

## **INNOVATIVE LOGISTICS AND SUPPLY CHAIN MANAGEMENT FOR SUSTAINABLE FOOD PUBLIC PROCUREMENT**

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### **ABSTRACT**

Food supply chains are increasingly asked to deliver sustainable products in a sustainable manner. Sustainability affects every segment of the supply chain and it is a key driver of innovation today. Even so, many companies are still reluctant to more environment-friendly investments. Public procurement through its “power of purchase” is one of the most influential means through which the state can effect behavioural change in economy and society. Forcing sustainable improvements in its suppliers, public procurement can have a huge influence over the food system, but organisational innovation is needed in logistics and supply chain management.

In the food sector, fish supply chain is one of the most critical in terms of sustainability due to the overexploitation of oceans’ resources, the decline in wild fish stocks and the big amount of waste generated along the chain from the ship to the consumers’ plate.

In this paper we report on our experience in innovating the logistics and the management of the fish supply chain for the school canteens of the city of Rome, in which around 150.000 pupils have lunch every day. The innovation consists of the introduction of fresh, organic, farmed fish of locally grown species transformed in attractive recipes, accurately studied based on the nutritional needs and the level of appreciation of the young consumers, instead of frozen, few wild fish presented in boring and tasteless preparations such as boiled fillets and breaded sticks. Examining the barriers and the solutions adopted, we explain how public procurement can become a creative force for sustainable development in the fish supply chain.

A qualitative case study methodology is used where catering managers and staff, fish suppliers and distributors, food procurement officers, dieticians and nutritionists are interviewed. The innovations in logistics, organisation and management are defined in interaction with all the actors of the chain involved in the research and implemented under several different conditions. Observations of the feasibility of the supply chain, from production to consumption, are conducted to assess the results. Findings show an example of good practice in the area of sustainability in the food supply chain and illustrate the substantive progress that can be made in achieving supply chain sustainability. At the same time, the paper provides the specific challenges in developing a management model in which the power is more balanced along the chain and where a holistic approach requires to be taken to reach sustainable improvements. Considering the scarcity of work examining empirically the issue of sustainability in food supply chains, this study demonstrates the evolutionary process and its stages based on the examination of the Rome school canteens’ supply chain and the sustainability approach it has taken with its suppliers. The author also illustrates a range of key implications that need to be considered by both managers and policy makers and it provides a range of areas where further research is required.

**Key words:** public procurement, fish supply chain, logistics, management, organisational innovation, sustainability.

## INTRODUCTION

The key idea of the research is that Italian organic aquaculture, that is a sustainable system of fish production, can be promoted by introducing its products into the public catering, starting from school canteens.

Public canteens are not just an opportunity to expand the market, which in itself would justify the research, but they also offer an opportunity to drive the whole supply chain towards innovative and sustainable forms.

In Europe, the demand for goods and services by the public administration has recently become a major policy tool for sustainable innovation. Public purchases have proven to be a powerful method to reach sustainable development objectives (OECD, 2000; Erdmenger, 2003; European Commission, 2004 and 2008; Carlsson and Waara, 2007; Walker e Preuss, 2008; Bala et al., 2008; Michelsen and de Boer, 2009). By obliging its suppliers to make sustainable changes, the public administration influences the whole sector and becomes a model of sustainable consumption, with effects on the behaviour of businesses and consumers. Morgan and Sonnino (2008, p. xvi) claim that public procurement that is “the power of purchase is one of the most influential means through which the state can effect behavioural change in economy and society.”

The use of public meals to pursue environmental and social objectives is widespread in Italy (Helstosky, 2006). In 1999, Financial Law no. 4881 gave legal status and lent greater strength to this phenomenon, which began after the second world war and is now occurring throughout the country. This particularly innovative law encouraged several municipalities to choose organic products. In just over 10 years, the number of school canteens serving organic food went from 70 (in 1996) to 800 in 2010, while the total number of organic meals served yearly in Italian schools grew from 24,000 (in 1996) to over 1 million (in 2011) (data Biobank, in Mingozi and Bertino, 2012 and Lunati and Bertino, 2003).

More recently, several Municipalities have started to focus on the importance of local food. Some of them (for instance, the Municipality of Asti for what concerns catering services at the “Cardinal Massaia” hospital) have chosen to use local suppliers only. The new tender specifications for the school catering service of the Municipality of Rome (for the years 2013-2017) promote the use of foods produced, processed and packaged within 300 kilometres of the Capitoline Hill, seat of the Municipality of Rome.

The Italian capital is an outstanding example which has turned Italy into a model studied by experts all over the world. Morgan and Sonnino (2008, p. 65), for instance, analyse the changes made to the school canteen service in the city of Rome from the early 2000s onwards and call them a “revolution”.

