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A decision support system to identify good agricultural practices in Short Food Supply Chain

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Introduction

The European Commission (EC) underpins strategies to promote local development establishing networks and spreading knowledge. Actors operating in European areas have to plan again strategies to implement locally, taking insights and feedback from global economic changes. To this extent, innovations, knowledge and networks play a fundamental role for developing local economies. The development can be achieved increasing the farm size (EC, 2015). In fact, in Europe there are many countries characterized by small-medium enterprises (SMEs). Small farms operating without cooperation suffer the deep and old problem of market asymmetry information (Reimann, F., Shen, P., & Kaufmann, L. 2017). It causes an excessive level of transaction costs (TCs). In fact Tcs increase when asset specificity rises because of opportunism, defined by Williamson (1985) as "self-interest seeking with guile". Over the years, several studies (Klein, Crawford, and Alchian, 1978; Williamson, 1985; Dyer, 1997; Libecap, 2014; Kelly, 2014) provide a clear explanation of the need to reduce asymmetric information through networks that enable innovation uptake and, in consequence, returning a reduction of transaction costs. These are composed as follows (Clemons et al., 1993):

Transaction costs = coordination costs + transaction risks

Coordination costs are related to information into decision processes, including information on products, price, availability and demand. While, transaction risk is strictly related to the issue of asymmetry information In this regard, innovations are the result of knowledge application. In other words, they allow the transition of findings from researchers to entrepreneurs. Grover and Malhotra (2003) argue that transaction risk may loss of resource control and, in consequence, increase the risk of opportunistic behavior. Uncertainty caused by asymmetric information generates higher transaction costs. Furthermore, the Transaction Cost Theory (TCT), postulated by Williamson, is

summarized by three propositions (Grover and Malhotra, 2003): the first one affirms that transaction costs are generated by bounded rationality and opportunism; the second one asserts that high asset specificity and high uncertainty gives rise transaction costs; the third one points out that governance mechanism determines higher or lower hierarchies. In particular, higher transaction costs favor the hierarchies. These are considered like those that mainly affect the increase of TCs by Williamson (1985). To this extent, networks can solve, or at least reduce, them. Within the markets, as well-known, there are two dimensions of the activities to manage the supply chain coordination: horizontal and vertical. The horizontal one intends all farmers typically competing each other. Benefits return them, whilst appears that gaining from pure competition is the only path to add value. The vertical one implies actors operating along the supply chain undergoing to different power positions. The outline of this scenario is based on the strategy to improve the added value of the supply chain reducing the costs, following one of the Porter' way to enhance the profitability of the agro-food sector in European areas. The Porter' differentiation strategy (Porter M. E., 1985) states that existing methods to get the competiveness consist of the elements displayed in Porter' matrix (Figure).

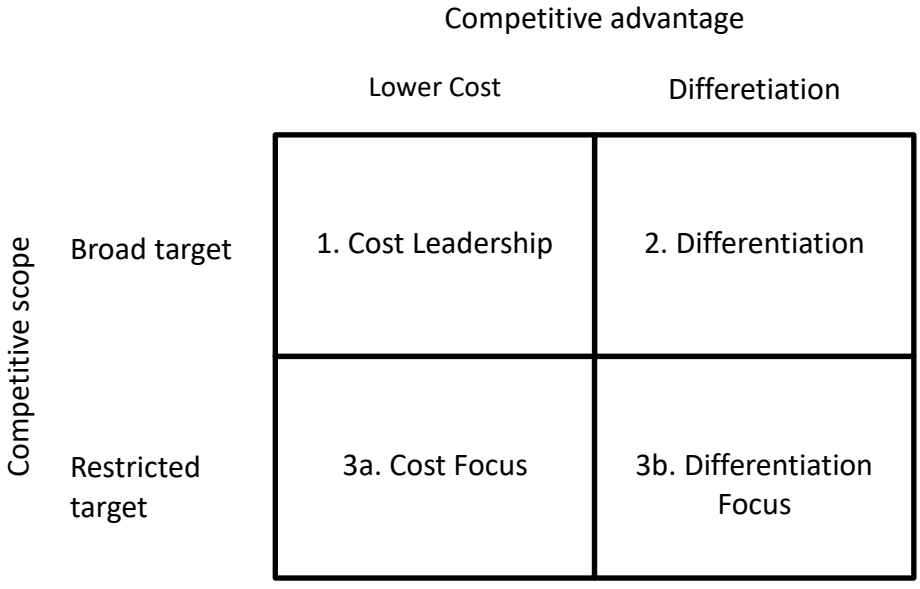


Figure 1 – The Porter' matrix showing the factor influencing the firms competitiveness.

1. Cost Leadership: the firms takes benefits reducing the costs. To this extent, they are intended as TCs. The sources of cost advantage depend on the structure of the considered firm. Different types of costs benefits may come from property technology, economies of scale or others factors. The property technology case is strictly related to the purposes of this study in terms of the added value that firms potentially gain boosting innovation and knowledge transfer. The Cost Leadership advantage is exploited by the firm for leading the price within the industry;
2. Differentiation: the firm aims to be unique in the sector along some dimensions that are widely considered by buyers. The firm puts in practice efforts in order to identify one or more features perceived as relevant by as much as possible buyer, and makes itself unique respect to those attributes. The firm gains through a premium price acknowledged by purchasers for its uniqueness;
3. Focus: the firm restricts the attention and the attention to a specific target within his sector. The focuser selects a segment or a group of segments in the industry and fits its strategy to supply them excluding the others. The focus strategy shows two paths:
    a. Cost focus: a firm seeks advantage cost in its restricted context;
    b. Differentiation focus: a firm seeks its uniqueness within its target segment.

The differentiation taking the path of reducing costs is that aiming to be achieved through the reduction of TCs (Contò et al., 2013b). Such issues need to be managed through the involvement of as much players as possible, increasing the number and the kind of them. It means that farmers, advisors, researchers, NGOs etc. should actively participate to

foster and underpin knowledge and information circulation. The cooperation has to be strongly raised by each one getting to become the basis of new cultural approach in competition game, named the multi-actor approach (AC, 2016). The latter explores the needs, and implies participatory acts finalized to share problems and relative solutions.

The Porter' competitiveness is in line with the main goals of the European Commission. In this regard, the effective plan Horizon 2020, based on the need of pursuing a sustainable, inclusive and smart growth, seeks to put in practice Porter' principles following different methods to implement daily firm' activities. Above all, in this article is shown a methodological approach, that is, in turn, based on the Focus Groups (EC, 2015) insights emerged after their work promoted by EC. Focus Groups (Levidow L., & Neubauer C., 2014) are thematic, and composed by different stakeholders. Each stakeholder had to bring its contribute to the discussion in order to show the local needs and provide suitable and useful returns to the policy issued by EC. Furthermore, the afterwards explained methodological approach has been elaborated on the specific call identified as Coordination and Support Action (CSA). It has specifically planned to create condition to lead firms toward sustainable growing paths. The general framework consists in taking and showing existing knowledge and engaging collaborative approach among the actors to make smarter the economic system and add value to the food supply chain. The methodological approach has been thought and translated in real actions that have been implemented since SKIN project started in November 2016.

Short Food Supply Chain

Short Food Supply Chain (SFSCs) is raised within the Regulation 1305/13, art. 2, providing the Rural Development scheme 2014-2020, as "a supply chain involving a limited number of economic operators, committed to co-operation, local economic

development, and close geographical and social relations between producers, processors and consumers" (Canfora, 2015).

This is a general assertion concerning a comprehensive domain of the European Food Supply Chains (Galli & Brunori, 2013). However, the economic realities around the Europe, relate different local food systems according to the geographic position (Nagurney, et al., 2018), and the relative background that each one has developed over the years (Ciani, et al., 2016). Each European area shapes quality (Carbone, 2016) by considering a specific scheme in operating. "For example, in southern European countries quality is shaped by the production context, which in turn conveys culture, tradition, terrain, climate, local knowledge systems. In northern and western countries, in contrast, quality criteria environmental criteria concern environmental sustainability or animal welfare, with innovative forms of marketing. In Central and Eastern European countries, traditional peasant culture survived especially in remote rural areas; quality criteria emphasize traditional and cultural aspects" (Kneafsey, et al., 2013).

These differences reveal different role of the supply chains within the territories they take place (Šūmane, et al., 2018). Yet whilst some local systems focus on environmental issues, there are others giving rise to factors being more or less parochial (Levidow, et al., 2014). The challenge is to enable European short food chains to get together in order to mix their approaches to deliver sustainability (Tregear, 2011). For sure, it is a hard objective because shortening supply chain means reducing connections, and in turn their capacity of being able to reach out with far markets where opportunities in terms of applied knowledge may come out. These opposed sides of the same coin are tackled with this conceptual study.

The definition of SFSCs conveys the relevance given to the matter by the European legislator. Importantly, it is the specific commitment of co-operating for engaging Rural

Development. Indeed, co-operation is the prerequisite to establish connections so that operators get enabled to find a channel to transfer the held knowledge (Fonte & Cucco, 2017). By cooperating, economic operators find the way to address and change their organization towards new solutions consistent with their sustainability. The cooperation comes therefore from the social consideration of the sustainability that is purported to be in the scope of economic, environmental and social goals (Tregear, 2011).

The case of "SKIN" project to address the study

SKIN, acronym for Short supply chain Knowledge and Innovation Network, is the European thematic network on Innovative Short Food Supply Chain Management, funded by the European program H2020 (European Commission, EC, 2015; Sara, D., & Francesco, C. 2016). The SKIN Project started in November 2016 and involves 20 partners from 14 countries in the area of short food supply chains (SFSCs), coordinated by the University of Foggia. The project is aimed at promoting an interactive innovative model to improve knowledge exchange between academia and practitioners of the management of SFSCs, thus contributing to reconnect EU food producers and consumers. The SKIN project concerns the creation of a network on the theme of Short Food Supply Chains and will is aimed at satisfying EC requirements throughout different actions.

In the form of innovation projects for the application/adaptation of existing research results, as well as innovation projects exploiting ideas coming from stakeholders and addressed through the coaching activities organized. This will stimulate researchers to disseminate and implement their results in the agro-food sector.

As for the exchange of good practices, specific elements will be taken into account in order to combining productivity, competitiveness and sustainability in agriculture, with

attention to the socio-economic impact on territories through the contribution to the development of rural areas in Europe and cooperation among the actors involved.

SKIN will organise and carry out the identification of about 100 good practices across Europe using the practice-abstract common format, and presenting them through the workshops, thus helping the generation of at least 10 innovation ideas to be supported through the coaching activities foreseen by the project.

The overall SKIN project approach is based on the need to systematise a pan-European knowledge base and its community of practice on the theme of short supply chains. Existing knowledge is highly fragmented into smaller, often regional or local communities, constituencies and experiences. So, these could be of benefit to agri-food communities at large, including supply chain actors, from producers to processors, distributors and retailers, if they were to be made easily accessible, shortening the distance between knowledge and its practical application in multi-actor communities.

The SKIN methodology is characterized by four elements, or pillars, as follows.

First Pillar: Multi-Actor.

The multi-actor approach (Figure 2) is reflected not only in the structure and composition of the consortium but also in the engagement strategy foreseen in its work-plan, throughout dissemination and coaching activities.

A multi-actor approach in SKIN is thereby an inclusive approach oriented to consider the role and perspectives of different players.

Thanks to the definition of the engagement strategy that will identify actors, methods and opportunities to aggregate around SKIN, a large and representative, multi-party community of stakeholders from as many countries and regions possible in the EU and associated countries will be involved.

To summarize, SKIN multi-actor approach is based on four elements that characterize the consortium:

1. The presence within the consortium of partners with complementary types of knowledge and skills;

2. The strategy developed and implemented to involving actors from the broad community of short food supply chains at different regional scale (regional nodes), as well as at the international level (transversal sub-thematic workshops);

3. The methods utilized to ensure quality and quantity of knowledge exchanges;

4. The realization of a structured organization and management all along the project.

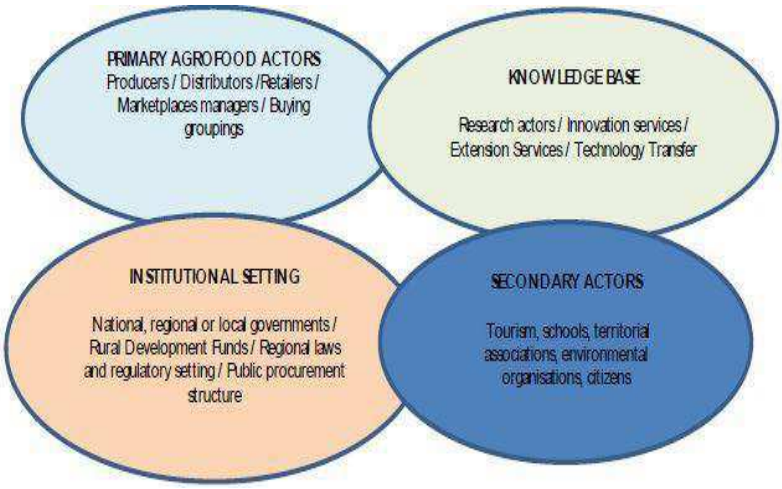


Figure 2 – The Multi-actor approach

Second Pillar: Multiplication of exposure to the research base, good practices and innovation opportunities.

One of the key drivers of the project is to deliver information and knowledge to those that need it across the EU, essentially through two complementary approaches from good practices to innovation projects. In particular, the systematization of information and data on good practices for short food supply chains (identified through an extensive mapping in different countries) and the organization of regional technical nodes (composed by territorial-based multi-actors partnerships), will provide the basis for coordinating the SKIN activities at different regional levels. The coordination of activities at regional levels, through the regional nodes, will help

capturing demand-driven innovation needs and opportunities from the different territories involved in SKIN, thus allowing the tailoring of the innovation to different contexts.

On the other hand, the organization of thematic workshops addressed to concrete innovation challenges, will possibly entail the exchange of those good practices or new approaches to innovating short supply chains.

Moreover, through online tools, the target communities may consult cooperation profiles, set up partnerships oriented to new innovation projects and access information in multiple languages in the form of easy accessible end-user materials. Such materials will be realized and targeted in compliance with the SKIN dissemination strategy, thus according to the principles of: accessibility, broadness, standardization, openness and sustainability.

Third Pillar: Practical experience, practical guidance. Since SKIN is a practice project, it will be considered a successful initiative if a wider number of SFSC actors will participate in the adoption of results of innovation driven research projects, or will take part in concrete projects with the support of SKIN coaching services. In this light, it is important to identify and bring to practitioners good practices that have significant potential, with concrete guidance on the possible adaptation of those good practices to their specific needs in order to promote effective knowledge exchange and cooperation with interested parties, as well as providing practical guidance (coaching phase) to those wishing to set up innovation projects.

Forth Pillar: Permanent network

Given the deep knowledge-fragmentation about SFSC, a coherent framework for cooperation around supply chains should be established, and reflected in the organization of a community of practice that will remain after the end of the project. According to this, SKIN intends to provide the European SFSCs with framework of reference for access to research and innovation advances, a mechanism to foster cross-border partnerships for

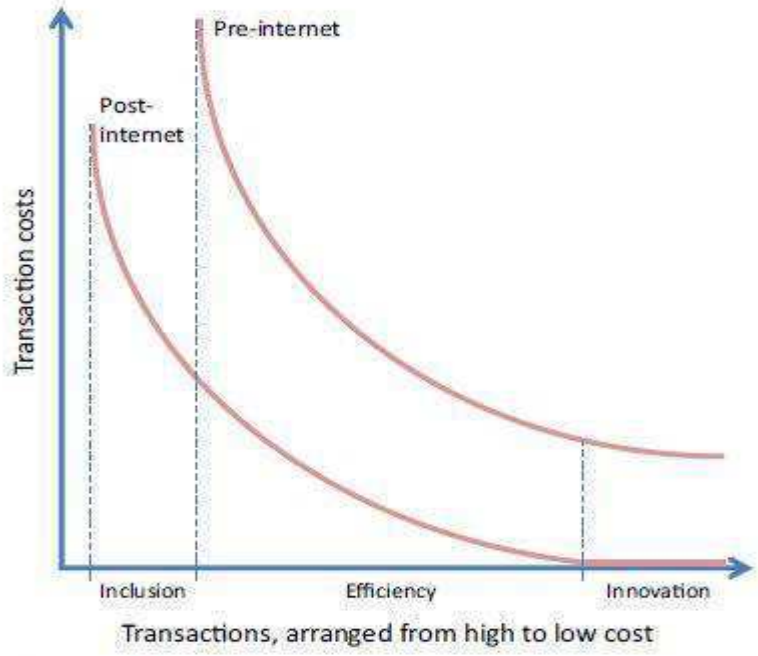
the uptake of innovative practices and research results, plus a growing network of experts and stakeholders able to contribute both on a research and policy level in different EU territories.

SKIN integrates coordination and support activities within the four pillars that constitute its overall approach, mainly related to community building and knowledge sharing activities.

The preliminary analysis provided in the introduction concerns the conceptual idea proposed by European institution and stakeholder indicating prerequisites and desired goals. Conversely, the showed methodological approach is a real application plan to whom EC agreed to finance. The EC approved the explained proposal and allocated resources to it. There, immediately, emerge two deductions, before going deepen to the economic implications occurring with such circumstance. Firstly, the outline of the project is in line with the aforementioned prerequisites and so, it goes satisfying the outcomes desired. It gets closer the innovation gap between research and practice. Secondly, it makes to feel responsible European stakeholders through their active involvement within the growth path. The Smart Specialization Strategy pursued by local government, is mainly focused on the idea to actively involve as much as possible stakeholder to initiate putting in practice efforts. It fulfills a social sustainability dimension indicated as inclusive approach. The topic of the project is the Short Food Supply Chain (Berti, G., & Mulligan, C. 2016) and following the addresses of the SSS, it is relevant due to many European area are characterized by different organizational features within the Food Supply Chain. The differences arise problems that operators cannot individually manage. In particular, Mediterranean areas suffer the geographic peripheral position in European scenario and they need to implement efficient and

successful method to get northern markets. To analyse such aspects and collect detailed information about the needs of the actors involved and to be involved in the project, there have been organizing online and non-online meeting. For example, from the already done meeting has appeared that there is a different meaning of the length of short food supply chain. Such difference hides prominent issues, concerning logistics knowledge that cannot be exploited everywhere, though they are going to be qualified as good practice. Therefore, the strongest challenge is to find the way to harmonize different features, seeking to combine rightly elements of each one with each other. Being aware of this risk, the multi-actor approach appears as indispensable. Indeed, according to the methodological framework provided, it plays a key role in reducing the asymmetric information among the economic operators. It also allows better understanding the European markets with high potential growth. Reducing the information gap makes operators much more collaborative and able to engage vital synergies. The Porter' idea to make competitive the firms through the differentiation of segments, costs or other attributes is substituted by the idea to improve the competitiveness of entire economic system (Gobble, M. M. 2016). The original purpose was aimed to return local benefits single firm. The current approach returns benefits to as much as possible actors. It is a prominent aspect for rightly facing the market globalization and for better allocate the available resources reducing wastefulness. In SKIN, the idea to treat the topic of the SFSC is strictly related to the higher level of sustainability that reach such method to organize the FSC (Fiore, 2016). In this regards, SSC is an acknowledged method to reduce the asymmetric information and, in turn, TCs (Williamson, 2008). Getting closer producers to consumers, each one gets to be much more aware and able to take rational decisions. However, many regions were stressed by economic crisis and they have appeared not able to cope it. A consistent issue of the farmers is that they often are not able to find and adopt

suitable and innovative technologies. The concerns are related to the methods looking for new markets, the adoption appropriate innovation to decrease the resources uses etc. All these things are grouped in with the difficult of finding them in time or with an affordable price. The natural consequence is the high level of TCs, appearing in both forms of coordination costs and transaction risk. The need of new technologies have been confirmed by a World Bank study (2016). For example, the study clearly shows as the adoption of internet devices significantly allows reducing TCs (Figure 2). The majority areas that suffer the lack of innovation in terms of adoption of new ICT based tools are located in southern peripheral countries. In addiction, although getting innovative digital resources is a prominent progress, there is a lack of infrastructures, restricting the opportunity and the potential of the innovation (World Bank, 2016).



