, C.; Searcy, C. A literature review and a case study of sustainable supply chains with a focus on metrics. *Int. J. Prod. Econ.* **2012**, *140*, 69–82. [CrossRef]
24. Van der Vorst, J.G.A.J.; Tromp, S.; Van der Zeec, D. Simulation modelling for food supply chain redesign; Integrated decision making on product quality, sustainability and logistics. *Int. J. Prod. Res.* **2009**, *47*, 6611–6631. [CrossRef]
25. Ajila, C.M.; Brar, S.K.; Verma, M.; Prasada Rao, I.J.S. Sustainable solutions for agro processing waste management: An overview. In *Environmental Protection Strategies for Sustainable Development*; Malik, A., Grohmann, E., Eds.; Springer: Dordrecht, The Netherlands, 2012; pp. 65–109.
26. Xu, R.; Takeda, F.; Krewer, G.; Li, C. Measure of mechanical impacts in commercial blueberry packing lines and potential damage to blueberry fruit. *Postharvest Biol. Technol.* **2015**, *110*, 103–113. [CrossRef]
27. Studman, C. Computers and electronics in postharvest technology—A review. *Comput. Electron. Agric.* **2001**, *30*, 109–124. [CrossRef]
28. Sloof, M.; Tijskens, L.M.M.; Wilkinson, E.C. Concepts for modelling the quality of perishable products. *Trends Food Sci. Technol.* **1996**, *7*, 165–171. [CrossRef]
29. Van der Vorst, J.G.A.J. Effective Food Supply Chains: Generating, Modelling and Evaluating Supply Chain Scenarios. Ph.D. Thesis, Wageningen University, Wageningen, The Netherlands, 2000.
30. Lowe, T.J.; Preckel, P.V. Decision technologies for agribusiness problems: A brief review of selected literature and a call for research. *Manuf. Serv. Oper. Manag.* **2004**, *6*, 201–208. [CrossRef]
31. Blackburn, J.; Scudder, G. Supply chain strategies for perishable products: The case of fresh produce. *Prod. Oper. Manag.* **2009**, *18*, 129–137. [CrossRef]
32. Ackerman, R.; Farahani, P.; Grunow, M. Quality, safety and sustainability in food distribution: A review of quantitative operations management approaches and challenges. *QR Spectrum* **2010**, *32*, 863–904. [CrossRef]
33. Aiello, G.; La Scalia, G.; Micale, R. Simulation analysis of cold chain performance based on time–temperature data. *Prod. Plan. Control* **2012**, *23*, 468–476. [CrossRef]
34. Verdouw, C.N.; Beulens, A.J.M.; Trienekens, J.H.; Verwaart, D. Towards dynamic reference information models: Readiness for ICT mass customization. *Comput. Ind.* **2010**, *8*, 833–844. [CrossRef]
35. Quested, T.E.; Parry, A.D.; Easteal, S.; Swannell, R. Food and drink waste from households in the UK. *Nutr. Bull.* **2011**, *36*, 460–467. [CrossRef]
36. Giuggioli, N.R.; Briano, R.; Baudino, B.; Peano, C. Effects of packaging and storage conditions on volatile compounds on raspberry fruits. *CyTA* **2015**, *3*, 512–521. [CrossRef]
37. Peano, C.; Giuggioli, N.R.; Girgenti, V. Effect of different packaging materials on postharvest quality of cv. Envie2 strawberry. *Int. Food Res. J.* **2014**, *21*, 1129–1134.
38. Taylor, D.H.; Fearne, A. Towards a framework for improvement in the management of demand in agri-food supply chains. *Supply Chain Manag.* **2006**, *11*, 379–384. [CrossRef]
39. Manzini, R.; Gamberi, M.; Gebennini, E.; Regattieri, A. An integrated approach to the design and management of a supply chain system. *Int. J. Adv. Manuf. Technol.* **2008**, *37*, 625–640. [CrossRef]
40. Kearney, J. Food consumption trends and drivers. *Phil. Trans. R. Soc. B* **2010**, *365*, 2793–2807. [CrossRef] [PubMed]
41. Caswell, J.A.; Noelke, C.M.; Mojduszka, E.M. Unifying two frameworks for analyzing quality and quality assurance for food products. In *Global Food Trade and Consumer Demand for Quality*; Krissoff, B., Bohman, M., Caswell, J.A., Eds.; Kluwer Academic/Plenum Publishers: New York, NY, USA, 2002; pp. 43–61.