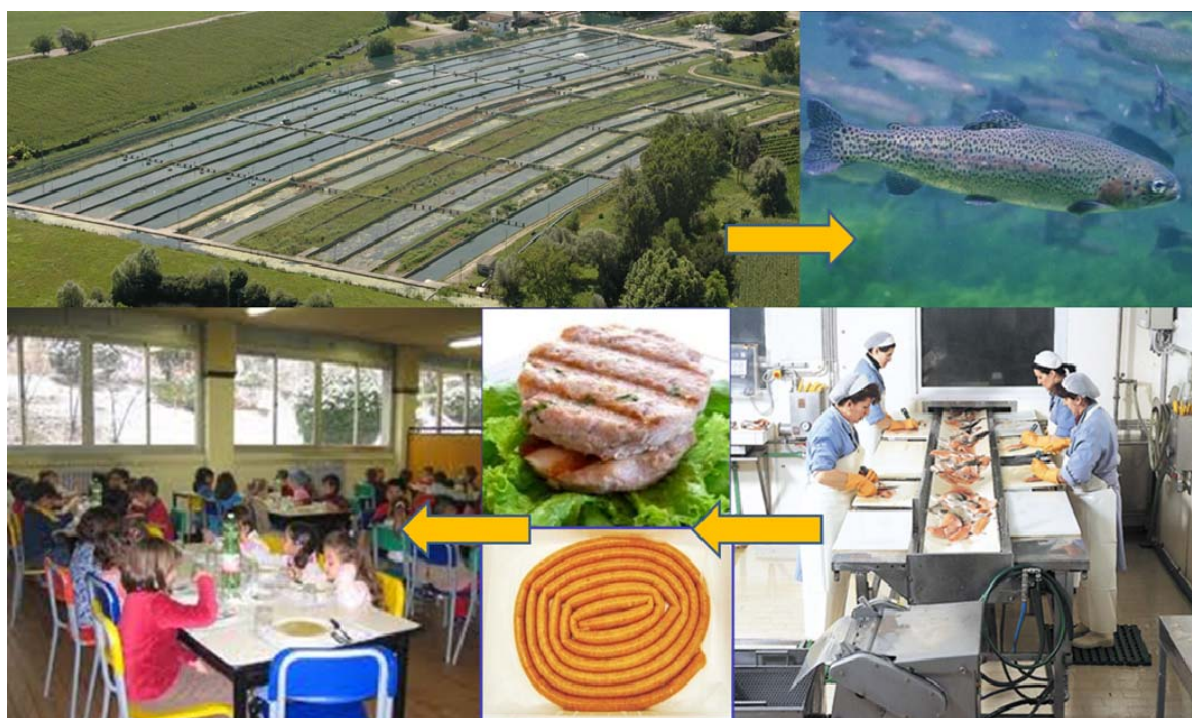
Therefore, Italian school catering services are the best example in Europe of a situation in which public tenders designate organic and local producers as their preferred supply channel (Ibidem).

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<sup>1</sup> To ensure the promotion of organic and quality farming, article 59, paragraph 4, states that the canteens of state schools and hospitals should include organic, local, traditional products into their daily menus.

As they already do for organic and local farming, school canteens can choose organic local aquaculture as their preferred fish supply channel because this innovation can make the fish production chain more sustainable. The products are fresher because they come from local farms and they are caught in amount and timing corresponding to those ones requested; the environmental impact of their distribution chain is more limited because the fish is not deep-frozen and not transported over long distances; the local economy is better supported; and – given the educational value of school meals (Burke, 2002) – the children’s identity and sense of belonging to their territory are strengthened.

About our research, we experimented the introduction of fresh, organic, farmed fish of locally grown and very common Italian species such as trout, mullet, sea bream and sea bass, transformed in attractive recipes (e.g. meat sauce for pasta, burgers, meatballs, sausages), accurately studied based on the nutritional needs and the level of appreciation of the young consumers, instead of frozen, few wild fish presented in boring and tasteless preparations such as boiled fillets and breaded sticks, in the school canteens of the city of Rome (Figure 1), in which around 150.000 pupils have lunch every day and that is one of the largest food contractors in Italy.



*Figure 1: The supply chain experimented in the research*

## OBJECTIVES

The key objective of the research was to assess the feasibility of such a direct link between organic local aquaculture and school canteens, never implemented before in Italy. The research questions we tried to answer were: (i) is it possible to provide school canteens with fresh fish from organic local farms? (ii) Which are the actors involved and their relationships? (iii) Which are the mechanisms needed to implement such a link? (iiii) Which are the technical, organisational, logistic, economic and regulatory aspects to be taken into account?

To answer the above questions, two different but synergetic research lines were pursued: (a) the analysis of the supply chain; and (b) the experimental implementation of the supply chain, adequately assessed during each phase.

## METHODOLOGY

The first step of the research was to identify and analyse all the actors involved in the production and supply chain, in order to understand their roles and their relationships with the other subjects. A draft of the structure of said chain was put together based on the information gathered during interviews with key individuals closely connected with the aquaculture sector and the foodservice industry. Then, a few representative actors involved in each step of the production and supply chain were contacted and interviewed. The main investigation tool in this part of the research was the so-called Semi-Structured Interview (SSI) or in-depth interview (Guala, 2003 and Bichi, 2007). The interviews helped build a complete picture of the “farm-canteen” chain (represented in Results, Figure 3) and understand weaknesses and opportunities perceived at various levels of the chain, summarised in a SWOT matrix (see Results, Table 1.a e 1.b). The SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis is a technique commonly used to investigate the main factors – both internal (strengths and weaknesses) and external (opportunities and threats) – which can create favourable or unfavourable conditions for the strategies of a business or economic system. Thanks to its easy interpretation and accurate results, the SWOT analysis has already been used in the study of food production and supply chains, for instance by Gambelli (2007) and Pagliarino *et al.* (2010), proving to be extremely effective in offering an analytical and critical synthesis of the results deriving from interviews with experts.