Source: World Bank (2016).

Figure 3 – The effects of falling TCs

The picture shows that the effects of falling TCs due to digital technologies, determine benefits in terms of (World Bank, 2016):

- Inclusion: because of overcoming information barriers, it is possible to get inclusion and, in turn, the opportunities increase, triggering a job creation process;
- Efficiency: because of augmenting existing factors, there appear an increasingly efficiency, which determines, in turn, an increasingly labour productivity;
- Innovation: because of generating economies of scale from innovation uptake, it is possible to obtain a consumer surplus, resulting as a benefit in terms of price.

Through SKIN project, good practices characterized by innovative systems have been collecting. The main features of such practices are being stored in a database to which each operator involved in the building consortium is able to access in real time, taking any date it needs. The knowledge and best collected experiences of each European area will be managed by local hubs concentrating knowledge and experts capable to reply efficiently to actors asking for advices. Regional nodes will be connected each other in order to return innovation circulation and real uptake. Each participant to the consortium will get benefits in terms of productivity, profitability and marketplaces. The lack of infrastructure can be compensated by building network implementing digital technologies and bringing together expertise to recognize solutions. In conclusion, EC approved the SKIN project as a result of a whole of factors that enables the actors of the supply chain to get more and more closer in order to pursue an horizontal and vertical integration through the entire agro-food sectors, avoiding further fragmentation, being the principal reason of the low export market volume of a consistent number of SMEs actives in European countries.

References

Berti, G., & Mulligan, C. (2016). Competitiveness of Small Farms and Innovative Food Supply Chains: The Role of Food Hubs in Creating Sustainable Regional and Local Food Systems. Sustainability, 8(7), 616.

Canfora, . I., 2015. *Is the short food supply chain an efficient solution for sustainability in food market?.* Florence, Agriculture and agricultural science procedia.

Carbone, A., 2016. Shaping food supply chains to enhance product quality. *Rivista di Economia Agraria/Italian Review of Agricultural Economics,* 71(1), pp. 19-29.

Ciani, A., Vörös, L. M. & Fagioli, F. F., 2016. The Role of Local Food Chain in the Sustainable Management and Promotion of Territories. A Comparison Case Study of Umbria Region in Italy and the Sub-Region of Pest County in Hungary. *Italian Review of Agricultural Economics,,* 71(1), pp. 546-559.

Contò F., Faccilongo N., La Sala P., Dicecca R. (2013a), Cloud approach for short chain administration. PROCEDIA TECHNOLOGY, Vol. 8, pp. 600 – 605, ISSN: 2212-0173.

Contò F., Fiore M. and La Sala P. (2013b). The role of innovation in the integrated processes of Integrated Project of Food Chain: the case of cherry cultivation chain in Apulia region. INTELLECTUAL ECONOMICS, Vol. 7, No. 4(18), pp. 467–485, ISSN 1822-8011.

European Commission, EC (2015). EIP-AGRI Focus Group Innovative Short Food Supply Chain management, Final report.

European Commission, EC (2015). Calls for proposals and related activities under the 2016-17 work programmes under Horizon 2020 — the Framework Programme for Research and Innovation (2014-20) and under the Research and Training Programme of the European Atomic Energy Community (2014-18) complementing Horizon 2020. OfficialJournal of the European Union (2015/C 399/02).

Fiore M. (2016), Direct selling in the wine sector: lessons from cellars in Italy's Apulia region, British Food Journal, Vol. 118, n. 8.

Fonte, M. & Cucco, I., 2017. Cooperatives and alternative food networks in Italy. The long road towards a social economy in agriculture. *Journal of rural studies,* Volume 53, pp. 291-302.

Foray D., David P. A., & Hall B. (2009). Smart specialisation–the concept. Knowledge economists policy brief, 9(85), 100.

Foray D., & Goenaga X. (2013). The goals of smart specialisation. Luxembourg: Publications Office of the European Union.

Galli, F. & Brunori, . G., 2013. *Short food supply chains as drivers of sustainable development,* s.l.: Evidence document.

Gobble, M. M. (2016). News and Analysis of the Global Innovation Scene. Research-Technology Management, 59(3), 2-9.

Kelly P. J. (2014). Information efficiency and firm-specific return variation. The Quarterly Journal of Finance, 4(04), 1450018.

Kneafsey, M. et al., 2013. *Short food supply chains and local food systems in the EU. A state of play of their socio-economic characteristics,* s.l.: JRC scientific and policy reports.

Levidow L., & Neubauer C. (2014). EU research agendas: Embedding what future?. Science as Culture, 23(3), 397-412.

Levidow, L., Pimbert, M. & Vanloqueren, G., 2014. Agroecological research: Conforming—or transforming the dominant agro-food regime?. *Agroecology and sustainable food systems,* 38(10), pp. 1127-1155.

Nagurney, A., Besik, D. & Yu, M., 2018. Dynamics of quality as a strategic variable in complex food supply chain network competition: The case of fresh produce. *Chaos: An Interdisciplinary Journal of Nonlinear Science,* 28(4), p. 043124.

Šūmane, S., Kunda, I., Knickel, K. & Strauss, A. T., 2018. Local and farmers' knowledge matters! How integrating informal and formal knowledge enhances sustainable and resilient agriculture. *Journal of Rural Studies,* Volume 59, pp. 232-241.

Tregear, A., 2011. Progressing knowledge in alternative and local food networks: Critical reflections and a research agenda. *Journal of rural studies,* 27(4), pp. 419-430.

Libecap Gary D., (2014). Addressing Global Environmental Externalities: Transaction Costs Considerations. Journal of Economic Literature, Volume 52,

Number 2, June 2014, pp. 424-479(56).

Reimann, F., Shen, P., & Kaufmann, L. (2017). Multimarket Contact and the Use of Power in Buyer–Supplier Relationships. Journal of Business Logistics.

Sara, D., & Francesco, C. (2016). University knowledge exchange and the SKIN Project. Research on Education and Media, 8(2), 33-41.

Thissen M., van Oort F., Diodato D., & Ruijs A. (2013). Regional Competitiveness and Smart Specialization in Europe: Place-based development in international economic networks. Edward Elgar Publishing.

Williamson, O. E. (2008). Outsourcing: Transaction cost economics and supply chain management. Journal of supply chain management, 44(2), 5-16.

World Bank, 2016.World Development Report 2016: Digital Dividends,World

Bank, Washington, D.C.

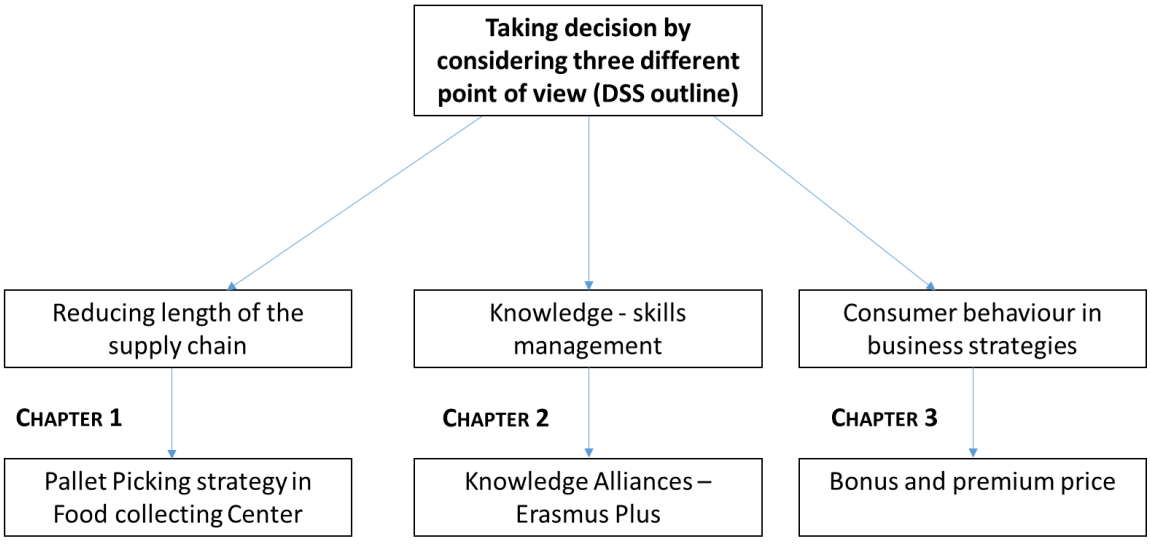
Rationale of the thesis

By referring to the study that has been conducted within the research activities of SKIN

project, it was emerged that to provide value in terms of sustainability, economic operators of the short food supply chain apply good practices when:

1. They are able to set up an internal organization to reduce as much as possible the length of the chain;
2. To apply skills to make the organization sustainable by implementing knowledge of the domain of multifunctional agriculture;
3. To consider the point of view of the consumers by addressing business strategy according their willingness to pay for green practices applied in supplying foodstuffs.

In this regard, the present thesis has tackle these three issues by following the workflow set out in the Figure 4.



These three dimensions of studying SFSCs represent a kind of framework to be considered in developing a Decision Support System. So, to identify good practices, it is hereby suggested to consider well designed organizations, the consumer intentions and the skills acquired and translated into practices. The latter means that analysing the

background of the human resources working in the organization, it is possible to realize whether good practices are implemented.

Importantly, the insights from the chapter two have been turned into an Erasmus project – Knowledge Alliances. The project has been approved, and started in November 2018. The name of the project is “Traning and Orientation for Multifunctional Agriculture entrepreneurial Opportunities – eTOMATO”.

1. Pallet Picking Strategy in Food Collecting Center

Introduction

Over the years, many changes have affected the agro-food system. In the wake of these changes, public policies have been leading economic players to rationalize the resource use in order to accomplish the goal of the efficiency of the agro-food system. The efficiency of agricultural production, and the reduction of emissions, are today important frontiers of research in the technical and economic field. [1] Within the European area for example, the European Commission is fostering policies toward innovation transfer and knowledge uptake to optimize the input use. Within this scope, the main ambition consists in maximizing value, instead of the traditional maximization of profit. The idea of value must be understood as benefits for the stakeholders in economic, social and environmental domain. [2]

In this context, the environmental concern is nowadays being raised as relevant issue, and people are striving to find optimal methods to reduce polluting agents and resources depletion. While this issue, the economic players must keep up the economic incomes, and as long as methodologic trade-off for achieving satisfying results in both directions are not found out, they are not will to refuse to use resources and/or methods unsustainable for the environment [3]. Yet, studies should keep addressing for solutions. It does mean that the solution may not represent the trade-off, though a manner to suggest to stakeholders to not waste resources and strains in adopting practices that do not allow for the trade-off [4]. Along with these considerations, the food marketing through short supply chain, whose actors are often small-medium organizations without marketing unit for reaching away markets, is quickly rising [3]. This hurdle is being started to be overcome by raising the role of collecting centers that gather seasonal foodstuffs for

supplying local, regional and off-region markets. This happens for organic labelled food produced somewhere and sold elsewhere, away from the production [5].

The design of those collecting centers depends on several factors related to logistic constrains, food cold chain performance, as well as supply chain network. In all cases the sustainability is considered as the central point of the issue [6]. According to Seuring and Muller, a supply chain network can be defined sustainable when information, capital flows, and cooperation among companies along the supply chain allow to minimizing the impact under economic, environmental and social perspective, keeping under consideration the stakeholder' interests [7]. For sustainability of the supply chain, the focus is nowadays shifting over approaches based on products and lean management. The first approach is based on the product lifecycle standards that allows to optimize the environmental and social performances, from cradle to grave, of the products [7]. The second approach is based on Lean management, in this case is considered everything that enable operators to rationalize resources input and avoid mistakes that cause inefficiencies by reducing related costs of quality efficiency [5]. About lean, many studies [8-10] highlight seven critical issues that are normally subjected to wastes: transport, inventory, motion, waiting, over-processing, overproduction and defects. On this subject, the food motion inside the warehouse is the question of this article. In the specific, the organizational layout, whether rightly chosen, allows for ameliorating sustainability performance both on the economic and environmental side. Indeed, it considers the logistic for moving foodstuffs when the collector have to face the seasonality of the freights. [11-14]

Logistics, therefore, plays an important role in improving economic and environmental performance [15], and it concerns the ways to store goods and their flows along the chain. Along with these considerations, the modern global market is characterized by high

uncertainty of product demand. Transportation costs can amount up to the 50% of total logistic costs and can affect the configuration of the logistic systems. [16] Additionally, the traditional manufacturing has been criticized for lots size, means of transport (defined as *Outbound Logistic* by Council of Supply Chain Management Professionals (CSCMP)), and management of the warehouse (referred as to *Inbound or Intra Logistic* by CSCMP), for which the need for sustainable manufacturing has been raised. In the specific, the environmental sustainability of logistic activities has become a prominent element of business strategy and competitive advantage. Hence, there are strong social and political pressures because of the increasing of public awareness for global warming and climate change finalized to reduce polluting emissions. [15] Along with these policies addressed to minimize the industrial environmental impacts, many companies have realized that the sustainable use of resources may also be associated with financial savings. In this regard, the Carbon Footprint (CF) and Management Costs (MCs) are relevant for measuring the goodness of the picked resources. [6,16]

In the case of the Italian agro-food sector, organizations are mainly small-medium enterprises mostly operating in Short Food Supply Chain, characterized by variable lead time when stocking and picking goods in warehouse for marketing processes. In most cases, the goods are handled and stocked, without a specific criterion, and lacking of proper planning for managing the delivering time: in this sector, the warehouse layout is crucial, and it affects noticeably the delivering time. These deficiencies are addressed to those intermediaries that are required to set up a logistic layout to minimize the economic and environmental impacts of the handling activities. Thus, intermediaries play an increasingly important role to keep small-medium farms alive. [17]

Starting from the lack of proper material handling planning in agro-food collect center, it emerges the necessity to provide a classification of a set of parameters and indicators

allow to evaluate the logistic performance of agro-food collecting center under environmental / economic perspective and conduct further empirical investigation in the field of Short Food Supply Chain. This gap allows us to formulate the primary research question: Considering the new logistic strategies (e.g. warehouse layout, Material handling equipment, warehouse storage strategy, etc.) in food collecting centers, and how they impact on the business of seasonal foodstuffs in the short food supply chain, is there a 'best-strategy' that allows to optimize the logistic performance of agro-food collecting centers under economic and environmental perspective?

To fully investigate the primary research problem, the following subsidiary research questions are raised:

a. What decisional parameters, in terms of logistics management, of agro-food collecting center, allow to evaluate the impacts on environmental and economic performance of short food supply chain?
b. What specific capabilities will be expected to have the agro-food collecting centers in order to reduce costs and travelled distances, and, consequently, Carbon Footprint emissions and management/operative costs?
c. How does the pallet picking strategy affect the business competitiveness of seasonal foodstuffs of the fruits and vegetables chain?

In other words, this study aims to assess the most efficient layout in agro-food class-based storage warehouses in order to identify the best pallet picking strategy allowing for the minimization of the environmental impact and the management cost due to inbound material handling. For this purpose, there have been considered three different warehouse management configurations: longitudinal, transversal, and fishbone. Each one is assessed considering the handling time from collecting the good from the rack, to the carry and to the picking area, according an ABC class-based storage approach. Following, an analytic

model allows calculating the impact of the material handling strategy adopted based on different Material Handling Equipment (MHE) powered by different engines, such as internal combustion and electrical, both for Carbon Footprint and Management Costs. Optimizing the supply chain handling in the agro-food sector can be accomplished through modifying the MHE, adopting greener measures in it, and/or minimizing the food miles both inside and outside the warehouse.

The optimization of the logistic infrastructure, under an environmental perspective, depends on whether one adopts green energy sources instead of conventional ones, which are more polluting. This study does not focus on the end consumers, but rather on the mitigation of the environmental impact of the production activities. The methodological approach adopted is developed on analytic heuristic process jointly based on environmental and cost considerations, according to literature review shown in following section, there are not previous scientific studies on logistic in agro-food business, based on similar approach.

The paper consists of six more sections. The next one goes through the literature defining the warehouse structure and the warehouse costs impact over the farm management. The third section raises the necessity to improve the warehouse performance to gain competitiveness benefits. The fourth section explains the context within which the study has been implemented. The fifth section shows the adopted methodology to simulate the energy consumption and managing costs. The sixth section discusses the results through a simulation model, whilst the last section presents discussion and relevant conclusions.