42. Grolleau, G.; Caswell, J.A. Interaction between food attributes in markets: The case of environmental labeling. *J. Agric. Res. Econ.* **2006**, *31*, 471–484. [CrossRef]
43. Sogn-Grundvag, G.; Larsen, T.A.; Young, J.A. Product differentiation with credence attributes and private labels: The case of whitefish in UK supermarkets. *J. Agric. Econ.* **2014**, *65*, 368–382. [CrossRef]
44. Vermeir, I.; Verbeke, W. Sustainable food consumption: Exploring the consumer "attitude-behavioral intention" gap. *J. Agric. Environ. Ethic* **2006**, *19*, 169–194. [CrossRef]
45. Girgenti, V.; Massaglia, S.; Mosso, A.; Peano, C.; Brun, F. Exploring perceptions of raspberries and blueberries by Italian consumers. *Sustainability* **2016**, *8*, 1027. [CrossRef]
46. Feenstra, G. Creating space for sustainable food system lessons from the field. *Agric. Hum. Values* **2002**, *19*, 99–106. [CrossRef]

47. Kader, A.A. (Ed.) Postharvest biology and technology: An overview. In *Postharvest Technology of Horticultural Crops*; UC Publication N°. 3311; University of California, Division of Agriculture and Natural Resources: Oakland, CA, USA, 1992; pp. 15–20.
48. Sirivatanapa, S. Packaging and transportation of fruits and vegetables for better marketing. In *Postharvest Management of Fruit and Vegetables in the Asia-Pacific Region*; Food and Agriculture Organization of the United Nations Agricultural and Food Engineering Technologies Service: Rome, Italy, 2006.
49. Van der Vorst, J.G.A.J.; Da Silva, C.C.; Trienekens, J.H. Agro-Industry Supply Chain Management: Concepts and Application. Available online: http://www.fao.org/3/a-a1369e.pdf (accessed on 6 October 2016).
50. Berruto, R.; Gay, P.; Peano, C. Hybrid modelling for fruit quality prediction in supply chain networks. *Acta Hortic.* **2003**, *604*, 137–144. [CrossRef]
51. Kader, A.A.; Saltveit, M.E. Atmosphere modification. In *Postharvest Physiology and Pathology of Vegetables*, 2nd ed.; Bartz, J.A., Brecht, J.K., Eds.; Marcel Dekker, Inc.: New York, NY, USA, 2003; pp. 229–246.
52. Bodbodak, S.; Moshfeghifar, M. Advances in controlled atmosphere storage of fruits and vegetables. In *Eco-Friendly Technology for Postharvest Produce Quality*; Elsevier: London, UK, 2016; pp. 39–76.