To complete the analysis, the rules and regulations applying to the production and supply chain were reviewed.

The second part of the investigation, that is the experimental implementation of the supply chain and the assessment of each of its steps, was carried out by involving actors from all the segments of said chain. During periodical meetings and through constant coordination via phone or e-mail, all the phases of the supply chain were planned, implemented, and monitored in collaboration with the above key actors.

The supply chain was experimentally implemented in the school canteens of the city of Rome for a total of seven times during the 2011-2012 school year.

The Municipality of Rome was chosen for the following reasons:

- due to its size<sup>2</sup>, the decisions taken by the Municipality of Rome have a strong impact on the Italian agro-industrial system;
- since it is the capital, Rome influences the choices of the other Italian Municipalities;
- due to the innovations introduced in its school catering services<sup>3</sup>, Rome has become an example of best practice at the national and international level;

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<sup>2</sup> There are over 700 schools in Rome in which 150,000 pupils every day (28.5 million per year) have lunch as well as a mid-morning snack and an afternoon snack, for a total of around 150 tons of food used every day and 64.4 million euro spent yearly on foodstuffs.

- due to its size, which creates major logistic and organisational problems, Rome provides a stimulating environment for experimentation.

Besides the Municipality of Rome, the following subjects were also included in the experimentation:

- the Italian Fishing Association and the Association of Italian Fish Farmers to coordinate the producers;
- three different Italian aquaculture firms: “Maricoltura Mattinata”, Mattinata (Foggia), for the supply of sea bass and sea bream, the “Azienda Vallicola del Lago di Paola”, Sabaudia (Latina), for the supply of mullet, and the “Società Agricola Sterpo”, Bertiole (Udine), for the supply of trout;
- the Italian catering companies Camst and Cir Food;
- the Italian foodstuffs distribution companies Marr and Capecchi;
- the primary schools of Rome “Palocco 84” and “IV Novembre” to test the appreciation of the fish recipes.

This part of the investigation brought to light some critical issues which, in order to be solved, required extensive collaboration among various actors belonging to different segments of the chain. The time elapsing between when the fish was caught in the aquaculture firm and when it was served in the school canteens had to be accurately planned with the farmers, distributors, catering companies, and the Municipality of Rome. Also the most suitable methods to process and prepare the fish had to be defined by the farmers (who also took care of early processing) together with the catering companies and the Municipality. This is why two focus groups were organised in order to identify problems and find possible solutions. The first focus group saw the participation of representatives from the fish farms, the distribution and catering companies, and the Municipality of Rome, while the second focus group was reserved for the catering companies only (with the participation of executives, quality control and purchasing managers, and supervisors of fish products and of the canteen services in Rome).

## RESULTS AND DISCUSSION

The project's aim was to serve fresh fish from organic farming in the canteens of the schools of Rome during the 2011-2012 school year, in order to assess whether it was appreciated by children and to identify the difficulties arising from such an operation in each step of the production and supply chain.

The fish was served on seven different occasions, with two repetitions for each variety included in the experiment (sea bass, sea bream, and mullet) plus trout served on one occasion. The organisation of such experiment proved to be quite complex and involved a large number of

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<sup>3</sup> In 2001, the Municipality of Rome started a revolution in its public school catering system in relation to both the origin and quality of the products and the organisation of the service. It chose to use organic food (all the types of food included in the menus are organic except meat and fish; 70% of foodstuffs expenditure, equal to 43.5 million euro per year, is for organic products; 400 firms supply organic products and 44% of the total foodstuffs comes from organic-only firms), as well as products with protected designations of origin and protected geographical indications (PDOs and PGIs) European Union's labels and products from fair trade (€ 6 million per year). Moreover, it required catering companies to train their employees, look after the canteens, manage waste in a sustainable way, etc.

different actors. The test took place between May and November 2011 and was carried out through the following steps:

- coordination with the person in charge of the service and the dieticians of the Municipality of Rome;
- coordination with the headmasters of the schools;
- coordination with the two catering companies which are the contractors for the canteen services;
- coordination with the two distribution companies which are the suppliers of the caterers;
- visit to the schools, their kitchens, and their dining halls;
- definition of the fresh fish serving schedule in agreement with the Municipality and the catering companies;
- selection and testing of the recipes<sup>4</sup>;
- definition of the amount of fish needed and of the time required to catch, process, pack, transport, deliver and prepare the fish, in collaboration with the farmers, the distribution companies, and the catering companies<sup>5</sup>;
- monitoring and evaluation of the experiment.