Literature Review

As introduced in the prior paragraph, the sustainability is a wide concept that undoubtedly encompasses economic and environmental issues, such as polluting reduction and costs

reduction, to say a few [18,19]. These two facets are squarely interrelated each other, and reducing environmental impacts means reducing costs for the ecosystem where organizations survive, so in turn, for single enterprises [20]. According to Centobelli et al. in [21] a considerable number of studies dealing with sustainability issues in logistics have been introduced, and several models have been developed in order to minimizing the impact under environmental and economic perspective. Indeed, scientific studies show that an improvement of environmental performances leads to an improvement of products and services quality which, in turn, improves cost performances. In this context Validi et al. in [22] provide a mathematical model to select the shortest path allowing to reduce environmental harmful emission in the field of food supply chain. A model based on Artificial Neural Network is developed in order to predict the emissions and evaluate how the cost related to green practices positively impacts on competitiveness in workplaces [23]. A very similar methodology is adopted by Zhu and Sarkis in order to analysis and evaluate the relationship between the adoption of green supply chain practices and economic performance [24]. In search for solutions to the sustainability challenge, researcher and practitioners have explored and established the potential for managerial systems to drive sustainable organizational performance [25]. According to Harris et al. in [26] a first class of models is based on the well-known Economic Order Quantity (EOQ) strategy that aims to minimize the inventory and ordering costs as developed in 1913. Later Baumol and Vinod in [27] modified the EOQ model with the purpose of evaluating transportation and other logistic costs separately. Several models followed the work of Baumol and Vinod [28,29], until a new inventory model that has been developed, namely the Sustainable Order Quantity (SOQ), which considers both economic and social – environmental costs [30]. Models mainly differ in the function adopted for calculating transportation costs and the solutions thought lowering them. An

increasing number of sustainable solutions make possible the minimization of logistic costs (inventory, transport costs) and environmental impact both, but most research is rather limited to studying the environmental impact of warehousing and inventory management from an outdoor perspective (outbound logistics) [19].

Gue et al. in [31] identified five decisional areas within the warehouse design, as shown in Figure 1 and reported, as follows:

(i) Overall structure

(ii) Department layout

(iii) Operation Strategy Selection

(iv) Equipment Selection

(v) Sizing and Dimensioning

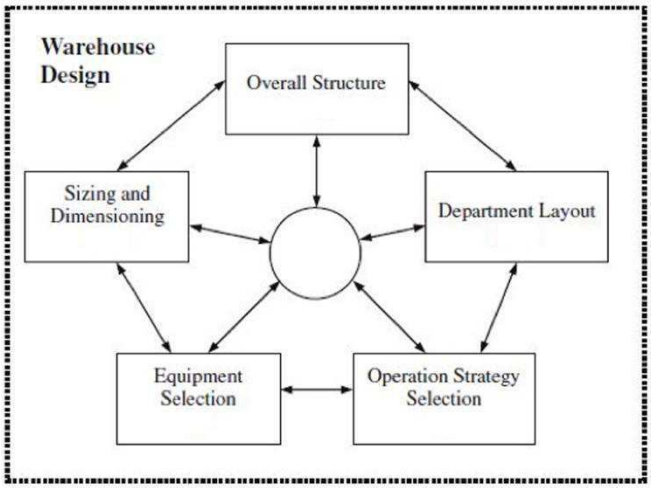


Figure 1 - Warehouse Design

In particular, the Department layout (II) concerns the configuration of the aisles and the retrieval area. Instead, the Operation Selection Strategy (III) is related to the way the warehouse works in terms of layout and order picking. Under this study, both components play an important role in optimizing the material handling strategy, and in turn in affecting the returning value in terms of environmental and economic performance [20].

In last decades, most researches have concentered on order picking strategy, in particular examining the energy usage in the forklift material handling, taking into account factors such as the pallet lift height and the routing of the non-road vehicles within the warehouse [32]. The choice of the Material Handling Equipment (MHE) characterized by low energy consumption is not the only strategy that allows for minimizing the environmental impact of the warehousing activities [33]. As a matter of fact, it is possible to ensure a low level of Carbon Footprint, with a minimal energy consumption, through adopting a specific material handling strategy through reducing the times of items retrieval and delivery in the warehouse [34]. According to Dukic and Oluic [35], the optimization of the routing policies is related to the identification of a batch order to be picked from the racks. This approach allows to minimize the total travel distance. For picker-to-part order picking system have been proposed different routing methods, including optimization algorithms. The performance of these heuristic approaches depends on the particular operating conditions of the system observed. It was estimated that the adoption of heuristic methods allows for an average reduction oscillating between 17% and 34% inside the path length of the forklift within the warehouse. In addition, the interaction between the routing strategy and the storage assignment adopted represents one of the most important aspects in the manual order picking approach. [36]

In most studies the items to be stocked are considered like “elementary units” to operate in warehouses adopting multiple MHE, each of them characterized by a different loading capacity. In this case, the time spent in the picking activity depends on the number of units carried in each travel and on some technical specifications (travel speed, lift speed, capacity load, etc.) according to the MHE adopted. Boenzi et al. in [36] developed a new model allowing the identification of the best MHE in order to minimize the Carbon

Footprint due to material handling activities, ensuring at same time the picking time required by warehouse management system.

Nonetheless, the studies concerning picking strategies leave several problems that still need to be solved. The review carried out by Gue et al. in [31], is a useful guide to tackle them. The review states five decisional areas, bearing in mind that each one of those cannot be evaluated as a stand-alone component but has to be integrated and developed in synergy with the others. The rationale is further shown by observing how a single decisional area modification affect outcomes of others. [31]

Therefore, the literature review shows that:

(i) Integrated models for the path routing identification and the storage assignment planning are not very widespread;

(ii) Most researches considering the environmental issue in warehouse activities are focused on specific 'save-energy' aspects, and most of them are related to the building attributes;

(iii) There is a lack in available scientific works that considers environmental sustainability in an integrated inventory and warehouse planning model;

(iv) The order picking models ensure the reduction of the travel distance and/or retrieval time, but in most cases the authors neglect the environmental performance and the management costs of the non-road vehicles adopted for material handling activities.

This paper is intended to help fill these gaps, and in particular, to provide an approach for minimizing the environmental and economic impacts of the intra logistic activities by means of jointly evaluating all aspects concerning the material handling activities, including the typology of the forklift to be adopted (internal combustion or electric engine

equipped), the layout of the warehouse (longitudinal layout, transversal layout, and fishbone layout), and the turnover index of the foodstuffs to be stocked.

The management of the warehouse as a factor of competitiveness: the case of fresh fruit and vegetables

In recent years, the need for a satisfying response from the production-logistic system to the complex demands of the market has been raised as a significant topic of discussion and reflection. This trend is probably due to a new physiological need of flexibility, understood as the ability of an economic organization to cope with a series of "contingencies", responding in a more economic and rapid manner to the environmental changes generated by the issue. [20]

In the specific case of agro-food chains there are different types of Production-Distribution-Consumption (PDC) systems, each one characterized by specific organizational forms and different degrees of complexity, whose, in turn, generates different environmental impacts (e.g. greenhouse gas emissions). For agro-food organizations, the chain efficiency represents one of the frontiers for ameliorating competitiveness and related commercial policies by building up a positive environmental image [20,37]. The improved chain efficiency, customer services rate, product quality, availability, affordability, consumption rate and higher customers satisfaction, waste minimization, waste utilization, reduced cost and lead time and strong competitive advantage in marketplace are only some of the outcomes of value addition practices in the food chain management [38].

In particular, the fruit and vegetable sector has undergone significant organizational changes in the last twenty years, in line with the general evolution in the agro-food system [4]. Advancements in information and transport technologies, changes in consumer habits, the evolution of large-scale retail trade, as well as the growth of global competition and the increase in foreign investments have redesigned the global economic and

organizational context. These changes have raised the focus of the studies on the supply chain and the structure of the value chain [39-41]. This study is based on the management of the information flows aiming to reduce procurement times and costs, increasing effectiveness in satisfying consumer demand, and increasing the added value of the supply chain. The fundamental change of the company perspective lies on reconsidering competencies and competitive advantage from the perspective of the whole chain and not solely the step where the single operator is positioned: this brings consequences on the structure of the contractual relations and authorities existing between the different actors of the chain. For these reasons, logistics, as part of the whole supply chain, has been intensifying in complexity. [42] In the specific, it is precisely the evolving trends in demand generated by industry and commerce and the structural changes on the supply side that suggest the opportunity to take an integrated view of the market for freight transport and logistics. However, we is defined "sustainable" logistics as that one that is capable to address the problems of safety and the environment, as well as the needs of the economic development that depends on it. [43]

One could then speak of a "triangle of sustainability" whose summits are:

- Economic efficiency
- Socio-territorial development
- Reduction of negative externalities

Despite of the important reorganization processes described above, some studies in the sector [44, 45], show that in the Italian fruit and vegetable industry, the traditional retail sector covers an important portion inside the chain distribution, especially in Southern Italy. Nonetheless, it is precisely in the traditional distribution that the greatest inefficiencies due to fragmentation of demand and supply and the number and type of intermediaries to name a few are found. Therefore at least two-thirds of the products (in volume) follow non-optimized logistics chains.

[2] In addition to inefficiencies detected, which would make the national companies uncompetitive, there are irresponsible companies that don't pursuit the sustainable performance theme for the sake of short-term profits. Based on the recently review findings conducted by Shashi et al. in [38], it can be inferred that the significant mitigation in waste, emission, energy consumption, use of toxic materials and enlargement in the rate of recycling in agro-food chain operations are due to law requirements rather than merely a business choice [38]. When compared to other European countries such as France and Germany, the fruit and vegetable value chain in Italy presents several criticalities, with a strong imbalance towards a capillary distribution that affects almost equally preservable products (apples, etc.) and perishable products (strawberries, salads, etc.). In other words, the small-medium size of the Italian farms is representing a shortcoming when intermediaries approach to receive the freights from farms. This problem is becoming an hurdle difficult to overcome due to, operating in short food supply chain, the farms mostly offer seasonal foodstuffs. It follows that warehouse management, understood as a set of planning and control decisions and procedures, becomes a fundamental element for the competitiveness of a company. [46]

The issue related to the small farms is faced in the next paragraph.

The considered context

Over the years, the agro-food sector has mainly changed because of several external forces. One is the rural development transition, which generates new objectives for the current players as its new purposes are qualitative oriented instead of the traditional quantitative ones. Small farms operating in close markets represent the common target adopting qualitative practices: to reach the farther demand, those actors need to outsource the marketing phases, which bear the highest costs. To do so, it appears that intermediaries are crucial. Even if their activities end when the product is delivered to the clients, they are part of an earlier stage consisting in setting up the design of the warehouse

and of the internal logistic activities to minimize the needed resources. [47] It follows that, as stated earlier, designing the layout has an important impact on the equipment amount, the reduction of the working time and the increasing of the throughput. For seasonal foodstuffs, the intermediaries, supplied by local small producers from local areas, need to tackle the issue of the optimal design for enhancing sustainability performance and keep it up over time across the seasons. Then, when the optimal layout may change between seasons, the distributor can miss the sustainability. [48,49] The literature lacks studies in this perspective, and this article tries to contribute to this issue. At this stage is necessary to introduce the logistic matter of the layout design for warehouse.

The literature states that the most used layouts until 2009 were the longitudinal and the transversal ones. The longitudinal one displays straight racks put in parallel, as well as the aisles, that are arranged as having the same width and length. The first attempt to optimize the longitudinal layout was developed with the transversal layout. The latter reduces the travelled time by decreasing the distances from the picking to the delivering area. [22]

Since the introduction of the fishbone layout [50], many academic studies have attempted to design it as the most efficient. Worries concern the dimensions of the warehouse and the slope for the diagonal cross aisles. For instance, Gue & Meller [50] tried to overcome the common barriers preventing the optimal utilization of the longitudinal and transversal layouts, finding alternative solutions. In this respect, they elaborated the Flying-V layout, the Fishbone and New Diagonal cross-aisle as shown in Fig. 2.

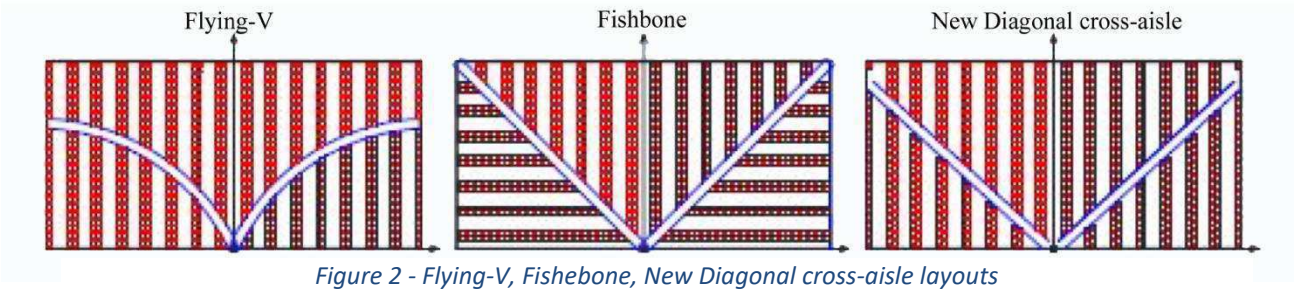


Figure 2 - Flying-V, Fishebone, New Diagonal cross-aisle layouts

The choice of the warehouse design is considered a notable result as it reduces costs and travelled distances, and, consequantly, Carbon Footprint emissions and additional costs.

Methodology

The design of the warehouse begins with the calculation of the travelled distances within each format. To do so, it is necessary to set and consider its main features. Before going to the description, the following list shows the notation used in the formula in the article:

A: width of the warehouse [m];

B: length of the warehouse [m];

P/D: pickup and deposit point [m^2];

L_x: distance along the x axis between the P/D point and storage area [m];

L_y: distance along the y axis between the P/D point and storage area [m];

N: overall number of the items to be stocked in warehouse [unit]

D: width of the aisles [m];

e_l, e_w, e_d: size of the selected item according length, width, and depth [m];

V_c: average travel speed of the forklift [km/h];

t: average time taken by the forklift for the material handling activities [h];

I: turnover index of the n-th item [#]

$\bar{P}$: average path required for the handling of the items stored in warehouse [m/unit];

CF_{LPG}, CF_{ele}: average Carbon Footprint of the adopting forklift, equipped by electric ('ele' as subscript) or LPG ('LPG' as subscript) engine [$kgCO_2$].

The method considers the following assumptions:

- The number of the total items stored in warehouse is constant and the maximum load capacity corresponds to *N* (there are not available slots in the racks of the warehouse);
- The items stocked have prismatic form and are characterized by the same sizes (e_w, e_l, e_h) and weight, the storing approach is based on only one-item for one-slot of the rack;
- The information order is known in advance;
- The picking of one-item does not depend by the position of the other items (racking system is adopted);
- The material handling phase is implemented by means of forklifts;
- Only one item is picked by the forklift for each loading/unloading cycle;
- The *P/D* point is placed near to the storage one, in the center-bottom level of the warehouse, as shown in fig. 3 and 4;
- The size of the warehouse is given;
- Class based storage is the stocked strategy adopted;
- The emission of the activities required for loading/unloading the pallet from rack are not considered, when the forklift is stopped. This assumption is considered acceptable since the time required for this operation is negligible when compared to the time required to reach the pallet;
- The energy and the time required for the pallet retrieving/stocking does not depend on the following: weight of the item, lift speed of the forks, and height of the slot where the item is stocked;
- Acceleration and deceleration of the forklift are not considered;

The process of pallet picking is composed by the following sequence of activities:

1. the forklift starts moving from the *P/D* point travelling at a constant speed;
2. the forklift stops in the storage area and pick the selected item;
3. the forklift, with the load, goes back (moving on the same path of point number 1) to P/D point at a constant speed;

The process of pallet stocking is composed by the following sequence of activities:

1. the forklift, with the load, starts moving from the *P/D* point travelling at a constant speed;
2. the forklift stops in the storage area and stock the selected item;
3. the forklift goes back (moving on the same path of point number 1) to P/D point at a constant speed;

The optimization purpose consists in minimizing the objective function considering the Carbon Footprint generated by the movement of the forklift. A comparison between forklift equipped with LPG engine versus an electrical one has been considered. These equations follow:

$$CF_{LPG} = F_{LPG} * C_{LPG} * t \quad (1)$$

$$CF_{ele} = F_{ele} * C_{ele} * t * \frac{1}{\eta} \quad (2)$$

where:

F_{LPG}, F_{ele}: Fuel and electric mission factor $\left[\frac{kgCO_2}{kWh}\right]$;

C_{LPG}, C_{ele}: average fuel and energy consumption hourly rate $\left[\frac{kWh}{h}\right]$;

η: overall efficiency of the electric energy due to electrochemical charging efficiency of the battery;

t: average time required for material handling activities [h/units]

The costs evaluation (Management Costs) has been distinguished in average Facilities Costs (FCs), as given by warehouse activities such as heating, lighting, cleaning service, warehouse maintenance, and so forth. Additionally, these operations are equal for warehouses with either electric or LPG forklifts. On the other hand, Operative Costs (OCs_{LPG}, OCs_{ele}) depend on average energy consumption relating to the handling activities in case of forklifts equipped by internal combustion or electric engine.

According to the following equations, the costs are calculated:

$$FCs = Area * c_{ut} \tag{3}$$

$$OCs_{LPG} = C_{LPG} * t * p_{LPG} \tag{4}$$

$$OCs_{ele} = C_{ele} * t * p_{ele} \tag{5}$$

where:

Area: overall surface of the warehouse [m^2];

c_{ut}: Utilities costs due to warehouse activities calculated per m-squared $\left[\frac{€}{m^2 * h}\right]$

p_{LPG}, p_{ele}: average cost of the fuel or electricity for forklift engine supply $\left[\frac{€}{kWh}\right]$

The objective function to be minimized (eq. 6) has been applied to come out the results of the overall minimum time (T_{tot}) required for picking and stocking all items from the rack within the warehouse. The function is evaluated on the basis of $\bar{P}$ parameter, that depends on the total path for material handling activity considering the layout and the turnover index of the stocked items. To this extent, V_c depends on technical specification of the forklift, generally for safety concern, the travel speed of the forklift in warehouse not exceed the 10 [km/h].

$$t = \frac{1}{N}\min\{T_{tot}(\bar{P})\} \tag{6}$$

Where N identifies the overall number of the items to be handled in warehouse.

The average time required by the forklift for material handling activities (t) is strongly related to the travel speed and routing path for picking activities. This means that the first parameter depends by forklift performance (V_c) and the second parameter ($\bar{P}$)on the pallet picking strategy adopted and on layout of the warehouse. Therefore, it is necessary to identify both parameters for each one of three different layouts adopted in the model.

Longitudinal and Transversal Layouts

The 'traditional' layouts of the warehouses are identified as longitudinal and transversal: in the first case the shelving is laid out perpendicularly to the *P/D* point and there is one aisle for each rack (see figure 3a). In the second case the shelving is laid out parallel to the *P/D* point and there is one main aisle for the material handling activities (see figure 3b). The notations adopted to identify the geometrical features of both warehouses are listed below:

s: sector of the layout;

k: rank of the layout;

j: position of the selected item within the generic rack;

l: level of the shelf;

O_{skjl}: position of the selected item to be retrieved.