53. Bessemans, N.; Verboven, P.; Verlinden, B.E.; Nicolaï, B.M. A novel type of dynamic controlled atmosphere storage based on the respiratory quotient (RQ-DCA). *Postharvest Biol. Technol.* **2016**, *115*, 91–102. [CrossRef]
54. Saltveit, M.E. Is it possible to find an optimal controlled atmosphere? *Postharvest Biol. Technol.* **2003**, *27*, 3–13. [CrossRef]
55. Beaudry, R.M. Effect of O_2 and CO_2 partial pressure on selected phenomena affecting fruit and vegetable quality. *Postharvest Biol. Technol.* **1999**, *15*, 293–303. [CrossRef]
56. Chong, K.L.; Peng, N.; Yin, H.; Lipscomb, G.; Chung, T.S. Food sustainability by designing and modelling a membrane controlled atmosphere storage system. *J. Food Eng.* **2013**, *114*, 361–374. [CrossRef]
57. Briano, R.; Giuggioli, N.R.; Girgenti, V.; Peano, C. Biodegradable and compostable film and modified atmosphere packaging in postharvest supply chain of raspberry fruits (cv. Grandeur®). *J. Food Process. Preserv.* **2015**, *39*, 2061–2073. [CrossRef]
58. Peano, C.; Giuggioli, N.R.; Girgenti, V.; Palma, A.; D'Aquino, S.; Sottile, F. Effect of palletized MAP storage on the quality and nutritional compounds of the Japanese Plum cv. Angeleno (*Prunus salicina* Lindl.). *J. Food Process. Preserv.* **2016**. [CrossRef]
59. Caleb, O.J.; Mahajan, P.V.; Al-Said, F.A.; Opara, U.L. Modified atmosphere packaging technology of fresh and fresh-cut produce and the microbial consequences: A review. *Food Bioprocess Technol.* **2013**, *6*, 303–329. [CrossRef]
60. Prange, R.K.; DeLong, J.M.; Harrison, P.A.; Leyte, J.C.; McLean, S.D. Oxygen concentration affects chlorophyll fluorescence in chlorophyll-containing fruit and vegetables. *J. Am. Soc. Hortic. Sci.* **2003**, *128*, 603–607.
61. Mahajan, P.V.; Oliveira, F.A.R.; Montanez, J.C.; Frias, J. Development of user-friendly software for design of modified atmosphere packaging for fresh and fresh-cut produce. *Innov. Food Sci. Emerg. Technol.* **2007**, *8*, 84–92. [CrossRef]
62. Linke, M.; Geyer, M. Condensation dynamics in plastic film packaging for fruit and vegetables. *J. Food Eng.* **2013**, *116*, 144–154. [CrossRef]
63. Sandhya. Modified atmosphere packaging of fresh produce: Current status and future needs. *LWT Food Sci. Technol.* **2010**, *43*, 381–392.
64. Mahalik, N.P.; Nambiar, A.N. Trends in food packaging and manufacturing systems and technology. *Trends Food Sci. Technol.* **2010**, *21*, 117–128. [CrossRef]
65. Tecco, N.; Baudino, C.; Girgenti, V.; Peano, C. Innovation strategies in a fruit growers association impacts assessment by using combined LCA and s-LCA methodologies. *Sci. Total Environ.* **2014**, *568*, 253–262. [CrossRef] [PubMed]
66. Pellegrini, N.; Serafini, M.; Colombi, B.; Del Rio, D.; Salvatora, S.; Bianchi, M. Total antioxidant capacity of plant foods, beverages and oils consumed in Italy by three different in vitro assays. *J. Nutr.* **2003**, *133*, 2812–2819. [PubMed]
67. Cheng, G.W.; Breen, P.J. Activity of phenylalanine ammonia-lyase (PAL) and concentrations of anthocyanins and phenolics in developing strawberry fruit. *J. Am. Soc. Hortic. Sci.* **1991**, *116*, 865–869.
68. Slinkard, K.; Singleton, V.L. Total phenol analysis: Automation and comparison with manual methods. *Am. J. Enol. Vitic.* **1977**, *28*, 49–55.