Once the schedule of all the above steps was organised, it was necessary to devise a methodology for the assessment of how much the children liked the fish served. This phase comprised observation of and interviews with the operators (cooks and kitchen staff). The interviews helped gather all the information needed to assess the children's level of appreciation and the information

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<sup>4</sup> Together with the dieticians of the Municipality and the managers and cooks of the catering companies, various recipes and different preparations were selected and tested. As for the sea bass/sea bream/trout medallions/balls, three different variations were tried. Potatoes, bread crumbs, and the soft part of bread soaked in milk were added respectively to the mix of minced fish meat, salt, and eggs. The first recipe proved to be too complex in its preparation and the taste of potatoes was too overwhelming. The second recipe was too dry. The third recipe, instead, was the best and it was eventually chosen by the work group. Furthermore, the use of fish meat minced after being boiled was tested against the use of minced raw meat and the second recipe was deemed more pleasant. As far as mullet is concerned, the minced raw meat of the fish was used to prepare a pasta sauce, similar to the "pasta with tuna" recipe normally served in the school canteens.

<sup>5</sup> Organising when the fish should be caught depends on several factors: the amounts of fish needed; the size of the fish in the tanks; the fact that the cages should be disturbed as little as possible during feeding and catching; the fact that, before being caught, the fish must be kept without food for a given amount of time; and, lastly, the time when the fish is sold, which in our case depended on the dates when it would be served in the canteens. Taking into account all the elements that contribute to the planning of when the fish should be caught, it was decided that this should occur 4-5 days before serving it. Freshly caught fish is put in water and ice, where it loses consciousness and dies. Upon entering the processing plant, the fish is stocked in refrigerating rooms until it is turned into fillets. It is gutted, cleaned, filleted, but its skin is not removed. Once packed in polystyrene boxes with ice in order to keep the cold chain unbroken, the fish is transported onboard refrigerated trucks to the distribution platforms in the early afternoon of the day before it is served. Here the fish is checked and repackaged (the melted ice is replaced). This operation occurs in the fish laboratory of the distributors' facilities. Lastly, the fish is delivered to the schools in the early morning of the day when it is served. Its preparation requires around two hours and it is completed in time for lunch.

about the fish waste deriving from processing and preparation and the fish leftovers during the consumption, but also to ensure the collaboration and availability of the operators, essential for the good functioning of the entire preparation and serving process.

Overall, 120 individuals were interviewed attributable to different categories as synthesized in the next figure.

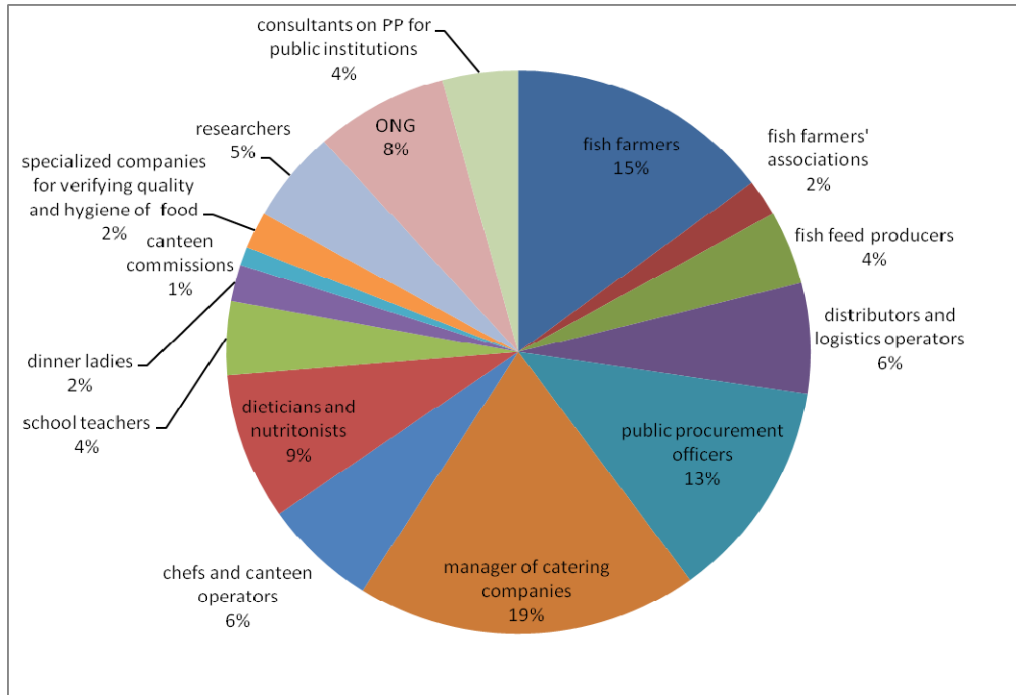


Figure 2: Actors interviewed for category

The information gathered during the interviews shows the complexity of the aquaculture-school catering system and the large number and heterogeneity of the actors involved, as summarized in the figure below.