These parameters are identified to evaluate the routing path of the forklift on the basis of adopted layout in the warehouse. In the following are shown the equations for calculating the average path $\overline{(P)}$ for the handling of the items stored in warehouses characterized by longitudinal or transversal layouts:

$$\bar{P} = \frac{2I_{skjl}}{N}\left(\sum_{s=1}^{2}\sum_{k=1}^{K}\sum_{j=1}^{J}\sum_{l=1}^{L}P_{skjl}\right) \quad (8)$$

where P_{skjl} is the path of the forklift for the handling of one selected item from position identified by *s*, *k*, *j*, and *l* parameters. According to the analytical model developed, this position can be identified by means *X* and *V* variables, which represent respectively the path travelled by the forklift to reach the k-th rack (*X*) and the path along the aisle to get the j-th rack (*V*). The I_{skjl} parameter instead identifies the specific turnover inventory ratio referring to selected items located in *s*, *k*, *j*, and *l* position.

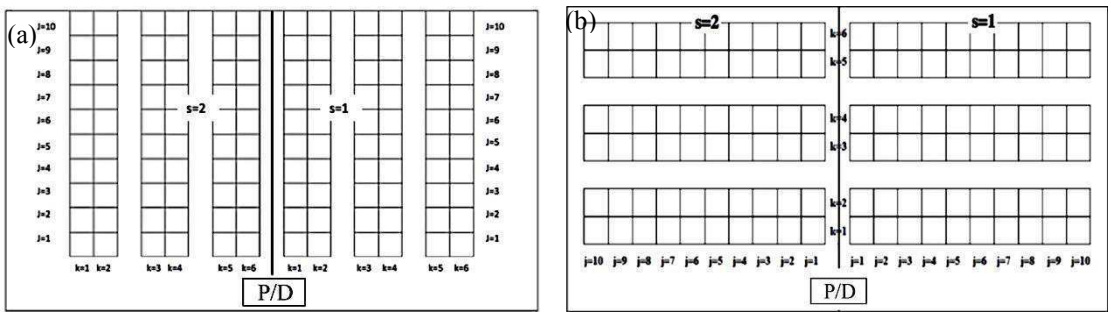


Figure 3 - Nomenclature for longitudinal (a) and transversal (b) layout

In the cases of longitudinal and transversal layouts, the evaluation of both parameters (*X* and *V*) changes, as it depends on different geometrical constraints characterizing the layouts. Instead, the *K*, *J*, and *L* values identify the maximum number of available slots in the racks within the warehouse.

Fishbone layout

The fishbone layout was introduced by Gue & Meller in [50]: their proposed design presents two main diagonal aisles forming a "V" and picking aisles that are perpendicular to the sides of the warehouse (see fig. 4a). According to the authors, this design ensure savings of 20% inside paths for the picking and the depot of the items within the warehouse. This claim is related to the particular diagonal position of the main aisles. Indeed, the distance between *P/D* point and the selected item to be picked is very close to the Euclidean distance (see fig 4b). This is not true in the case of the traditional rectilinear warehouse (both longitudinal and transversal layout) in which it is always necessary to traverse the full rectilinear aisle to complete picking activities. It is important to note that in these cases, the authors consider that the items to be stocked are all characterized by same turnover index ratio.

According to the design of fishbone layout, is possible to identify the following geometrical characteristics:

- There are four equal zones shaped as triangles and they are identified from 'zone 1' to 'zone 4';
- There are three aisles: one in the middle between the zone 2-3, and two diagonally, respectively between zone 1-2 and zone 3-4;
- *D* parameters are the same for every aisle;
- The diagonal aisles always end in the upper corners of the warehouse.

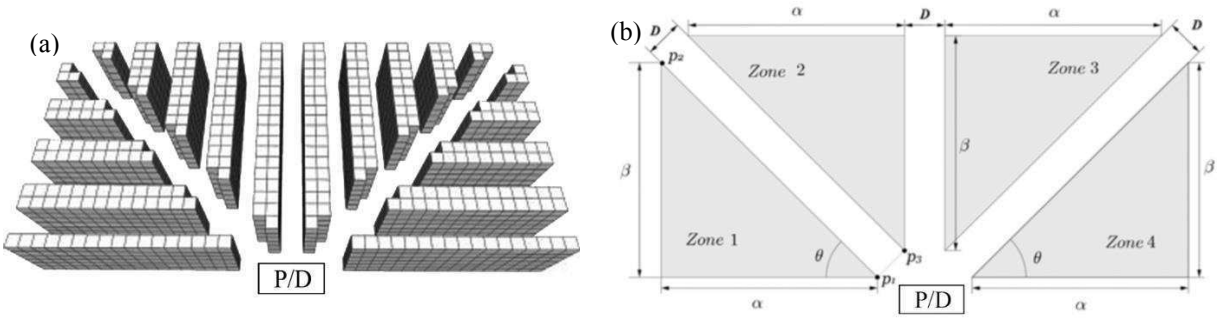


Figure 4 – Tridimensional fishbone layout (a) and geometrical specification (b)

The average path $\overline{(P)}$ for the handling of the items stored in warehouses is calculated by means of the equation 7; the nomenclature adopted to identify the geometrical features is shown in fig 5a and 5b.

In this case, the developed analytical model to identify P_{skjl} is related to four different variables. In the specific, *X* represents the distance along the diagonal aisle to get the selected items and it depends on the slope of the aisles and the lengths of the legs of one of the identified triangles.

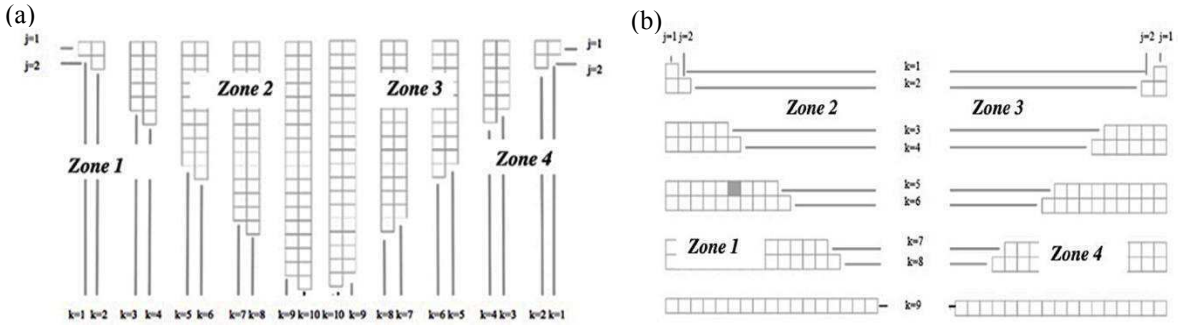


Figure 5 - Nomenclature of the fishbone layout for zone 2 and 3 (a) and zone 1 and 4 (b)

Concerning parameter v, this represents the distance within the parallel aisles from the start of the aisle to the position of the select item according to the j-th position.

Simulation model and Results

A simulation model was implemented in order to identify the optimal warehouse layout for different agro-food collecting centers, adopting the proposed model. In the case hereby presented, the stocking of the three-different classes of items identified as A, B and C is considered, with each of them being characterized by a specific turnover index ratio (I_A, I_B, and I_C), whose values are listed below:

- I_A = 90 the items are picked very frequently in a given interval time;
- I_B = 12 the items are picked occasionally in a given interval time;
- I_C = 3 the items are picked rarely in a given interval time.

the parameter I is assumed to embrace a season, therefore the goods from the collecting center are considered to be seasonal food. Four different scenarios are evaluated considering the same value of N parameters for each case; in table 1 it is possible to observe that the percentage of the different classes of items to be stocked in the collecting center change significantly for each scenario.

Table 1 - Hypothesis of the stored goods in the warehouse over the time, according four different scenarios corresponding to different mix of ABC classes

	Percentage of A, B and C-items stocked in warehouse		
Scenarios	A [%]	B (%)	C(%)
#1	100	0	0
#2	70	20	10
#3	40	30	30
#4	20	50	30

The model allows the evaluation of the environmental (measured as Carbon Footprint) and economic impacts (measured as Management Costs) due to material handling activities adopting a collecting center with different layouts and with forklifts powered by internal combustion or electric engine. The strategy suggested by the model is shown in the following tables, in four different scenarios, in order to minimize the Carbon Footprint (table 2) and Management Costs (table 3).

Table 2 - Layout and MHE identified in order to minimizing of the Carbon Footprint due to inbound material handling

	Input parameters				Output (minimal CF)	
Scenarios	N [u]	A [%]	B [%]	C [%]	Layout	MHE
#1	120	100	0	0	Fishbone	Electric-forklifts
#2	120	70	20	10	Fishbone	Electric-forklifts
#3	120	40	30	30	Longitudinal/Transversal	Electric-forklifts
#4	120	20	50	30	Longitudinal/Transversal	Electric-forklifts

Table 3 - Layout and MHE identified in order to minimizing of the Management Costs due to FCs and OCs

	Input parameters				Output (minimal MCs)	
Scenarios	N [u]	A [%]	B [%]	C [%]	Layout	MHE
#1	120	100	0	0	Longitudinal/Transversal	Electric-forklifts
#2	120	70	20	10	Longitudinal/Transversal	Electric-forklifts
#3	120	40	30	30	Longitudinal/Transversal	Electric-forklifts
#4	120	20	50	30	Longitudinal/Transversal	Electric-forklifts

It is possible to observe that the layouts suggested by the model in the collecting center, change on the basis of the mix of the goods to be stocked. In particular, the environmental impact is reduced by approximately of 10% adopting the fishbone layout in cases

identified as #1 and #2. Instead, in cases #3 and #4 the longitudinal and the transversal layouts ensured a reduction of Carbon Footprint by approximately of 1% (see fig. 5a). Although the fishbone layout ensured a lower average path for the handling of the goods, it requires a collecting center with larger surface area compared to the one calculated for the longitudinal and transversal layouts. As a result, the Management Costs of fishbone layouts averages 20% higher than the longitudinal and transversal layout in terms of economic scores (see fig. 5b).

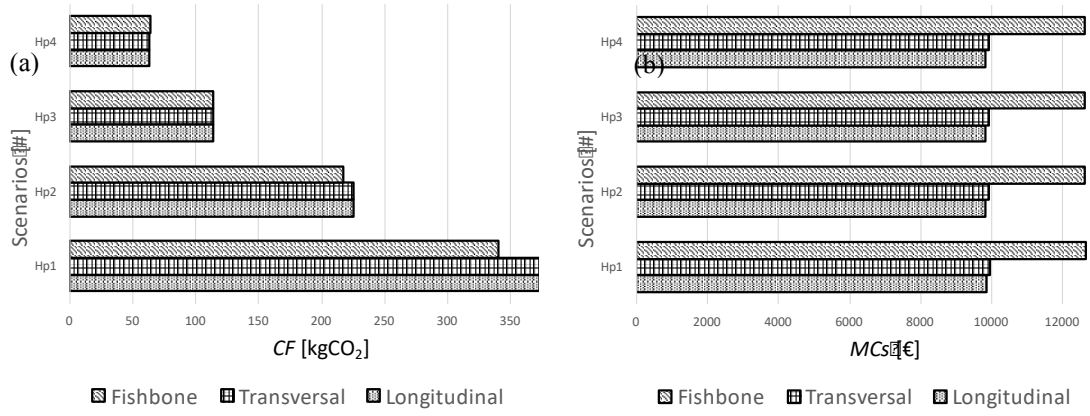


Figure 6 – Log report generate by the model regarding the Carbon Footprint and Management Costs evaluation in all scenarios

Regarding the MHE evaluation, the electric forklift adoption gives the best results in terms of environmental and economical performances both. Indeed, in the cases analyzed, the electric forklift ensured a reduction of about 50% of Carbon Footprint and a *OCs* saving of about 20% when compared to LPG-forklift.

Discussion and Conclusions

Trying to find a solution to increase the environmental and economic sustainability of the food supply chain, this study shows that such issues can be treated with having consideration of the logistics inside the warehouse where foodstuffs are stocked. In that case, seasonal foodstuffs of the fruits and vegetables chain have been considered, and the

logistics issue regards the layout design for stocking food in order to find the optimal solution in terms of Carbon Footprint and related Managing Costs. The researched value to be added to the supply chain [44] implies that through minimizing the picking time of the goods, the Carbon Footprint and related costs are optimized with checking out among the performance of each layout. Results show that when the layout is fixed over the time, the performance return the best solution. However, to fix the layout, it is necessary to take into account the turnover index of the supplied goods. Within a long supply chain, the issue does not matter, on the contrary, the short fruit and vegetable chain entails that the suppliers are locally placed, and the production comes from seasonal farming [51]. Nowadays the short chains of the seasonal foodstuffs are seen as a paradigm of quality and trust for the producers, and they are quickly taking hold. This evidence is mainly appearing in contexts where operate farms having small-medium sizes. Indeed, although they work close to the consumers, they make use of intermediaries to increase the market share. Intermediaries (collecting centers), in turn, when collecting freights from different small farms, need to set up the finest resources organization that encompass the logistics issues. [13,52,53] Nonetheless, the results of this study display that the optimum layout changes when changing the turnover index of the stocked goods. In this regard, the seasonal fruit and vegetable carry different turnover indexes in the warehouse, and the sustainability of the performance is inevitably subjected to change over the seasons.

Results, hereby presented, clearly suggest that when most goods stocked in collecting centers are characterized by high turnover indices, the fishbone layout ensure the minimal environmental impact if compared with the longitudinal and transversal layouts, by keeping lower level of Carbon Footprint for collecting center in which most goods stocked are characterized by low values of turnover index ratios.

Of course, the difference in terms of Carbon Footprint is much more relevant when considering the two types of engine fuel instead of the layout modification only. With a fishbone layout in fact, the electrical engine generates half of the emissions produced by LPG engine instead.

This finding brings meaningful insight concerning the evolution of the warehouse layout studies: bringing together the fishbone layout and electrical engine, they can produce positive synergies in terms of environmental impact. Further comments in terms of cost level can be made, taking into account that implementing the fishbone layout is more expensive due to larger surface required and the higher complexity of the design. In this context, a limit of the model is surely represented by the utility costs related to warehouse facilities (*FCs*). The costs of a charging station and relative infrastructure installations required in the case of electric forklifts are not considered.

According to the output generated by the model in the previous section, Carbon Footprint and Management Costs performance depends on the turnover inventory ratio of the goods stocked. Consistently, if keeping the average turnover at a fixed level, it becomes easy to make the best decision after witnessing the results of the analytical model. In other words, if the average turnover index of the goods stocked in the collecting center can be aligned at a specific level within a season, it is possible to identify the optimum strategy. Therefore, a good approach can be oriented to store the goods by monitoring the average turnover index so that it is kept within and/or over a critical point that represents the border level for considering another layout as "optimal".

The last consideration regards the divergence between the strategies suggested by the model in order to optimize the environmental and economic aspects. Consistently with this claim, in many cases the model, given the same input, could suggest two different strategies: one strategy allowing minimization of Carbon Footprint and another different

strategy ensuring the minimization of the Management Costs. In these cases, it is harder for logistic operators to make a decision. Therefore, the model should be further developed in order to include more optimization criteria in its objective function. This will lead to the possibility of applying it to more complex scenarios, thus ensuring greater flexibility and increasing the number of the industrial environments in which it can find place.

References

Accorsi, R. et al., 2016. The land-network problem: ecosystem carbon balance in planning sustainable agro-food supply chains. *Journal of Cleaner Production,* Volume 112, pp. 158-171.

Accorsi, R., Manzini, R. & Pini, C., 2017. How Logistics Decisions Affect the Environmental Sustainability of Modern Food Supply Chains: A Case Study from an Italian Large-scale Retailer. In: R. Bhat, a cura di *Sustainability Challenges in the Agrofood Sector.* s.l.:Wiley, p. 175.

Albliwi, S. . A., Antony, J. & Lim, S. A. H., 2015. A systematic review of Lean Six Sigma for the manufacturing industry. *Business Process Management Journal,* 3(21), pp. 665-691.

Antony, J., Rodgers, B. & Cudney, E. A., 2017. Lean Six Sigma for public sector organizations: is it a myth or reality?. *International Journal of Quality & Reliability Management,* 9(34), pp. 1402-1411.

Baumol, , W. . J. & Vinod, H. D., 1970. An inventory theoretic model of freight transport demand. *Management science,* 7(16), pp. 413-421.

Berger, R., 2005. *Analisi della filiera dell'ortofrutta.* s.l., s.n., p. 19.

Bertazzoli, A. et al., 2011. Food chains and value system: the case of potato, fruit, and cheese. *Journal of food products marketing,* 17(2-3), pp. 303-326.

Bing, X., Bloemhof-Ruwaard, J., Chaabane, A. & van der Vorst, J., 2015. Global reverse supply chain redesign for household plastic waste under the emission trading scheme. *Journal of cleaner production,* Volume 103, pp. 28-39.

Boenzi, F. et al., 2015. *Sustainable Warehouse Logistics: a NIP Model for non-road vehicles and storage configuration selection.* Napoli, s.n., pp. 263-270.

Boenzi, F. et al., 2016. *Greening activities in warehouses: a Model for identifying Sustainable strategies in Material Handling.* Vienna, B. Katalinic (Ed.) Published by DAAAM International, pp. 0980-0988.

Boronico, J. S. & Bland, D. J., 1996. Customer service: the distribution of seasonal food products under risk. *International Journal of Physical Distribution & Logistics Management,* 1(26), pp. 25-39.

Bortolini, M., Faccio, M., Gamberi, M. & Bortolini, M., 2015. Diagonal cross-aisles in unit load warehouses to increase handling performance. *International journal of production economics,* pp. 838-849.

Carbon Trust, C., 2008. *Product carbon footprinting: the new business opportunity,* s.l.: The Carbon Trust.

Cesaretti, G. P. & Green, R., 2006. *L'organizzazione della filiera ortofrutticola: esperienze internazionali a confronto.* s.l.:FrancoAngeli.

Chen, J. X. & Chen, J., 2017. Supply chain carbon footprinting and responsibility allocation under emission regulations. *Journal of environmental management,* Issue 188, pp. 255-267.

Chiarini, A., 2017. Environmental Policies for Evaluating Suppliers' Performance Based on GRI Indicators. *Business Strategy and the Environment,* 1(26), pp. 98-111.

Dekker, R., Bloemhof, J. & Mallidis, I., 2012. Operations Research for green logistics–An overview of aspects, issues, contributions and challenges. *European Journal of Operational Research,* 219(3), pp. 671-679.

Digiesi, S., Mascolo, G., Mossa, G. & Mummolo, G., 2016. Internalisation strategies of external costs of transport for a sustainable logistics. *International Journal of Productivity and Quality Management,* 18(2-3), pp. 238-257.

Đukić, G., Česnik, V. & Opetuk, T., 2010. Order-picking methods and technologies for greener warehousing. *Strojarstvo: časopis za teoriju i praksu u strojarstvu,* 52(1), pp. 23-31.