69. Peano, C.; Baudino, C.; Tecco, N.; Girgenti, V. Green marketing tools for fruit growers associated groups: Application of the Life Cycle Assessment (LCA) for strawberries and berry fruits ecobranding in northern Italy. *J. Clean. Prod.* **2015**, *104*, 59–67. [CrossRef]
70. Girgenti, V.; Peano, C.; Baudino, C.; Tecco, N. From "farm to fork" strawberry system: Current realities and potential innovative scenarios from life cycle assessment of non-renewable energy use and green house gas emissions. *Sci. Total Environ.* **2014**, *473–474*, 48–53. [CrossRef] [PubMed]
71. Girgenti, V.; Peano, C.; Bounous, M.; Baudino, C. A life cycle assessment of non-renewable energy use and greenhouse gas emissions associated with blueberry and raspberry production in northern Italy. *Sci. Total Environ.* **2013**, *458–460*, 414–418. [CrossRef] [PubMed]
72. Trienekens, J.; Zuurbier, P. Quality and safety standards in the food industry, developments and challenges. *Int. J. Prod. Econ.* **2008**, *113*, 107–122. [CrossRef]
73. L'editoriale. Available online: http://www.ortofruititalia.org (accessed on 12 October 2016). (In Italian)
74. Cacchiarelli, L.; Russo, C.; Sorrentino, A. Potere di mercato e contrattuale nella filiera agroalimentare: Il ruolo delle OP. *AgriregioneEuropa* **2016**, *46*. Available online: http://agriregionieuropa.univpm.it/en/node/9679 (accessed on 12 October 2016). (In Italian)
75. Duarte, C.; Guerra, M.; Daniel, P.; Camelo, A.L.; Yommi, A. Quality changes of highbush blueberries fruit stored in CA with different CO_2 levels. *J. Food Sci.* **2009**, *74*, S154–S159. [CrossRef] [PubMed]
76. Ceponis, M.J.; Cappellini, R.A. Reducing decay in fresh blueberries with controlled atmospheres. *HortScience* **1985**, *20*, 228–229.
77. Forney, C.F.; Nicholas, K.U.K.G.; Jordan, M.A. Effects of CO_2 on physical chemical, and quality changes in "Burlington" blueberries. *Acta Hortic.* **2003**, *600*, 587–593. [CrossRef]
78. Harb, J.Y.; Steif, J. Controlled atmosphere storage of higbush blueberries cv. 'Duke'. *Eur. J. Hortic. Sci.* **2004**, *69*, 66–72.
79. Peano, C.; Briano, R.; Giuggioli, N.R.; Girgenti, V.; Sottile, F. Evolution of qualitative characteristics during blueberry fruit storage in a modified atmosphere. *Acta Hortic.* **2015**, *1071*, 343–348. [CrossRef]
80. Briano, R.; Giuggioli, N.R.; Girgenti, V. Sustainable storage of raspberries: First experiences of biodegradable films in the warehouse. *Acta Hortic.* **2016**, *133*, 383–390. [CrossRef]
81. Briano, R.; Girgenti, V.; Giuggioli, N.R.; Peano, C. Performance of different box bags for MAP to preserve the quality of plums cv. Angeleno in the transport storage conditions. *Acta Hortic.* **2015**, *1079*, 561–566. [CrossRef]
82. Almenar, E.; Samsudin, H.; Auras, R.; Harte, B. Consumer acceptance of fresh blueberries in bio-based packages. *J. Sci. Food Agric.* **2010**, *90*, 1121–1128. [CrossRef] [PubMed]
83. Hu, W.; Woods, T.; Bastin, S. Consumer acceptance and willingness to pay for blueberry products with nonconventional attributes. *J. Agric. Appl. Econ.* **2009**, *41*, 47–60. [CrossRef]
84. Koutsimanis, G.; Getter, K.; Behe, B.; Harte, J.; Almenar, E. Influences of packaging attributes on consumer purchase decisions for fresh produce. *Appetite* **2012**, *59*, 270–280. [CrossRef] [PubMed]
85. Schnettler, B.; Miranda, H.; Sepulveda, J.; Denegri, M.; Mora, M.; Lobos, G. Preferences for Berries Among Consumers in Southern Chile: Blueberries Are Produced but Are They Consumed? *J. Food Sci.* **2011**, *76*, 458–464. [CrossRef] [PubMed]
86. Verbeke, W.; Scholderer, J.; Lähteenmäki, L. Consumer appeal of nutrition and health claims in three existing product concepts. *Appetite* **2009**, *52*, 684–692. [CrossRef] [PubMed]
87. Capitanio, F.; Coppola, A.; Pascucci, S. Product and process innovation in the Italian food industry. *Agribusiness* **2010**, *26*, 503–518. [CrossRef]
88. Sutopo, W.; Hisjam, M.; Yuniaristanto. An agri-food supply chain model to empower farmers as supplier for modern retailer using corporate social responsibility activities on deteriorated product. In *IAENG Transactions on Engineering Technologies*; Springer: Dordrecht, The Netherlands, 2013; pp. 189–202.