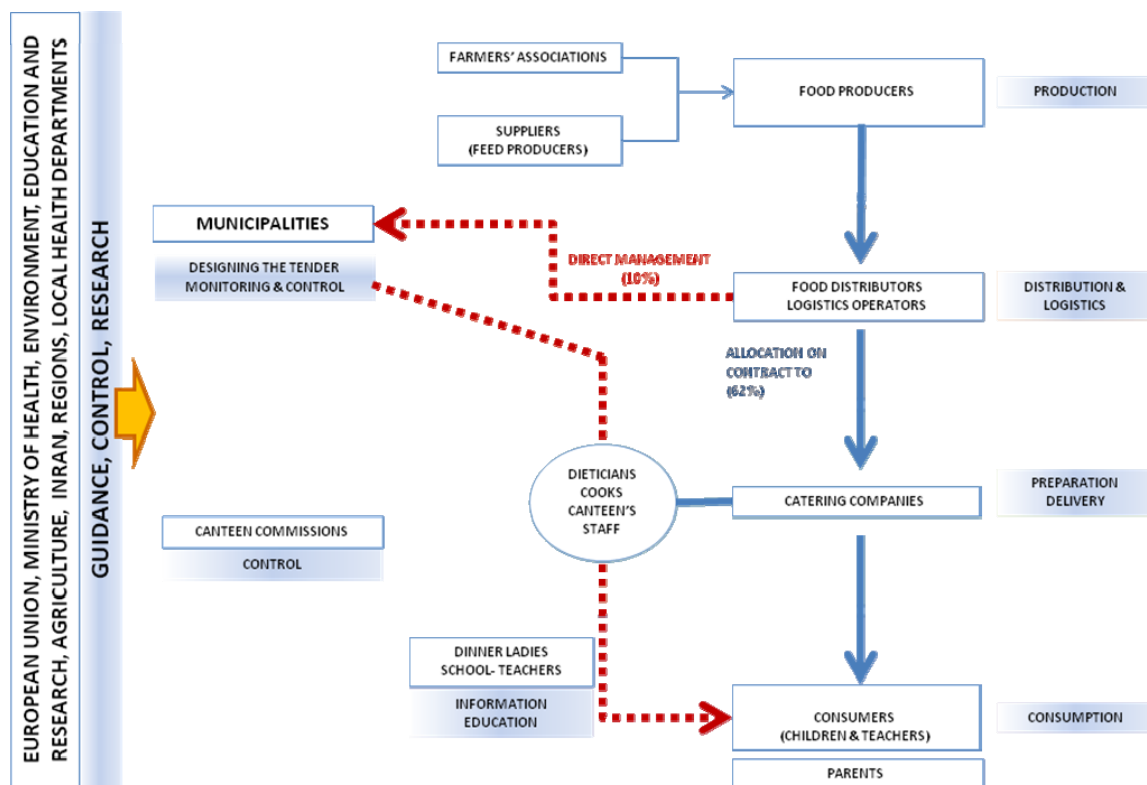


Figure 3: Actors, functions, and relationships of the innovative fish supply chain for public school canteens

The supply chain from aquaculture to the school canteen service is rather heterogeneous and complex. It appears to be well integrated both in its upstream portion (farming, processing firms and their suppliers) and in downstream activities, from distribution to consumption. Although several criticalities were detected, all the actors involved clearly perceived the potential of introducing fresh fish from aquaculture into the school canteen menus.

To summarise the information gathered, we have elaborated a SWOT matrix, describing the strengths, weaknesses, opportunities and threats of the whole “Italian organic aquaculture – public school canteen service” supply chain.



*Table 1.a: SWOT matrix of the aquaculture-public school canteen service supply chain. Strengths and Weaknesses*

Strengths	Weaknesses
<p>From a technical point of view, the organic farming of sea bass and gilt-head bream is similar to conventional farming for what concerns the growth and mortality of the fish and palatability of the feed.</p> <p>Aquaculture of sea bass and gilt-head bream represents a valid alternative to fish caught in the sea in terms of nutritional quality and food safety.</p> <p>Municipalities show interest in organic fresh fish.</p> <p>Adequate planning of the serving dates and efficient organisation of the various phases – fishing, processing, transportation, distribution, delivery to the canteen kitchens, and preparation – make it possible to use fresh fish.</p> <p>Care in handling the product and preparing the recipes reduces the risk of fish bones left in the portions.</p> <p>The average appreciation of the new fish dishes is similar to that of the traditional products but the distribution of leftovers seems more positive.</p> <p>Consumption education positively influences the children’s level of appreciation.</p> <p>The supply chain displays a good level of integration and communication among actors working both upstream (farmers, processing firms and their suppliers) and downstream (distribution and so on).</p>	<p>Criticality related to organic feed and fry.</p> <p>General lack of specific information on fish from organic farming provided by the Municipality employees in charge of the school canteen service.</p> <p>Insufficient supply of fish from organic farming.</p> <p>Municipalities and catering firms perceive the management of the product to be difficult from many points of view (e.g. perishability, complex logistics, presence of fish bones).</p> <p>The actors along the supply chain believe that the cost of the product is incompatible with the school canteen system. Our analysis seems to indicate that this is not such a major issue, but further investigation is needed.</p>

*Table 1.b: SWOT matrix of the aquaculture-public school canteen service supply chain. Opportunities and Threats*