Dukic, G. & Oluic, C., 2004. Order-picking Routing Policies: Simple Heuristics, Advanced Heuristics and Optimal Algorithm. *Journal of Mechanical Engineering,* Volume 50, pp. 530-535.

EC, 2015. *EIP-AGRI Focus Group Innovative Short Food Supply Chain management, Final report.,* Bruxelles: European Commission (EC).

Faber, N., De Koster, M. B. M. & Smidts, A., 2013. Organizing warehouse management. *International Journal of Operations & Production Management,* 9(33), pp. 1230-1256.

Facchini, F. et al., 2016. Minimizing the carbon footprint of material handling equipment: Comparison of electric and LPG forklifts. *Journal of Industrial Engineering and Management,* 5(9), p. 1035.

Fearne, A. & Hughes, D., 1999. Success factors in the fresh produce supply chain: some examples from the UK. *Supply Chain Management: An International Journal,* Volume 4, pp. 120-131.

Fischer, C., Gonzalez, M. A., Henchion, M. & Leat, P., 2007. Trust and economic relationships in selected European agrifood chains. *Acta Agriculturae Scand Section C,* 1(4), pp. 40-48.

Fredriksson, A. & Liljestrand, K., 2015. Capturing food logistics: a literature review and research agenda. *International Journal of Logistics Research and Applications,* 1(18), pp. 16-34.

Gallo, C., Faccilongo, N. & La Sala, P., 2018. Clustering analysis of environmental emissions: A study on Kyoto Protocol's impact on member countries. *Journal of Cleaner Production,* Volume 172, pp. 3685-3703.

Garza-Reyes, J. A., 2015. Green lean and the need for Six Sigma. *International Journal of Lean Six Sigma,* 3(6), pp. 226-248.

Goran, D., Cesnik, V. & Opetuk, T., 2010. Order-picking Methods and Technologies for Greener Warehousing. *CODEN STJSAO,* pp. 23-31.

Gue, J., Goetschalckx, M. & McGinnis, L., 2010. Research warehouse design and performance evaluation: A comprehensive review. *European Journal of Operationa Research,* 3(203), pp. 539-549.

Gue, K. & Meller, R., 2009. Aisle confifuration for unit-load warehouses. *IIE Transaction,* 3(41), pp. 171-182.

Gulati, S. & Roy, D., 2015. Free trade and the greening of domestic industry. *Environment and Development Economics,* 20(1), pp. 1-19.

Hardy, P. . Y. et al., 2016. Viability and resilience of small-scale fisheries through cooperative arrangements. *Environment and Development Economics,* 21(6), pp. 713-741.

Harris, I. et al., 2011. Assessing the impact of cost optimization based on infrastructure modelling on CO2 emissions. *International Journal of Production Economics,* 131(1), pp. 313-321.

Janic, M., 2007. Modelling the full costs of an intermodal and road freight transport network. *Transportation Research Part D: Transport and Environment,* 12(1), pp. 33-44.

Jayaram, J. & Xu, K., 2016. Determinants of quality and efficiency performance in service operations. *International Journal of Operations & Production Management,* 3(36), pp. 265-285.

Koh, S. L., Gunasekaran, A., Morris, J. & Obayi, R., 2017. Conceptualizing a circular framework of supply chain resource sustainability. *International Journal of Operations & Production Management,* 10(37), pp. 1520-1540.

Kumar, S. & Managi, S., 2016. Carbon-sensitive productivity, climate and institutions. *Environment and development economics,* 21(1), pp. 109-133.

McKinnon, A., Browne, M., Whiteing, A. & Piecyk, M., 2015. *Green logistics: Improving the environmental sustainability of logistics.* s.l.:Kogan Page Publishers.

Meller, R. & Gue , K., 2006. Fishbone aisles. *Daily Headlines: University of Arkansas.*

Pandit, R. & Palekar, U., 1993. Response time considerations for optimal warehouse layout design. *Journal of Engineering for Industry,* Issue 115, pp. 322-328.

Powell, D., Lundeby, S., Chabada, . L. & Dreyer, H., 2017. Lean Six Sigma and environmental sustainability: the case of a Norwegian dairy producer. *International Journal of Lean Six Sigma,* 1(8), pp. 53-64.

Sahin, E. & Dallery, Y., 2009. Assessing the impact of inventory inaccuracies within a newsvendor framework. *European Journal of Operational Research,* 197(3), pp. 1108-1118.

Savino, M. M., Manzini, R. & Mazza, A., 2015. Environmental and economic assessment of fresh fruit supply chain through value chain analysis. A case study in chestnuts industry. *Production Planning & Control,* 26(1), pp. 1-18.

Soode-Schimonsky, E., Richter, K. & Weber-Blaschk , G., 2017. Product environmental footprint of strawberries: Case studies in Estonia and Germany. *Journal of environmental management,* Issue 203, pp. 564-577.

Soysal, M., Bloemhof-Ruwaard, J. M. & Van der Vor, J. G. A. J., 2014. Modelling food logistics networks with emission considerations: The case of an international beef supply chain. *International Journal of Production Economics,* Volume 152, pp. 57-70.

Tait, P., Saunders, C., Guenther, M. & Rutherford, P., 2016. Emerging versus developed economy consumer willingness to pay for environmentally sustainable food production: A choice experiment approach comparing Indian, Chinese and United Kingdom lamb consumers. *Journal of Cleaner Production,* Issue 124, pp. 65-72.

Ugarte, G. M., Golden, J. S. & Dooley, K. J., 2016. Lean versus green: The impact of lean logistics on greenhouse gas emissions in consumer goods supply chains. *Journal of Purchasing and Supply Management,* 22(2), pp. 98-109.

Vavra, P. & Goodwin, B. K., 2005. *Analysis of price transmission along the food chain,* s.l.: OECD.

Zajac, P., 2011. The idea of the model of evaluation of logistics warehouse systems with taking their energy consumption under consideration. *Arch. Civil Mech. Eng.,* Volume 2, pp. 479-492.

Zhang, A. et al., 2016. Lean and Six Sigma in logistics: a pilot survey study in Singapore. *International Journal of Operations & Production Management,* 11(36), pp. 1625-1643.

2. Policy to share existing knowledge and overcome fragmented skills. The case of eTOMATO project

Over the last decades, governments, citizens, companies and research institutions have been struggling with understanding the right and most efficient way to underpin initiatives to transfer knowledge. These four corners of our political, societal and economic

environment (well-designed as representing the so-call four helix) constantly challenge to get in contact each other in order to keep relationship flows. These links have become even more important in the wake of the recent economic crisis, as more and more countries seek to secure sustainable sources of economic growth (Aghion, et al., 2009). Subsequently, science, capabilities and skills are growingly targeted by concerted policy efforts, in an attempt to reduce countries' economic reliance on financial or real estate markets (Blanchard, et al., 2012).

In Europe, such initiatives relies on the so-called Smart Specialization Strategy (S3). S3 aims at reducing the productivity deficit in relation to global leaders. S3 stresses the need of focusing on vertical areas (specialization) by building on existing strengths and assets (smart) as base for innovation-driven growth (Foray & Rainoldi, 2013).

In this respect, Krammer (2017) well explained what critical issues around Europe in applying S3 come up. He set out how in some countries, S3 has not been returning the expected results, and by browsing the weaknesses from its SWOT analysis, some of them captured my attention:

- Increase in environmental standards;
- Insufficient skilled human capital;
- Outdated educational curricula;
- Lack of national funds;
- Limited collaboration between firms and universities;
- Limited collaboration with foreign entities.

This point of departure was harnessed to proceed with analyzing the emerging results of SKIN project about Short Food Supply Chain. In the specific, by SKIN results, emerged that:

1. Although relevant knowledge exist and that are applied in good practices, there is a fragmented distribution of the skills obstructing its replacement;
2. The shorter is the supply chain, the greater is the possibility to find a multifunctional organization of the agri-food sector.

Multifunctional Agriculture is a way to get across inter-sectoral approach to manage resources. So the further step was to analyze some areas around Europe in the field of multifunctional agriculture.

This study was conducted as shown in the paragraph about the method. The last paragraph will just show the framework of the approved project.

Why Multifunctional Agriculture and Needs analysis

Agriculture is the economic sector using natural resources (land, weather etc.) to produce output. All over the world, the availability of the natural resources is getting reduced and/or altering with environmental changes. Population is quickly growing, getting aged and facing increasingly social problems as well. Any actions to cope critical situations from such scenarios is supported by public finances without returning economic results (resources wasting). To overcome this, it is necessary **to shift from methods based on quantitative approaches** - stressing the land and the environment to return increasingly outputs - **to qualitative ones** - based on the lean principles to pursue the growth and business diversification (*Figure 1*). The principles inspired by Lean Resources Management aim at adopting good practices in agriculture, minimizing the inputs to

optimize the outputs. Such qualitative practices are commonly adopted within the initiatives to engage the Rural Development (RD).

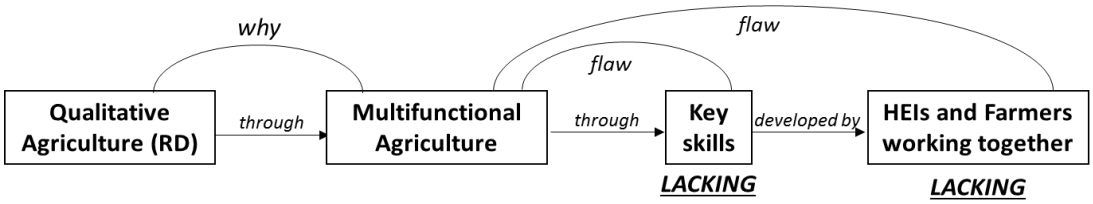


Figure 1 – Why the MA topic and related main flaws

In turn, **the agribusiness diversification through lean principles to foster the RD is implemented with the Multifunctional Agriculture (MA).** MA carries out methods and practices:

1. To take care of natural and cultural heritage to gain from touristic movements **(Need 1)**;
2. To reach economic viability by reducing inputs **(Need 2)**;
3. To foster and offer social inclusion opportunities through social farming **(Need 3)**;
4. To prevent unsustainable behaviours from future generations by implementing didactical farms **(Need 4)**;
5. To balance the power of the consumers within the supply chain and build strong trust between producers and consumers by exploiting the short food supply chain **(Need 5)**.

The MA domains are represented by Social and Didactical Agriculture (SDA), Short Food Supply Chain (SFSC) and Rural Tourism (RT). On the other hand, implementing a successful MA business means to achieve the environmental, social and economic results (Triple Bottom Line – TBL) (**Need 6**). TBL is a complex result and needs for merged practical (farm experience) and theoretical (HEIs training) knowledge. However, **the farmers are currently not able to achieve satisfying results for the stakeholders due to lacking *synergetic key skills* –** see Fig. 2.

Key skills are represented by interrelated knowledge, necessary for implementing MA within the three domains hereby identified, merged with Entrepreneurial skills (such as marketing, problem solving, decision-making, networking, information gap management etc. **(Need 7)**). As stated by EIP-AGRI (the European Innovation Partnership launched by EC in 2012) "the new entrants into farming usually miss entrepreneurial mind-set". ["New entrants into farming: lessons to foster innovation and entrepreneurship" EIP-AGRI, 2016].

Synergetic means that the key skills have to appropriately run together to return higher results than the simple sum of its parts. In other words, it is necessary to tackle the key skills fragmentation: bringing together key skills coming from practical experiences (**Need 8**) and HEIs advanced training. It means that if **farmers and HEIs** do not work together, practitioners can just acquire fragmented and/or limited skills (or developed only through practical experience - thus lacking of advanced knowledge *or* only through theoretical training - lacking of empirical experience).

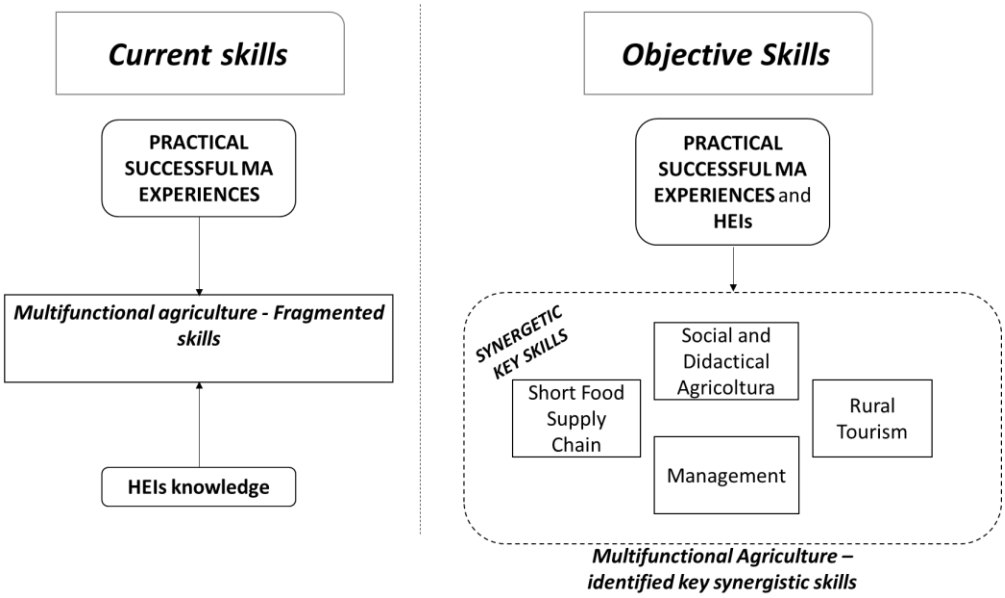


Figure 2 – Current skills vs. Objective skills

What results-outcomes should be achieved by meeting needs analysis

A detailed need analysis, which will bring to the creation of the MA practitioners identikit allows the creation tailor-made training materials, blending traditional classes (on entrepreneurial skills – **Need 7**) and e-learning modules (on the specific MA domains). The innovative tools for assessing internal resources of traditional farms (MA Readiness Framework) and designing resilient businesses (Business Model Canvas for MA) will complement the training, increasing the capacity of the trainees (students, traditional farmers and new entrants) to avoid mistakes (**Need 6**). During the first implementation, partners will also collect the Business Models created by the students during the BM competition and, after revision and validation, will include them in the training materials for the following editions (as an inspiration and example for other aspiring practitioners) (**Need 6)**. Work-based experience (**Need 8**) will complete the training path, giving the participants the possibility of having a training on the job experience and allowing the Universities to assess the impact on the students for validating the e-TOMATO training format.

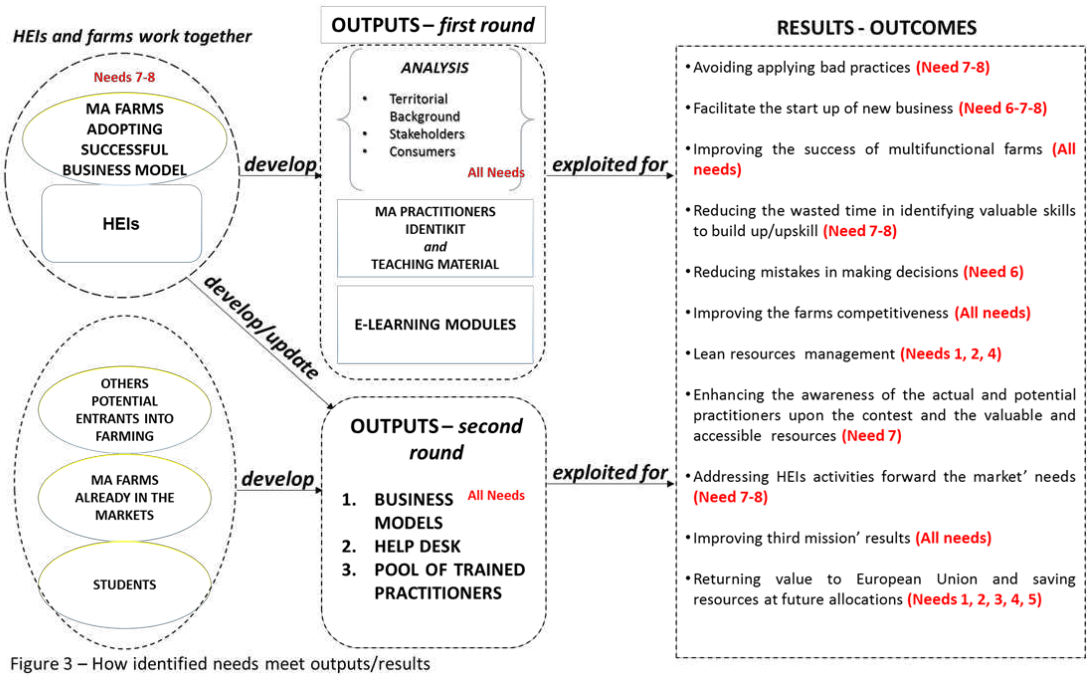


Figure 3 – How identified needs meet outputs/results

These identified needs aim at overcoming the weaknesses presented by Krammer (2017).

Areas of intervention

S3 was applied in some countries. In the specific, the analysis was conducted in four different regions by four different countries: Puglia (Italy); Belgium; Bulgaria and Andalusia-Murcia (Spain). It was considered the research focus of the universities dealt with studying rural development through MA and the key local resources on which local economies are based on. It came up a sort of disconnection between farms and universities for those countries in which the agricultural sector is in their own S3, as shown in the next Figure 4.

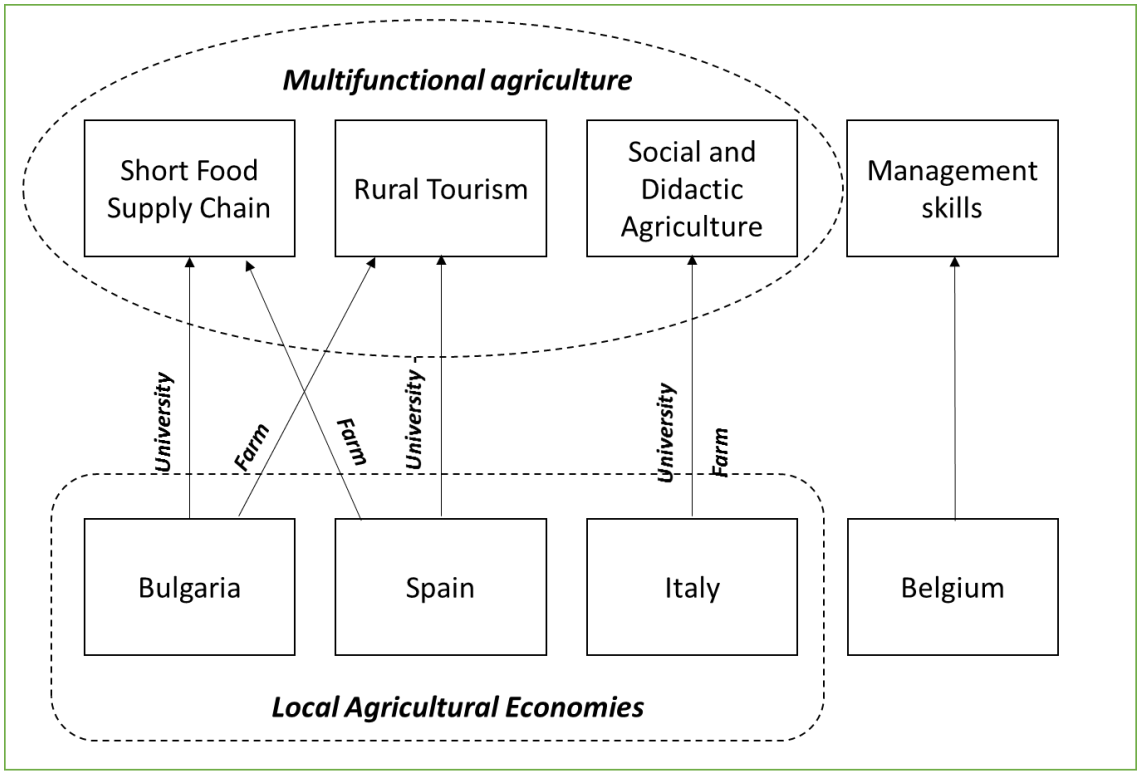


Figure 4 – Rationale for identifying the European areas

In contrast, although Belgium is a country where the Agriculture dos not represent a key sector, they are able to gain in terms of low environmental impacts, high income,

short travelled distances, diversify their business. The investigation was conducted by analysis data on almost fifty farms by visiting them during my PhD visiting.

Along with this finding, it was analyzed the Puglia region, in the south of Italy. By a sample of almost sixty farms, It emerged that more than the half are dealt with MA, in all domains aforementioned. In turn, regional universities are also dealt with deepening the topic of MA.

Finally, by collecting data from secondary sources (such as ERDN),

Results – The case of eTOMATO. Erasmus Plus – Knowledge Alliance project

By bringing together all the previous assessment. The result was the project eTOMATO that was approved in July 2018 by the European Commission. The framework of the project is depicted in the workflow at the Figure 5.

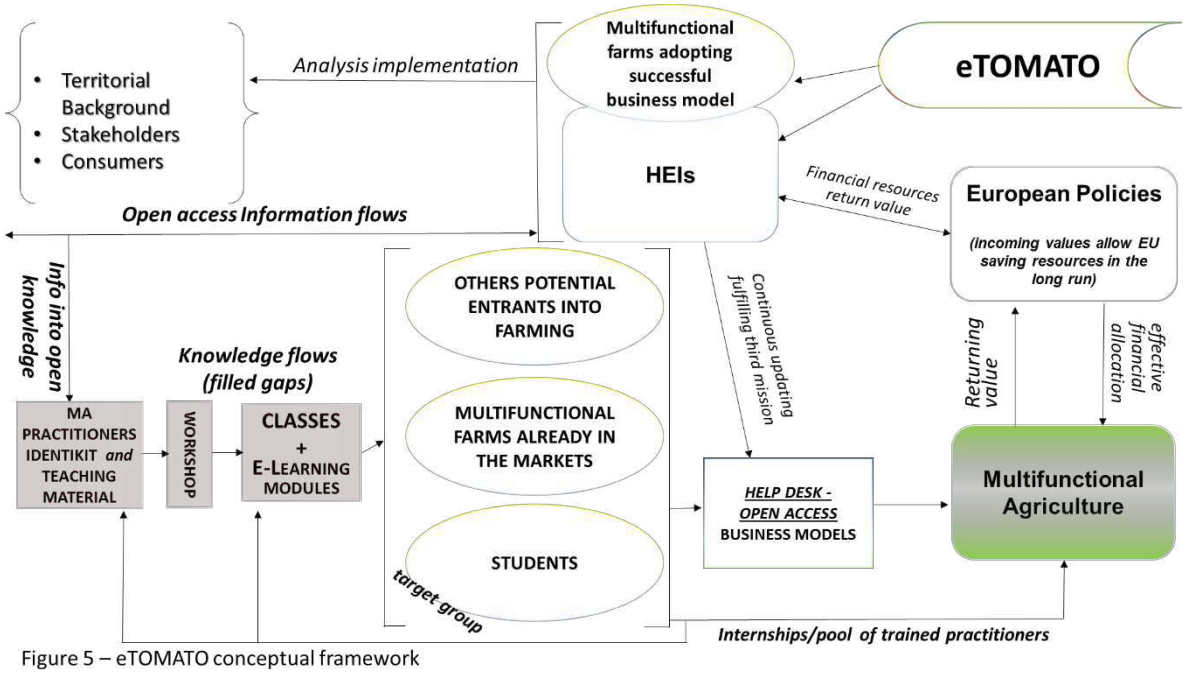


Figure 5 – eTOMATO conceptual framework

The eTOMATO rationale is to achieve project specific objectives is shown in the Figure 5. eTOMATO will allow farms and HEIs to work together in order to undertake analysis to clarify the prominent facets characterizing the MA context. The context information, presented as training needs analysis and MA practitioner identikit, will be turned into **synergetic key skills**, to be addressed with "tailor-made" teaching material.

The course will be delivered to the identified target groups (students, farmers and potential new entrants into farming). The candidates will attend the Business Model Competition and the winner(s) will obtain access to the transnational work-based experience. HEIs will develop open-access Business Models (as good practices for MA practitioners) and will keep them updated over time. Furthermore, HEIs will establish a **permanent MA Help Desk** providing services to practitioners. At the end of the project, all outputs will be open to all existing and potential new entrants into farming. In the long period, European policies will benefit through the virtuosity system enabled by the fulfilment of these objectives.

Hence, the project specific objectives include:

Objective 1. to allow universities and farms working together

Obj. 1.1. to identify the key actors operating in MA,

Obj. 1.2. to identify the consumer target of MA,

Obj. 1.3. to identify needs and methods meeting theoretical and practical background,

Obj. 1.4 to provide classes training and farms coaching

Objective 2. to build up synergetic key skills, deliver entrepreneurial support and Business models,

Obj. 2.1. to identify training needs to develop skills,

Obj. 2.2. to develop management skills,

Obj. 2.3. to develop open-access Business Models

Obj. 2.4 to establish the help desk service to help managing the project outputs

Objective 3. to transform organisations and farms into open and adaptive systems.

Obj. 3.1. to guide organisations step-by-step in advancing their future readiness,

Obj. 3.2. to transform and enhance farms' management and innovation strategies,

Obj. 3.3. to instil organisational capability to utilize internally the knowledge about external forces,

Obj. 3.4. to build an innovative ecosystem of agents of change around MA.

Erasmus Plus – Knowledge Alliances is way to exploit policies addressed to overcome the weaknesses pinpointed by Krammer (2017).

References

Aghion, P., David, P. A. & Foray, D., 2009. Science, technology and innovation for economic growth: linking policy research and practice in 'STIG Systems'. *Research policy, ,* 38(4), pp. 681-693.

Blanchard, O., Romer, D., Spence , M. & Stiglitz, J., 2012. In the Wake of the Crisis: Leading Economists Reassess Economic Policy. *MIT Press.*

Foray, D. & Rainoldi, A., 2013. *Smart Specialisation programmes and implementation,* Luxembourg:: European Commission.

Sutherland, L. A., Monllor, N. & Correia, T., 2015. *EIP-Agri Focus Group. New Entrants into Farming: Lessons to Foster Innovation and Entrepreneurship,* Brussels: European Commission.

3. Do consumer behaviours address green business strategy? An empirical test on young adults

Introduction

Over the past decades, increasing attention has given worldwide to the natural environment. Many studies have emphasized the need of turning into sustainable economies by applying green practices in organizing business (Safari, et al., 2018; Schmidt, et al., 2017; Carrete, et al., 2012; Jansson, et al., 2010; Straughan & Roberts , 1999; Meadows, et al., 1972).

One of the most concerning impact is represented by climate change, which certainly causes several disruptions, such as rising ocean levels and desertification (United Nation, 2018). However, a condition of ecological and economic stability and social equity sustainable into the future can be reached by means of responsible behaviours of both society and companies (European Commission, 2014; European Parliament & Council of the European Union, 2012; Brundtland, 1987). Then, a growing number of companies, aiming at integrating environmental concerns in their business operations and in their interactions with stakeholders, is embracing environmental sustainability into business strategies (Grosso, et al., 2012). Consumers represent a group of primary stakeholder (Carroll, 1991). In this respect, nowadays, their role is being considered as growingly important (Fotiadis & Polemis, 2018).

In a free-market, for example, consumers interested in reducing negative externalities of environmental nature, may purchase only 'green' products'. So they choose their supplier based not only on the price (the supplier that provides the service at the lowest price in accordance with market rationale), yet on criteria of environmental sustainability, rewarding suppliers that, independent of the price at which they deliver,

use a larger share of ‘green’ and renewable technologies (Gupta, 2018).

This approach has been already tested in some sectors, often without obtaining tangible results. The problem of free riding is, for example, very much present in the field of green energy (Batley, et al., 2001). In fact, the experience showed that the percentage of green electricity purchased by consumers without incentives does not exceed 2-3% of the total; other studies confirm that to stimulate demand it is necessary to at least introduce tax relief for consumers of green energy (Jegen & Wüstenhagen, 2001). In the field of the ecotourism, the premium price is largely used, and tourists are often willing to pay more for services that are less comfort than the mass tourism offering (Hultman, et al., 2015). However, the growing of the sector is still facing difficulties to be tackled by implementing different price strategies, with reference to the different attitudes of the audience (Yusof, et al., 2017). A premium price is also paid for house placed nearby green areas. Urban green has positive influences on neighbouring property values. Despite this, the green spaces are non-commodity goods, and it is very challenging to measure the monetary on willingness to pay a premium price (Perera, et al., 2016). This risk causes adverse selection when people decide to buy a house (Noor, et al., 2015). Also in food market, less than the four percent of the worldwide market share is for green products (Gleim, et al., 2013). Then, it struggles with taking hold (Dupré, 2005), and the reasons may be explained by unexplained factors (O’Neill, et al., 2014).

In other words, these unsuccessful experiences confirm that, despite an ever greater number of people being interested in environmental protection (Grizzetti, et al., 2013), individual choices do not fully reflect the real value that can be placed on protection of the environment by purchasing ‘green' goods (Fiore, et al., 2017). Yet in contrast, five meta-analysis (Bansal & Song, 2017; Margolis, et al., 2007; Orlitzky & Benjamin, 2001; Orlitzky, et al., 2003; Frooman, 1997) pointed out a positive relationship between

green behaviours and financial performance (Gupta, 2018; Kempa, 2013). Is there any business strategy issue?

It was decided focus on the food due to the issue of this thesis and also, it has a major impact on many economies and they are at the heart of many environmental and social issues (Brulhart, et al., 2017).

This study, indeed, considers active and passive behaviours that consumers put in practice when they decide to purchase food (Young, et al., 2010). Passive behaviour means that consumers do not implement green practices, but receive it by the active behaviour of the supplier. Consumers recognise that food has a greater value and they pay a premium. The greater value is given by the underlying green practice implemented by the supplier (Hultkrantz, L., 2018). Active means that consumers implement the green practice, and for this, they purport a discount, that we here identify as bonus price. In considering green practices, we followed the list proposed by Garcia-Garcia et al. (2016). We categorized them in two groups: preventive and successive. Preventive practices regard processes that are carried out before happening environmental damages, and aim to prevent exactly that circumstance. On the contrary, successive practices concern processes are carried out once happened environmental damages.

Passive and active behaviours for preventive/successive practices are matched with premium and bonus price, respectively.

In the wake of these claims, were formulated some questions.

Are consumers sensitive to the environmental issues so that are willing to pay more? Do consumers have any willingness to pay a premium price for passive behaviours or to ask a bonus price for active behaviours, when purchasing a green food product? In planning

price policies, is there any propensity of the consumer in preferring preventive instead of successive green practices?

Answering to these questions, will allow for understanding whether the price strategies convey reasons that hinder the green food markets. It means that consumer behaviours may change when they are involved in the supply processes along with paying discounted price, as pointed out by Vitell (2015) when addressed for further studies.
It was used used paired T-test to compare the groups two by two to determine if young adults are willing to pay/act to reduce environmental impacts, and if they make a choice between preventive and successive practices. Two main results have been found out: (1) consumers prefers paying/acting for preventive practices; (2) consumers are willing to both pay act to get green food. These results bring to four different business strategy that a food supplier should consider.
Section 1 of this chapter provides basics of literature this study in grounded in. Section 2 reviews the empirical research methodology used to undertake analysis. Section 3 sets out results, discussion and limitations for further works through the conclusions.

Literature Review

The relationship between sustainability and business performance has been largely argued for years. However, different results from studies have been mixed, leading to conflicting conclusions, recommending to keep investigating (Surroca, et al., 2010; Barnett, 2007; Margolis & Walsh, 2003). Brulhart et al. (2017) asserted “one explanation for the discrepancies may be that certain terms, such as social responsibility and sustainability practices, are used to cover a broad range of company behaviours”. Therefore, scholars have pointed out that it is worthy to specify that a single study is

referred to specific circumstances (Surroca, et al., 2010; Brammer & Millington, 2008; Wagner, 2005; Margolis & Walsh, 2003; King & Lenox, 2002).

Vitell (2015) claimed that most of the studies investigate the importance of the role of the Corporate Social Responsibility (CSR) that takes place when firms do good things (Verteramo Chiu, et al., 2017). However, he also claims that few studies discuss the role of the consumer in achieving the CSR, which means that it exists the Consumer Social Responsibility (CnSR). CnSR has been aptly defined as the principles and 'the standard that guide the behaviours of individuals as they obtain, use, and dispose of goods and services' (Muncy & Vitell, 1992). Moreover, that study assessed consumer preferences on picking products whose production has been made by using different practices environmental-friendly (Bahrick & Hall, 1991). These practices have been later distinguished between preventive (Ben Mabrouk, et al., 2016) and successive practices to reduce environmental impacts by mitigating food loss and waste (Di Florio & Fanelli, 2016). In the specific, preventive initiatives relate to the application of practices mitigating food loss and waste by working on the source of the production (Corrado, et al., 2017; Ben Mabrouk, et al., 2016). Successive (after distribution) means adopting practices for recovering emerging harmful events (Park, 2018). As such, successive means adopting practices aiming at handling circumstances risky for environmental issues (Garcia-Garcia, et al., 2016; Lipinski, et al., 2013).

In this context, green food market faces difficulties to take hold: green practices of the CSR have costs for the suppliers, and the CnSR can be exploited for undertaking price policies through reducing the costs for the supplier. Do con

The payoff for the consumers comes from the competitiveness of the producer organizations that Pigors & Rockenbach (2016) point out as the relation that exists

between the Corporate Social Responsibility (CSR)) pursued by producers, and how consumers react to it (Balogh, et al., 2016). On the other hand, consumers pay attention in choosing the goods respecting standard of greener quality (Verteramo Chiu, et al., 2017), mainly when they purchase intention meet their purchase behaviour (Verteramo Chiu, et al., 2017), and they likely act for purchasing within, such as, short food supply chains, to organizations adopting green practices for reducing waste and loss of food (Shu, et al., 2016; van Grinsven, et al., 2015). Bringing together these initial considerations, it is right to specify that many initiatives are being carried out for achieving sustainable food consumption along with practices environmentally friendly (Hardwing, 2010). To improve the success of the current and future initiatives, it is urgent the involvement of a worldwide pool of stakeholders in the processes for developing plans and applying actions returning synergies in results (Carter, 2018). Stakeholders are the community of the actors that someway affects the outputs/value of the supply chain (Wang & Berens, 2015), or is affected by the choices of the leading players within the chain (Limnios, et al., 2016). As such, the consumers represent a specific category of stakeholders. In the past, their role was neglected. However, things have been changed over the years, and they were reconsidered to play a consolidated substantial role in addressing the supplier' choices (Bartsch, et al., 2016).

In doing that, emerging four groups, as well as their comparison, are shown in the methodology section.

Active behaviour – Bonus Price and Passive Behaviours - Premium Price

Since the financial crisis that started in 2008, global awareness of the long-standing issue of resources depletion has put strong pressures on economic operators. People has

become increasingly attentive in use resources (Fernandez-Feijoo, et al., 2014), both from the side of the marketers and the consumers (Flammer, 2013). In this regard, Aragón-Correa & Sharma (2003) argue that exist two different environmental management practices: reactive and proactive. Reactive strategy is when environmental response means just compliance with laws and norms, so these firms, contrary to the proactive ones (Berry & Rondinelli, 1998), do not make changes in product and process (Jabbour & Santos, 2006). Then, starting from this claim, Brulhart et al. (2017) suggest that a proactive strategy is inspired by a strategic intent of considering environmental issues substantial for the firm' going concern itself. We aim to address this study to proactive firms. Nonetheless, we go through the strategy design by raising the issue that firms need to interpret these proactive behaviours by fitting theirs with the consumer sentiment (Alimi & Workneh, 2016).

In doing that, we simplify this wording by considering proactive as active behaviour in order to avoid making confusion with the readers. Active relates to actions that are undertaken to get something for which is asked a price (consumer' payoff). If this price is asked by consumers, we call it as bonus price. If consumers refer to producers any practice without acting, we call it premium price payed by the consumer (producer' payoff). The point hereby considered refers to understanding if consumers pay attention to do something for bonus or receive something giving a premium (Chekima, et al., 2016; Bashaa, et al., 2015). Based on these developments, we formulate hypothesis 1:

Hypothesis 1: consumers make a choice to decide to act for bonus or pay for premium

Successive and Preventive practices

Within our workflow, we decided to strengthen hypothesis 1 in order to improve the returning value from the results our data analysis. To do this, we considered the green

practices found in literature (Ingrao, et al., 2018; Garcia-Garcia, et al., 2016). These studies regard the management of food waste and loss. Indeed, for a proactive firm (Aragón-Correa & Sharma, 2003), to supply food by environmental-friendly actions mainly means applying principles referred to food losses and wastes (Klassen & McLaughlin, 1996). Avoiding losses and wastes means reducing the risk of environmental food issues (Lipinski, et al., 2013). While if the issue has already come up, its mitigation regards the readdressing its flow in order to avoid that such issue causes damaging impact (Girotto, et al., 2015). In this regards, we consider preventive and successive practices those ones in the domain of preventing food loss/waste and readdressing the food management when losses and wastes are coming.

We assume that the awareness on the environmental matters regarding food markets of the young adults is such that if well addressed by the offering firm, they pay attention to this difference. Finally, we matched preventive and successive practices to active and passive behaviours in order to come up with potential differences to be considered in planning green business strategy.