Opportunities	Threats
<p>The serving of organic food in school canteens is a growing trend.</p> <p>The possibility of combining extensive lagoon farming with intensive farming in tanks for both the sea bass and the gilt-head bream was verified: young wild specimen easily adapt to captivity.</p> <p>Privileged channel: school canteen services may choose to prefer fresh fish of native varieties coming from local organic farms.</p> <p>Early processing of the fish can occur directly at the farms. The added value thus remains in the first segment of the supply chain, with no other steps that would increase costs.</p> <p>Full product traceability, from the fry farm to the school canteen.</p> <p>Reduction of the environmental impact of the supply chain – expected but to be measured.</p> <p>Fish consumption in Italy is growing but the supply is insufficient to meet the demand, hence our dependence on imported fish progressively increases. Aquaculture represents a valid alternative.</p> <p>The crisis affecting the fishing and aquaculture sector requires new, reliable and long-lasting market outlets, such as public school canteen services.</p>	<p>Lack of specific regulations on the use of fresh fish from aquaculture in school canteens (e.g. freshness characteristics day by day, expiry date).</p>

Municipalities play a key role in the supply chain. They manage the school catering service by defining its characteristics through the service tender specifications. It is in this phase that the Municipalities play a steering role, which affects the whole supply and production chain. The rules on public procurement allow public organisations to determine the type and origin of the foods, the methods for the preparation of meals and the procurement regulations.

The organic fish recipes were served seven times during the 2011-2012 school year, in periods characterised by adverse circumstances: a flood (20th October 2011), one of the major snowfalls in Rome in the last few years (February 2012), public transport strikes and truck drivers strikes. All

these events caused severe traffic disruptions with negative effects on the logistics of the experiments. It can certainly be said that the feasibility of the chain was put to the test.

One of the problems emerging from the investigation is that catering firms find it difficult to comply with the ever more stringent regulations included in the tender specifications, with shrinking income margins. In this regard, the foodservice companies suggest that the menus should be made simpler, i.e. include a more limited variety of products, and that the procurement contracts should be extended in duration, to ensure greater stability and, consequently, better services. The introduction of fresh fish, from local organic farms, is seen as a good opportunity due to increasing difficulties in purchasing deep-frozen products, ascribable to reduced supply and rising prices of the wild species. The main problems derive from the presence of fish bones, the characteristic smell of fresh fish not generally liked by children, logistic difficulties (dedicated refrigerated vehicles and strict monitoring of the cold chain are necessary) and the lack of sufficient supply to meet the needs of large companies such as those of the foodservice industry. The presence of bones and the characteristic smell can be easily eliminated by creating suitable recipes. Conversely, supply and logistic problems are harder to solve.

*Regulatory aspects.* In order to introduce fresh fish from organic farming into the menus of school canteens, a series of regulations set by the national laws must be followed, as well as regulations included in the tender specifications of Municipalities, which might envisage further limitations and requirements not specified in the national laws. In fact, the tender specifications list all the characteristics that the service provided by the contractor must have and discipline the supply and provision of said service. Obviously, fish, like any other food served in canteens, must comply with specific health and hygiene prerequisites as well as with chemical, microbiological, nutritional and organoleptic requirements. When replacing deep-frozen fish with fresh fish, the matter of freshness appears to be the most sensitive. The regulations mention no specific definition of freshness of fish expressed in days since catching and make no reference to the concept of expiry date. Fresh fish must be in a good state of preservation and display all the typical features of a fresh product (as for its smell, colour, texture and general aspect). It is up to the operators receiving the products to ascertain their freshness and to accept or reject the delivery. The most important aspect, rather than the number of days since catching, is the way in which the fish is preserved. The fish must be refrigerated, packed in crates with ice and transported at a maximum temperature of 4°C, but preferably around 0°C, onboard an authorised and clean truck. During transportation, the vehicles and containers must be hermetically sealed; they must also be provided with devices for the collection of water deriving from the ice melting, in order to avoid its stagnation. The fish must be physically separated from other products to avoid any risk of cross-contamination. Once delivered, the product must be stocked in refrigerators at a maximum temperature of 4°C and separated from other products, far from any possible sources of contamination.

From a logistic point of view, great attention must be paid to avoid breaking the cold chain, so that the products are constantly preserved at a temperature no higher than 4°C. Obviously, as time passes, the fish deteriorates despite being preserved correctly. In the case of our project, around 72 hours elapsed from catching to consumption. The operations took place over a total of four days: on the first day the fish was caught, on the second day it was filleted, on the third day it was transported to the distribution platform in the early afternoon and on the fourth day it was delivered to the school kitchens in the early morning in time to be prepared and served on the same

day. With this type of organisation, it is best to plan for the fish to be caught on Mondays, so that it can be served on Thursdays or, in case of delays, on Fridays. Further delays make it impossible to use the fish, since schools are closed on Saturdays and Sundays and the kitchen refrigerators must be emptied and cleaned. Should it be decided that fresh fish will be served twice a week, for instance on Mondays/Tuesdays and on Thursdays/Fridays, it must be remembered that the carriers do not always travel at weekends and that the farms and processing plants, which are often of small size, are likely to be closed on Saturdays and Sundays. In this way, in order to include fresh fish in the Monday or Tuesday menu, the whole operation will take 5 days (120 hours from catching to serving) or 6 days (144 hours from catching to serving) respectively.

In order to calculate the quantity of fish needed, the following must be borne in mind: (i) upon first processing the fish (to turn it into fillets with skin), the waste amounts to around 50%; (ii) while preparing the recipes, the waste amounts to a further 30%; (iii) the quantity of raw fish per portion changes depending on the age of the children.