Hypothesis 2 can thus be developed as follows:

Hypothesis 2: consumers make a choice to decide to act/pay between preventive and successive practice

Method

Study context

The attention to environmental issues is quickly rising for people having long lifespan. The term of lifespan is intended for those whose cultural knowledge are based on the newest awareness of preserving the environment, strongly prone to respecting the environmental social norms well-established in their education. In our study, we consider

those people being between 18 and 40 years-old. Indeed, social norms are knowingly respected whether people know the problem or potential positive actions (Gifford & Nilsson, 2014). People that know possible problem get activated to respect the social norms acquired during their educational growth. These considerations are based on the two models that have been extensively exploited to set out consumer's environmentally-friendly behaviour, which are the Theory of Planned Behaviour (TPB) (Ajzen, 1991) and the Norm Activation model (NAM). Both models assume that consumers act in a rationally-informed manner. In the wake of these assumptions, individuals holding interests in preserving the environment should be mainly represented by young adults (Yadav & Pathak, 2016; Sasmita & Mohd Suki, 2015; Kanchanapibul, et al., 2014; Lee, 2008; Reinhardt, 1999) as this article considers..

Data collection has been undertaken within the geographical area of Foggia city where the agro-food is the core economic sector, and the issue of reducing the environmental impacts needs to be constantly raised to keep high the attention of the citizens. In that context, it is not clear whether the limit is either about the consumer attitude, that turns into intention first, and behaviour afterwards, or it is ascribable to mistakes invalidating the firms' strategies when marketing products (Albino, et al., 2009). In the latter case, people may have the right environmental attitude, but it is not met by firm' strategy (Leonidou, et al., 2015). It obviously causes failure of related green markets (Ball & Kittler, 2017; Ottum & Moore, 1997). The hypothesis is that the meeting of organizational/managerial theories and environmental-friendly approaches are being missed by economic operators. Such assumption is supported by the study carried out by Daddi et al. (2018). It states that upon 28 management theories (e.g. stakeholder and institutional theories), the relation between business environmental strategies and other organization theories seems to be unexplored.

Survey

The survey has been targeted to understand whether the consumer intention is driven by practices for either preventing environmental harms (Limnios, et al., 2016) or mitigating the emerging harms when a kind of inefficiency comes up. As consequence of the intention, behaviours are driven by the actual strategy put in practice (Prakash, 2002). It means that the right strategy stimulating the intention to turn to behaviour. Therefore, the questionnaire investigated the willingness to pay by comparing preventive and successive practices (Limnios, et al., 2016). Each group brings together different actions, as indicated in Table 1 and 2 (Ingrao, et al., 2018; De Pascale, et al., 2017; Garcia-Garcia, et al., 2016).

Table 1. List of the preventive practices proposed to interviewed by questionnaire, distinguished by active (bonus) and passive (premium) consumer behaviour

Preventive practices	
WTP1pp prevent	packaging (e.g. small package, package material)
	Increase the frequency of weekly delivery
	Short Supply Chains
	use green means of transports
	planned production (such as 'just in time')
WTP1bp prevent	direct purchasing from the producer
	purchase of not processed products (raw materials)
	purchase seasonal products

	inform in advance the producer of periodic needs

Table 2. List of the successive practices proposed to interviewed by questionnaire, distinguished by active (bonus) and passive (premium) consumer behaviour

Successive practices	
WTP2pp after	social issues
	extraction of compounds/industrial uses
	animal feeding
	reuse for firms issues
	biofuel production
	anaerobic digestion
	bio-fertilizers
WTP2bp after	purchasing foodstuffs of second choice close to the expiry date
	keep up a food diary to register the daily food consumption and waste and somehow broadcast data to produc**er**
	social issues
	return containers to producer

search for producers applying green practices

The distinction between preventive and successive practice, the specification of the list of actions, has been proposed by Garcia-Garcia et al. (2016). Instead, WTP has come by our framework and research purpose.

The questionnaire has been shared by emailing the link (CAWI). It has been sent to almost 600 subjects selected by contact list updated over time for others activities of the University of Foggia. Table 3 shows the questionnaire submitted to consumers.

Table 3. Questionnaire submitted to consumers

Survey questions – the survey is divided in two parts: A, B.
Please, continue to answer the next questions only if you do not find futile the questions and you have time to read them carefully and reply with consciousness. The questionnaire is set to exclude the forms not fully filled.
Part A – in this section, you are kindly invited to answer to questions regarding your willingness to pay a premium for foodstuffs produced by applying the green practices listed below. You pay a premium for a practice implemented by the seller (producer). <u>Please indicate a value between 0 and 10 and feel free to use decimal place to indicate your willingness to pay.</u> **(1) How much would you be willing to pay as a premium whether the producer applies several practices to prevent environmental degradation? _____** **Practices (1) → Packaging (e.g. small package, package material); Increase the frequency of weekly delivery; Short Supply Chains; use green means of transports; planned production (such as 'just in time').**

(2) How much would you be willing to pay as a premium whether the producer applies several practices to recover environmental degradation? _____

Practices (2) → social issues; extraction of compounds/industrial uses; animal feeding; reuse for firms issues; biofuel production; anaerobic digestion; bio-fertilizers.

Part B – in this section, you are kindly invited to answer to questions regarding your need to ask for a bonus (discount) for foodstuffs when you are called to behave following the actions listed below. You pay a discounted price for applying green practice by yourself. Please indicate a value between 0 and 10 and feel free to use decimal place to indicate your willingness to pay.

(3) How much discount you ask for as bonus whether you should apply several practices to prevent environmental degradation? _____

Practices (3) → direct purchasing from the producer; purchase of not processed products (raw materials); purchase seasonal products; inform in advance the producer of periodic needs.

(4) How much discount you ask for as bonus whether you should apply several practices to recover environmental degradation? _____

Practices (4) → purchasing foodstuffs of second choice; close to the expiry date; keep up a food diary to register the daily food consumption and waste and somehow broadcast data to producer; social issues; return containers to producer; search for producers applying green practices.

As such, it has been asked to a sample of young adults the percentage of increased price that there are willing to pay, and the percentage of decreased price. In both cases, the marginalities have been surveyed by suggesting the options in the following continuous set of percentage values [0, 10]. Obviously, this set of values represent the choice of paying a marginal price (premium), or asking for a marginal discount (bonus).The survey obtained 356 respondents.

Processed variables and methodological framework

Consumer' Willingness to Pay has been checked by considering its composition as depicted in Figure 1. Within the range of marginal price that the survey asked for, WTP is considered as the expression of pay more or less food. The remaining part of the range [0, 10] is deemed as residual representing the not expressed willingness (Figure 1, 2). Whether this consideration is raised for bonus price then the remaining part is the consumer' WTP even though acting positively, while the remaining price of the premium is the price that consumer are willing to pay though not acting positively.

Figure 1. Willingness to Pay when asking for bonus

Source: My processing

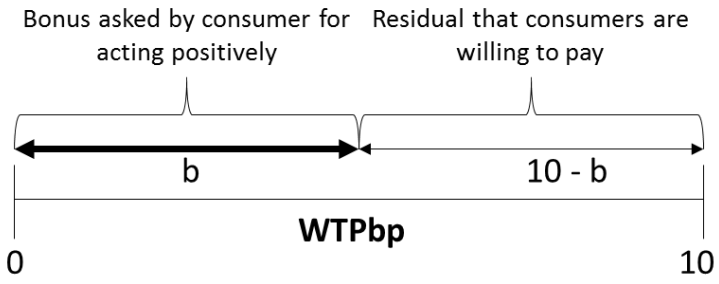
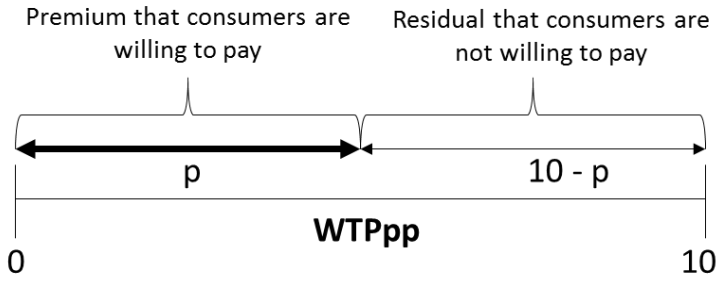


Figure 2. Willingness to Pay when asking for premium

Source: My processing



Following this rationale, our analysis to compare the consumer' intention to prefer acting, and so asking for bonus, is elicited by the relation resulting from $b - (10 - p) > 0$. If $b >$

(10 – p), then the respondent is more willing to pay a premium than acting personally. Likewise, if p > (10 – b), consumer is intended to prefer paying a premium. As such, that procedure has been applied by comparing the mean of the differences of the samples. Therefore, the order relations between means are explicated as $\mu(b) > \mu(1 - p)$ and so forth. Results from using this rationale are presented in Table 5 and 6.

Data collection has been addressed to a paired sample, and so groups have been compared two by two. In the wake of this consideration, it has been chosen to proceed with using the T-student test (De Winter, 2013; Mee & Chua, 1991).

Table 4 presents the compared variables by considering the structure of the WTP depicted in Figures 1 and 2, and the list of the practices (actions) listed at Tables 1 and 2.

Table 4. Groups compared by T-test

1st group		**2nd group**
b prevent	**to**	b after
p prevent	**to**	p after
b prevent	**to**	10 – p prevent
b after	**to**	10 – p after
b prevent	**to**	10 – p after

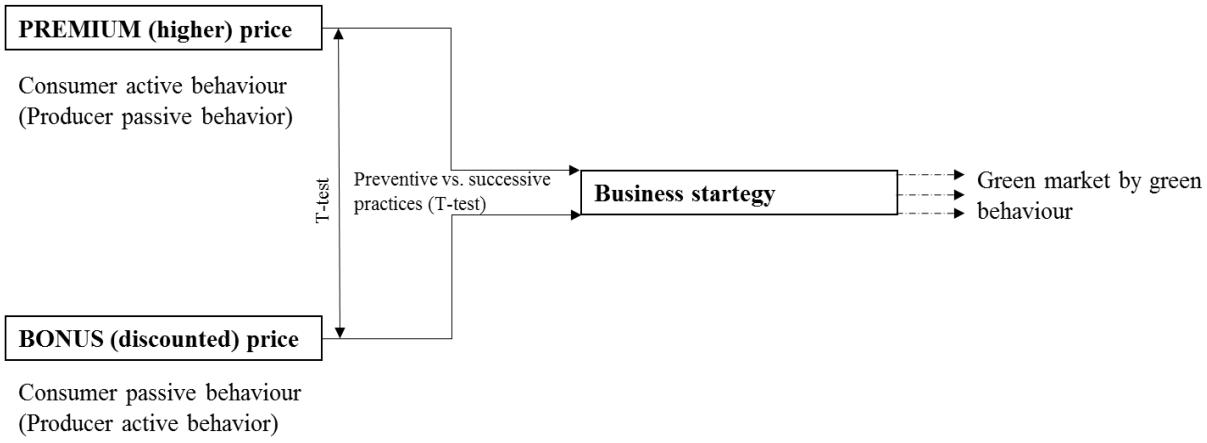
b after	**to**	10 – p prevent

Group comparison has been carried out without replying assessment for symmetric values. It means, for example, that when compared ‘b prevent’ to ‘10 – p prevent’, it was not replied between ‘10 – b prevent’ and ‘p prevent’.

Figure 3 provides details of the logical framework of this study by bringing together the analysis hereby presented.

Figure 3. Logical framework of this study. Purpose and related method

Source: My processing



Results

Once the groups had been summarized into the two sets distinguishing between preventive and successive practices for paired sample of respondents, the attention was raised for the bonus and premium price. Since the distributions were normally distributed, we utilized T-Student Test.

A T-Student test is therefore set for understanding whether emerge differences. In this regard, the two below tables confirm what has come up with the histograms of the answers by the questionnaire, which means that there an inclination with preferring preventive practices, both for active and passive consumer behaviour.

Since the p-value (checking the null hypothesis) is lesser than 0.05 (interval of confidence at 0.95), and T-test with 355 degrees of freedom is greater than 1.96, that is a symmetric value for a normal function compared to the mean, there are differences between the groups. These considerations concern the bonus as well as the premium samples.

The next table (Table5), instead, summarize the results of the T value for the compared groups.

Table 5. T values of the compared groups with significant p-value

Variable	b after	p after	10 – p prevent	10 – p after	10 – p after	10 – p prevent
b prevent	-13.75*					
p prevent		22.98*				
b prevent			6.38*			
b after				0.36*		
b prevent					-13.07*	

b after	15.97*

*p<0.05

The first line and column indicate the comparing variables, and the figures are put in the cells matching comparing variables. The comparison considers the T Student on two-nailed, and so the two negative values depend on the negative differences, which means that there is a greater propensity in preferring preventing practices linked to bonus for acting positively. T value at 22.98 means that consumers prefer paying a premium for preventive than successive practices. Between bonus and premium preventive practice, consumers prefer premium as confirmed by the T value at 6.38. No differences emerged between successive practices of bonus and premium, and it is proved by the T value at 0.36. Between preventive for bonus and premium, premium is preferred.

Table 6 shows the order relation being between the means of the compared groups.

Table 6. Means of the compared groups and meaning of the related order relation

Group 1	Group 2	μ_1	μ_2	**Meaning**
b prevent	b after	4.82	6.50	Consumers ask for lesser discount whether preventive practice than successive
p prevent	p after	6.04	3.56	Consumers willing to pay greater premium when adopted preventive practices

b prevent	10 – p prevent	4.82	3.96	Consumers ask for lesser discount (willing to pay greater premium) if adopted preventive practices
b after	10 – p after	6.50	6.44	No significant differences between groups of bonus/premium for successive practice
b prevent	10 – p after	4.82	6.44	Consumers ask for lesser discount whether preventive practice than successive with a premium
b after	10 – p prevent	6.50	3.96	Consumers are willing to pay a greater premium than asking for small discount

Discussion

This study, that investigated the food consumer' choice in supporting green business orientation, gathered two main results that give rise to XXX implications.

Before discussing them, it is necessary to spend few words on the respondents. The survey was addressed to young adults that was in contact lists of the University of Foggia. We

selected the mailing list by considering a target group composed by students, professionals that already worked with the University in regional, national and European projects, and University' staff. Additionally, as we also asked to be dedicated in filling the questionnaire, we assume that respondents has found not futile and noise the questionnaire. Some of them also contacted us asking for more details about the study that was being developed. The number of respondents was almost the half of the total requests emailed. This response rate may be an indicator that many interviewees did not have time to spend for the survey or not concerned about environmental proactive organizations. Based on these forethoughts, we consider reliable the resulting strategies hereby discussed.

As previous studies demonstrate a link between sustainability and business performance can include a wide range of actions and, therefore, it is necessary to identify the boundaries of any evaluation, we analysed the role of the consumers in the business strategy (Brulhart, et al., 2017; Surroca, et al., 2010; Brammer & Millington, 2008; Barnett, 2007; Wagner, 2005; Margolis & Walsh, 2003; King & Lenox, 2002). In this respect, resulting strategies represent a reference point for the economic operators in terms of what they should take into account when designing business strategy, however the specific inclination of the consumer on preferring a choice instead of any other, may be change area by area.

Such results showed, at first, that hypothesis 1 is partially true. Indeed, it is true that there are consumers that prefer paying a premium and others acting for a discounted price. However, this is not always factual: if successive practices are applied, there is no difference between their willingness to pay a premium and renounce at a discount. It means that they do not make a choice, but choice may be induced by the firm supplier. It

is different when being considered preventive practices: in this case, respondents prefer paying a premium with behaving passively. This result suggest that consumers trust firms that are consumer oriented (Brulhart, et al., 2017; Alimi & Workneh, 2016). However, there is a number of respondents that showed their preference in acting for bonus. Hence, the order relationship between the strategies within the consideration of the preventive practices points that WTP1pp $\succ$ WTP1bp. This implies the first two strategies that a firm may undertake, by referring to the real ability it holds for handling practices application, as depicted by Garcia-Garcia et al (2016) and Ingrao et al. (2018).

The second hypothesis is confirmed by the results. As a matter of facts, there is a consumer preference for the preventive practices, so they approve proactive firms prone to prevent environmental issues (Ben Mabrouk, et al., 2016; Di Florio & Fanelli, 2016). This output address to the identification of two additional strategies, WTP2bp and WTP2pp, for which there is no consumer preference (WTP2bp $\equiv$ WTP2pp). Thus, a firm adopting this strategy shall be aware that there is a broader range of actions to structure business strategy, but consumers environmental concerned prefer preventive practices (Girotto, et al., 2015).

This study set out that if a firm considers young adults as consumer' target, it is allowed to design a specific business strategy by referring to their willingness to pay more or less for buying food. In the specific, premium price (passive behaviour) tied to preventive practices is preferred to bonus price (active behaviour) tied to preventive practices. These, in turn, are preferred to premium/bonus (passive/active behaviours) tied to successive practices for which it does not emerge differences.

Conclusion

As seen, literature presents plenty of studies upon premium price and related variables explaining its determinants (Hultman, et al., 2015; Noor, et al., 2015). However, in the last years, it is being occurred the transition to qualitative approaches that somehow engage consumers. On the other hand, firms are called to apply increasingly green principles, and this generates costs that need to be rewarded through markets. These costs concern the development and implementation of active behaviour from the side of the producer. Active behaviour that is turned into a premium price. Nevertheless, if firms do not gain from markets, they miss to achieve green goals as planned in forecasting income for economic sustainability.

This study has inverted this point of view by working on the bonus price, as strategy to apply discount for those consumers whom act positively when purchasing goods. It has been appended it to the premium price strategy, and compared to it.

Moreover, it has been done a distinction between preventive and successive practices. Such difference allows for understanding what stimulates the green young adult consumer awareness. Results have shown that in the area where data were collected, consumers prefer preventive practices, so when a food seller assesses the resources existing, available and accessible on the territory, it may address the business strategy by considering that preventive practices (listed before) fit into the green purchase willingness to pay of the potential consumers (Kanchanapibul, et al., 2014). What about premium and bonus? Results return the following preference order relation in terms of best strategy to be considered: $WTP1pp \succ WTP1bp \succ WTP2bp \equiv WTP2pp$. Therefore, we suggest that one leading a food organization, should firstly check the existing resources to access in order to start up the business, and then in doing that, consider

what business strategy to actual put in practice by keeping in mind that consumers react to willingness to pay in terms of either premium or bonus, by proposing passively or active behaviours, respectively. Additionally, consumer intention is positively influenced by preventive practices.

Food suppliers should consider four different strategies to push green purchasing intention (Basu & Hicks, 2008). With this article, we just placed a starting point in bringing some insights about the opportunity of enlarging the point of view of the willingness to pay: there is a WTP supported by passive consumer behaviour for which can be payed a premium, WTP supported by active consumer behaviour for which can be applied a discount.