According to the Italian National Guidelines for School Catering (2010) and the LARN/INRAN Tables (2006), the amounts of fish needed for the various age groups are as follows:

- Kindergartens

- children aged between 3 and 6 months: fish is not served due to allergy problems.
- children aged between 6 and 9 months: 40 g of puréed fish once a week.
- children aged between 9 and 12 months: 50 g of finely minced fish once a week.
- children aged between 12 and 36 months: 60 g of fish fillets, balls or nuggets twice a week.
  - Nursery school (3-5 years of age): 70 g of fish fillets, balls or nuggets twice a week.
  - Primary school (6-10 years of age): 100 g of fish fillets, balls or nuggets twice a week.
  - Middle school (11-13 years of age): 110 g of fish fillets, balls or nuggets twice a week.

The tender specifications analysed list the types of farmed fish allowed (before our experiment only trout and salmon were considered) and define the characteristics of the fish farms (similarity to the natural habitat, attention to animal welfare, organic or low-intensity farming systems) and the chemical requirements (no antibiotic and antiseptic residues, absence of external polluting chemicals or traces deriving from poor processing techniques).

## CONCLUSION

The study shows that implementing a direct link between organic aquaculture and school canteens is feasible, even though it had never been done before in Italy. The study also analyses a practical case of sustainable public procurement applied to the fish supply chain.

The purpose of the research was to test the serving of fresh fish from Italian organic farms in school canteens. In order to understand the reasons behind this research, it is important to start by focusing on the meaning of the school canteen service and on the role of the public administration in

managing it. As explained in the introduction, both aspects can have a “political” function, aimed at steering the development of the economy, of the local society and of the environment.

Meal times at school have become multifunctional not only for the pupils and their families but also for the public bodies in charge of providing the service, i.e. the Municipalities. Besides receiving nourishment and benefiting from the positive effects of food on their psycho-physical state, children have the opportunity to learn much about food and the act of eating, which are both rich in meaning for them as individuals, members of the school community and target consumers of the supply chain, whether long or short. On the other hand, the Municipality has the opportunity to provide a service – feeding its younger citizens – and, at the same time, to influence the whole food supply chain, by preferring certain raw materials, suppliers and features of the service. Awareness of the environment and of waste reduction, the ethical values of the products and of the firms producing and distributing them, the development and vitality of the local economy and communities and the education of children about healthy, critical and responsible food consumption are all aspects which take on as much significance as the provision of the service itself. Hence, local bodies play a truly political role through the purchase of certain products and services. This is the public procurement, which can become “green” and/or sustainable if it pursues one or many of the above mentioned goals. With the economic crisis and the ensuing austerity, this objective becomes even more important because it implies trying to find a balance, so as to provide school children not with products purchased at the lowest price but with products having the fairest price in relation to their quality. This also stimulates changes, leading local administrations to pay more attention to the choices made within a new system of values and lifestyles.

In relation to the above, fish consumption is a particularly interesting case study. Within the agro-food sector, the fish production chain is one of the most critical in terms of sustainability. Fish consumption is increasing, whereas the natural fish stocks – especially of the most commonly eaten varieties, such as cod, sole and tuna – are decreasing due to overfishing. Several fishing tools and methods, as well as pollution coming from various sources, destroy the marine ecosystem. Aquaculture, which might represent an alternative to intensive fishing, has not yet overcome one of its greatest criticalities, i.e. the fact that farmed fish is fed by large quantities of wild fish (the so-called forage fish). Lastly, the production chain is very heavy in terms of energy consumption (for instance, to deep-freeze the fish and to keep the cold chain unbroken from the ships to the consumers) and generates extremely large amounts of waste throughout, from the fishing vessels to the portions served to pupils in school canteens.

Furthermore, fish is one of the most challenging types of food to be served in school canteens as it displays some major criticalities in its supply, distribution, preparation, as well as consumption.

Hence, research can give its contribution by studying innovations able to make the supply chain of fish served in school canteens more sustainable. The key idea of our research was very simple, i.e. to replace the fish commonly served at school (deep-frozen and belonging to a few wild species subject to intensive fishing in distant seas) with fresh fish coming from Italian organic farms. We expect this change to have a wide range of beneficial effects: helping the development of organic aquaculture, making the fish served at school more palatable, decreasing the amount of fish waste in school canteens, as well as increasing consumption of fish by children with positive consequence on their nutrition and health.

As in every research project, it was necessary to test the initial hypothesis, i.e. the feasibility of the operation in each step of the supply chain. This is why the project implemented – for the first time in Italy – an experimental supply chain in one of the most stimulating national contexts: the city of Rome. Indeed, the capital of Italy has one of the most innovative and most frequently studied school canteen systems worldwide. It is also a particularly interesting case study due to its size, logistic-organisational difficulties and the impact of its changes on the Italian agro-food sector as a whole and on the behaviour and choices of other Italian Municipalities.

In order to achieve our research objectives, we tested a supply chain approach by studying each of its segments, from production to consumption.

To assess the overall feasibility of the operation, the fish was served for a total of seven times in the schools of Rome, during the 2011-2012 school year. This research-action was preceded by a careful analysis of the supply chain, which helped to identify the various actors involved, their mutual relations, and what they perceived as the main criticalities concerning the introduction of fresh fish from aquaculture into the school canteen service. This innovative project led to a series of practical results – concerning the time schedule, logistic aspects and creation of new recipes – which might be useful to those who wish to implement a similar initiative. Furthermore, several positive effects were detected. The most significant consequence was that all the actors involved, public as well as private, developed greater awareness of the feasibility of introducing innovative and sustainable fish products into the school canteen service. Therefore, participating in the project also turned out to be a learning experience.

Moreover, after being involved in the project and thanks to the success of the experimental phase, the Municipality of Rome decided to include in the special tender specifications for the 2013-2017 school canteen service a number of new recipes, i.e. “battered sea bass fillets”, “sea bass fillet medallions” and “pasta with organic trout sauce”, along with the (rewarded) option to use fresh sea bass and trout fillets to replace the standard frozen ones.<sup>6</sup>

Yet, the most important conclusions reached at the end of this project are of a theoretical nature. Firstly, the experiment showed that short-term actions, such as our experimentation, can contribute to more long-term solutions (green public procurement strategies) and to new approaches to complex problems (e.g. the sustainability of the fish production and supply chain). Secondly, the participatory approach of our project, aimed at bringing together various types of professionals with different skills, proved to be a fundamental prerequisite not only to make the initiative successful but also to allow the actors involved to learn by doing. Hence, this experience sets an example which will make it easier for other actors to replicate the experiment elsewhere.

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<sup>6</sup> See appendices no. 2 (p. 10-11) and no. 12 (p. 7-8) to the special tender specification of the Municipality of Rome (in Italian):  
[http://www.comune.roma.it/PCR/resources/cms/documents/ristorazione\\_scolastica\\_allegato2.pdf](http://www.comune.roma.it/PCR/resources/cms/documents/ristorazione_scolastica_allegato2.pdf) and  
[http://www.comune.roma.it/PCR/resources/cms/documents/ristorazione\\_scolastica\\_allegato12.pdf](http://www.comune.roma.it/PCR/resources/cms/documents/ristorazione_scolastica_allegato12.pdf) (visited on 27/2/2013).

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## REFERENCES

- Bala, A., Muñoz, P., Rieradevall, J., Ysern, P., (2008), "Experiences with greening suppliers. The Universitat Autònoma de Barcelona", in: *Journal of Cleaner Production*, 16: 1610-1619.
- Bichi, R., (2007), *La conduzione delle interviste nella ricerca sociale*, Carocci: Rome.
- Burke, L., (2002), "Healthy eating in the school environment – a holistic approach", in: *International Journal of Consumer Studies*, 26: 159–163.
- Carlsson, L., Waara, F., (2007), "Environmental concerns in Swedish local government procurement", in: Thai, K.V., Piga, G., (Eds.), *Advancing Public Procurement: Practices, Innovation and Knowledge-sharing*, PrAcademic Press, Boca Raton, Florida (USA): 239-256.
- Erdmenger, C., (Ed.), (2003), *Buying into the Environment: Experiences, Opportunities and Potential for Eco-procurement*, Greenleaf Publishing Limited: Sheffield (UK).
- European Commission, (2004), *Buying green! A Handbook on Environmental Public Procurement*, vol. 1050, SEC, Brussels.
- European Commission, (2008), *Communication from the European Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Public Procurement for a Better Environment*, vol. 400, COM, Brussels.
- Gambelli, D., (2007) "Nota metodologica: l'uso dei dati qualitativi nelle analisi socio-economiche territoriali", in: Zanoli, R., (ed.), *Le politiche per l'agricoltura biologica in Italia. Casi di studio nazionali e regionali*, FrancoAngeli: Milan.
- Guala, C., (2003), *Interviste e questionari nella ricerca sociale applicata*, Rubbettino: Soveria Mannelli (Italy).
- Helstosky, C., (2006), *Garlic and Oil: Food and Politics in Italy*, Berg: Oxford (UK).
- Lunati, F., Bertino, R.M., (eds), (2003), *Mense bio in Italia Il biologico in cifre 2004*, Bio Bank: Forlì (Italy).
- Michelsen O., de Boer L., (2009), "Green procurement in Norway; a survey of practices at the municipal and county level", in: *Journal of Environmental Management*, 91: 160-167.
- Mingozzi, A., Bertino, R.M., (eds), (2012), *Tutto Bio 2012 Annuario del Biologico*, Bio Bank by Egaf Edizioni: Forlì (Italy).
- Morgan, K., Sonnino, R., (eds), (2008), *The School Food Revolution Public Food and the Challenge of Sustainable Development*, Earthscan: London.
- OECD, (2000), *Greener Public Purchasing. Issues and practical solutions*, OECD: Paris.
- Pagliarino, E., Farina, R., Borelli, S., (2010), "La pecora sopravvissana", in: Elias, G., (ed.), *Prodotti agroalimentari tradizionali della montagna italiana Tradizione e innovazione in cinque casi studio*, FrancoAngeli: Milan.
- Walker, H., Preuss, L., (2008), "Fostering sustainability through sourcing from small business: public sector perspectives", in: *Journal of Cleaner Production*, 16: 1600-1609.