As being a starting point, this study does not take into consideration factors determining different these different behaviours. We can surely state that this analysis just regards young adults. So, are such differences the same when considered over 40-year-old consumers? What are the factors determining the consumer choices within these groups? How can be ensured sustainability on the active consumer behaviours? What are the specific resources making differences in planning business by these four strategies?

Further works should be addressed by following these findings and the aforementioned research questions.

References

Ajzen, I., 1991. The theory of planned behavior. *Organizational behavior and human decision processes,* 50(2), pp. 179-211.

Albino, V., Balice, A. & Dangelico, R. M., 2009. Environmental strategies and green product development: an overview on sustainability-driven companies. *Business strategy and the environment,* 18(2), pp. 83-96.

Alimi, B. A. & Workneh, T. S., 2016. Consumer awareness and willingness to pay for safety of street foods in developing countries: a review. *International journal of consumer studies,* 40(2), pp. 242-248.

Aragón-Correa, J. A. & Sharma, S., 2003. A contingent resource-based view of proactive corporate environmental strategy. *Academy of Management Review,* 28(1), pp. 71-88.

Bahrick, . H. P. & Hall, L. K., 1991. Preventive and corrective maintenance of access to knowledge. *Applied Cognitive Psychology,* 5(1), pp. 1-18.

Ball, C. & Kittler, M., 2017. Removing environmental market failure through support mechanisms: insights from green start-ups in the British, French and German energy sectors. *Small Business Economics,* pp. 1-14.

Balogh, P. et al., 2016. Consumer willingness to pay for traditional food products. *Food Policy,* Volume 61, pp. 176-184.

Bansal, P. & Song, H. C., 2017. Similar But Not the Same: Differentiating Corporate Sustainability from Corporate Responsibility. *Academy of Management,* 11(1), pp. 105-149.

Barnett, M. L., 2007. Stakeholder influence capacity and the variability of financial returns to corporate social responsibility. *Academy of management review,,* 32(2), pp. 794-816.

Bartsch, F., Diamantopoulos, . A., Paparoidamis, N. G. & Chumpitaz, R., 2016. lobal brand ownership: The mediating roles of consumer attitudes and brand identification. *Journal of Business Research,* 69(9), pp. 3629-3635.

Bashaa, M. B. et al., 2015. Consumers Attitude Towards Organic Food. *Procedia Economics and Finance,* Volume 31, pp. 444-452.

Basu, A. K. & Hicks, R. L., 2008. Label performance and the willingness to pay for Fair Trade coffee: a cross-national perspective. *International Journal of Consumer Studies,* 32(5), pp. 470-478.

Batley, S. L., Colbourne, D., Fleming, P. D. & Urwin, P., 2001. Citizen versus consumer: challenges in the UK green power market. *Energy policy,* 29(6), pp. 479-487.

Ben Mabrouk, A., Chelbi, A. & Radhoui, M., 2016. Optimal imperfect preventive maintenance policy for equipment leased during successive periods. *International Journal of Production Research,* 54(17), pp. 5095-5110.

Berry, M. A. & Rondinelli, D. A., 1998. Proactive corporate environmental management: A new industrial revolution. *Academy of Management Perspectives,* 12(2), pp. 38-50.

Brammer, S. & Millington, A., 2008. Does it pay to be different? An analysis of the relationship between corporate social and financial performance. *Strategic Management Journal,* 29(12), pp. 1325-1343.

Brulhart, F., Gherra, S. & Quelin, B. V., 2017. Do Stakeholder Orientation and Environmental Proactivity Impact Firm Profitability?. *Journal of Business Ethics,* pp. 1-22.

Brundtland, G., 1987. *Our common future: Report of the 1987 World Commission on Environment and Development,* Oslo: United Nations.

Carrete, L., Castaño, R., Felix, R. & Centeno, E., 2012. Green consumer behavior in an emerging economy: confusion, credibility, and compatibility. *Journal of consumer marketing,* 29(7), pp. 470-481.

Carroll, A. B., 1991. The pyramid of corporate social responsibility: Toward the moral management of organizational stakeholders. *Business horizons,* 34(4), pp. 39-48.

Carter, N., 2018. *The politics of the environment: Ideas, activism, policy.* Cambridge: Cambridge University Press.

Chekima, B. et al., 2016. Chekima, B., Wafa, S. A. W. S. K., Igau, O. A., Chekima, S., & Sondoh Jr, S. L. (2016). Examining green consumerism motivational drivers: does premium price and demographics matter to green purchasing?. *Journal of cleaner production,* Issue 112, pp. 3436-3450.

Cohen, P., West, S. G. & Aiken, L. S., 2014. *Applied multiple regression/correlation analysis for the behavioral sciences.* s.l.:Psychology Press.

Corrado, S., Ardente, F., Sala, S. & Saouter, E., 2017. Modelling of food loss within life cycle assessment: From current practice towards a systematisation. *Journal of cleaner production,* Volume 140, pp. 847-859.

Daddi, T., Todaro, N. M., De Giacomo, M. R. & Frey, M., 2018. A Systematic Review of the Use of Organization and Management Theories in Climate Change Studies. *Business Strategy and the Environment,* 27(4), pp. 456-474.

De Pascale, G., Colantuono, F., Djelveh, S. & Contò, . F., 2017. Economic sustainability in Short Food Supply Chain. The case of the Horizon 2020 project" Short Food Supply Chain Knowledge and Innovation Network (SKIN). *RIVISTA DI STUDI SULLA SOSTENIBILITA'.*

De Winter, J. C., 2013. Using the Student's t-test with extremely small sample sizes. *Practical Assessment Research & Evaluation,* 18(10).

DeFries, J. C. & Fulker, D. W., 1985. Multiple regression analysis of twin data. *Behavior genetics,* 15(5), pp. 467-473.

Di Florio, A. & Fanelli, R. M., 2016. Food waste in the phase of domestic consumption: the causes and preventive actions. *Italian Review of Agricultural Economics,* 71(1), pp. 278-291.

D'Souza, C., Taghian, M., Lamb, . P. & Peretiatkos, R., 2006. Green products and corporate strategy: an empirical investigation. *Society and business review,* 1(2), pp. 144-157.

Dupré, S., 2005. *Talk the walk: Advancing sustainable lifestyles through marketing and communications.* s.l.:UNEP/Earthprint.

European Commission, 2014. *EU Agricultural Income 2014 – First Estimates,* Brussels: DG Agriculture and Rural Development.

European Parliament & Council of the European Union, 2012. *Agricultural Product Quality Schemes (COM(2010) 0733 – C7–0423/2010 – 2010/0353 (COD)),* Brussels: European Parliament.

Fernandez-Feijoo, B., Romero, S. & Ruiz, S. J., 2014. Effect of stakeholders' pressure on trasparency of sustainability reports within the GRI framework. *Journal of Business Ethics,* 115(1), pp. 53-63.

Fiore, M., Gallo, C., Tsoukatos, E. & La Sala, P., 2017. Predicting consumer healthy choices regarding type 1 wheat flour. *British Food Journal,* 119(11), pp. 2388-2405.

Flammer, C., 2013. orporate social responsibility and shareholder reaction: the environmental awareness of investors. *Academy of Management,* 56(3), p. 758–781.

Fotiadis, M. & Polemis, M. L., 2018. The Role of Sustainability-Related Strategies on the Biofuel Industry: Trends, Prospects and Challenges.. *Business Strategy and the Environment.*

Frooman, J., 1997. Socially irresponsible and illegal behavior and shareholder wealth: A meta-analysis of event studies. *Business and Society,* 36(3), pp. 221-249.

Garcia-Garcia, G. et al., 2016. A methodology for sustainable management of food waste. *Waste and Biomass Valorizatio,* 8(6), pp. 2209-2227.

George, D. & Mallery, P., 2016. Multiple Regression Analysis. In: *IBM SPSS Statistics 23 Step by Step.* s.l.:Rotledge, pp. 218-231.

Gifford, R. & Nilsson, A., 2014. Personal and social factors that influence pro-environmental concern and behaviour: A review. *International Journal of Psychology,* 49(3), pp. 141-157.

Girotto, F., Alibardi, L. & Cossu, R., 2015. Food waste generation and industrial uses: a review. *Waste management,* Volume 45, pp. 32-41.

Gleim, M. R., Smith, J. S., Andrews, D. & Cronin Jr, J. J., 2013. Against the Green: A Multi-method Examination of the Barriers to Green Consumption. *Journal of retailing,* 1(89), pp. 44-61.

Grizzetti, B. et al., 2013. The contribution of food waste to global and European nitrogen pollution. *Environmental Science & Policy,* Volume 3, pp. 186-195.

Grosso, M. et al., 2012. The implementation of anaerobic digestion of food waste in a highly populated urban area: an LCA evaluation. *Waste Management & Research,* 30(9), pp. 78-87.

Guerrero, L. et al., 2009. Consumer-driven definition of traditional food products and innovation in traditional foods. A qualitative cross-cultural study. *Appetite,* 52(2), pp. 345-354.

Gupta, . K., 2018. Environmental sustainability and implied cost of equity: international evidence. *Journal of Business Ethics,* 147(2), pp. 343-365.

Hardwing, J., 2010. The stockholder - A lesson for business ethics from bioethics?. *Journal of Business Ethics,* Volume 91, pp. 329-341.

Hart, S. L., 1995. A natural-resource-based view of the firm. Academy of management review. *Academy of management review,* 20(4), pp. 986-1014.

Hultkrantz, L., 2018. Benefit-cost evaluation of prevention and early intervention measures for children and youth in Sweden. In: *Social Impact Investing Beyond the SIB.* Cham: Palgrave Macmillan, pp. 177-194.

Hultman, M., Kazeminia, A. & Ghasemi, V., 2015. Intention to visit and willingness to pay premium for ecotourism: The impact of attitude, materialism, and motivation. *Journal of Business Research,* 68(9), pp. 1854-1861.

Hultman, M., Kazeminia, A. & Ghasemi, V., 2015. Intention to visit and willingness to pay premium for ecotourism: The impact of attitude, materialism, and motivation. *Journal of Business Research,* 68(9), pp. 1854-1861.

Ingrao, C., Faccilongo, N., Di Gioia, L. & Messineo, A., 2018. Food waste recovery into energy in a circular economy perspective: A comprehensive review of aspects related to plant operation and environmental assessment. *Journal of Cleaner Production,* Volume 184, pp. 869-892.

Jabbour, C. J. C. & Santos, F. C. A., 2006. The evolution of environmental management within organizations: toward a common taxonomy. *Environmental Quality Management,* 16(2), pp. 43-59.

Jansson, J., Marell, A. & Nordlund, A., 2010. Green consumer behavior: determinants of curtailment and eco-innovation adoption. *Journal of consumer marketing,* 27(4), pp. 358-370.

Jegen, M. & Wüstenhagen, R., 2001. Modernise it, sustainabilise it! Swiss energy policy on the eve of electricity market liberalisation. *Energy Policy,* 29(1), pp. 45-54.

Kanchanapibul, M., Lacka, E., Wang, X. & Chan, H., 2014. An empirical investigation of green purchase behaviour among the young generation. *Journal of Cleaner Production,* Volume 66, pp. 528-536.

Kempa, D., 2013. Environmental services coupled to food products and brands: Food companies interests and on-farm accounting. *Journal of environmental management,* Volume 127, pp. 184-190.

King, A. & Lenox, . M., 2002. Exploring the locus of profitable pollution reduction. *Management Science,* 48(2), pp. 289-299.

Klassen, R. D. & McLaughlin, C. P., 1996. The impact of environmental management on firm performance. *Management science,* 42(8), pp. 1199-1214.

La Scalia, G. et al., 2017. An innovative shelf life model based on smart logistic unit for an efficient management of the perishable food supply chain. *Journal of food process engineering,* 40(1).

Lee, K., 2008. Opportunities for green marketing: young consumers. *Marketing intelligence & planning,* 26(6), pp. 573-586.

Leonidou, L. C. et al., 2015. Environmentally friendly export business strategy: Its determinants and effects on competitive advantage and performance. *International Business Review,* 24(5), pp. 798-811.

Limnios, E. M. et al., 2016. Willingness to pay for product ecological footprint: Organic vs non-organic consumers. *Technological Forecasting and Social Change,* Volume 111, pp. 338-348.

Lipinski, B. et al., 2013. *Reducing food loss and waste.* s.l.:World Resources Institute.

Margolis, J. D., Elfenbein, H. A. & Walsh, J. P., 2007. *Does it pay to be good? A meta-analysis and redirection of research on the relationship between corporate social and financial performance.* Cambridge: Harvard Business School.

Margolis, . J. . D. & Walsh, J. P., 2003. Misery loves companies: Rethinking social initiatives by business. *Administrative science quarterly,* 48(2), pp. 268-305.

Mason, C. H. & Perreault Jr, W. D., 1991. Collinearity, power, and interpretation of multiple regression analysis. *Journal of marketing research,* pp. 268-280.

Meadows, D. H., Meadows, D. L., Randers, J. & Behrens III, W. W., 1972. *The Limits to Growth: A Report fort he Club of Rome's Project on the Predicament of Mankind.* Signet a cura di New York: New American Library.

Mee, R. W. & Chua, T. C., 1991. Regression toward the mean and the paired sample t test. *The American Statistician,* 45(1), pp. 39-42.

Muncy, J. A. & Vitell, S. J., 1992. Consumer ethics: An investigation of the ethical beliefs of the final consumer. *Journal of business Research ,* 24(4), pp. 297-311.

Noor, N. M., Asmawi, M. Z. & Abdullah, A., 2015. Sustainable Urban Regeneration: GIS and Hedonic Pricing Method in determining the value of green space in housing area. *Procedia-Social and Behavioral Sciences*\, Volume 170, pp. 669-679.

O'Neill, V., Hess, S. & Campbell, D., 2014. A question of taste: Recognising the role of latent preferences and attitudes in analysing food choices. *Food quality and preference,* Issue 32, pp. 299-310.

Orlitzky, M. & Benjamin, J. D., 2001. Corporate Social Performance and Firm Risk: A Meta-Analytic Review. *Business and Society,* 40(4), pp. 369-396.

Orlitzky, M., Schmidt, F. L. & Rynes, S. L., 2003. Corporate social and financial performance: A meta-analysis. *Organization studies,* 24(3), pp. 403-441.

Ottum, B. D. & Moore, W. L., 1997. The role of market information in new product success/failure. *Journal of Product Innovation Management: AN INTERNATIONAL PUBLICATION OF THE PRODUCT DEVELOPMENT & MANAGEMENT ASSOCIATION,* 14(4), pp. 258-273.

Park, K. C., 2018. Understanding ethical consumers: willingness-to-pay by moral cause. *Journal of Consumer Marketing,* 35(2), pp. 157-168.

Perera, C., Auger, P. & Klein, J., 2016. Green consumption practices among young environmentalists: a practice theory perspective. *Journal of Business Ethics,* pp. 1-22.

Pigors, M. & Rockenbach, B., 2016. Consumer social responsibility. *Management Science,* 62(11), pp. 3123-3137.

Prakash, A., 2002. Green marketing, public policy and managerial strategies. *Business strategy and the environment,* 11(5), pp. 285-297.

Protocol, K., 1997. *United Nations framework convention on climate change,* Kyoto: Kyoto Protocol.

Reinhardt, F., 1999. Market failure and the environmental policies of firms: Economic rationales for "beyond compliance" behavior. *Journal of Industrial Ecology,* 3(1), pp. 9-21.

Safari, A., Salehzadeh, R., Panahi, R. & Abolghasemian, S., 2018. Multiple pathways linking environmental knowledge and awareness to employees' green behavior. *Corporate Governance: The International Journal of Business in Society,* 18(1), pp. 81-103.

Sasmita, J. & Mohd Suki, N., 2015. Young consumers' insights on brand equity: Effects of brand association, brand loyalty, brand awareness, and brand image. *International Journal of Retail & Distribution Management,* 43(3), pp. 276-292.

Schmidt, C. G., Foerstl, K. & Schaltenbrand, B., 2017. The supply chain position paradox: Green practices and firm performance. *Journal of Supply Chain Management,* 53(1), pp. 3-25.

Shu, T. et al., 2016. Analysing remanufacturing decisions of supply chain members in uncertainty of consumer preferences. *Applied Economics,* 48(34), pp. 3208-3227.

Straughan, R. D. & Roberts , . J. A., 1999. Environmental segmentation alternatives: a look at green consumer behavior in the new millennium. *Journal of consumer marketing,* 16(6), pp. 558-575.

Surroca, J., Tribó, J. A. & Waddock, S., 2010. Corporate responsibility and financial performance: The role of intangible resources. *Strategic management journal,* 31(5), pp. 463-490.

United Nation, D. o. E. a. S. A. P. D., 2018. *World Population Prospects 2017.* [Online] Available at: https://esa.un.org/unpd/wpp/Publications/
[Consultato il giorno 07 05 2018].

van Grinsven, H. J., Erisman, J. W., de Vries, W. & Westhoek, H., 2015. Potential of extensification of European agriculture for a moresustainable food system, focusing on nitrogen. *Environmental Research Letters,* Volume 10.

Venter, O. et al., 2016. Sixteen years of change in the global terrestrial human footprint and implications for biodiversity conservation. *Nature Communications,* 7(12558).

Verteramo Chiu, L. J., Liaukonyte, J., Gómez, M. I. & Kaiser, H. M., 2017. Socially responsible products: what motivates consumers to pay a premium?. *Applied Economics,* 49(19), pp. 1833-1846.

Vitell, S. J., 2015. A case for consumer social responsibility (CnSR): Including a selected review of consumer ethics/social responsibility research. *Journal of Business Ethics,* 130(4), pp. 767-774.

Wagner, M., 2005. How to reconcile environmental and economic performance to improve corporate sustainability: corporate environmental strategies in the European paper industry. *Journal of environmental management,* 76(2), pp. 105-118.

Wang, Y. & Berens, G., 2015. The impact of four types of corporate social performance on reputation and financial performance. *Journal of Business Ethics,* 131(2), pp. 337-359.

Yadav, R. & Pathak, G. S., 2016. Young consumers' intention towards buying green products in a developing nation: Extending the theory of planned behavior. *Journal of Cleaner Production,* Volume 135, pp. 732-739.

Young, W., Hwang, K., McDonald, S. & Oates, C. J., 2010. Sustainable consumption: green consumer behaviour when purchasing products. *Sustainable development,* 18(1), pp. 20-31.

Yusof, Y., Awang, Z., Jusoff, K. & Ibrahim, Y., 2017. The influence of green practices by non-green hotels on customer satisfaction and loyalty in hotel and tourism industry. *International Journal of Green Economics,* 11(1), pp. 1-14.

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