

## Responsibility and Sustainability in a Food Chain: A Priority Matrix Analysis

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### ABSTRACT

This paper shows the results of empirical research conducted to assess the sustainability of a typical food supply chain, suggesting feasible solutions to satisfy inter-dimensional requisites of durable development. The analysis was conducted with reference to the supply chain of the San Marzano tomato (SMZ), a typical local food. The product is endowed with an origin certification label (PDO), meeting demand within high-value market niches. The SMZ is a flagship product in the Italian region of Campania and has benefited from several regionally funded interventions, such as genetic research and support for the application for EU certification of origin). Two key findings emerged from the research. First, the results allowed us to define a Stakeholder Priority and Responsibilities' Matrix (SPRM), and monitor the sustainability trend of SMZ food supply chains. Second, the consistency between the adoption of quality strategy (brand of origin) and sustainable development of the sector was evaluated. Despite its intrinsic characteristics and its organized, well-defined structure, the SMZ food supply chain is unable to address sustainable objectives without considerable public intervention and support. In terms of sustainability, to be able to show desirable food chain characteristics, the existence of a fully collaborative relationship between the actors has to be ascertained. Identifying shared goals is essential to assign and implement coordinated actions, pooling responsibility for product quality into social and environmental dimensions.

*Keywords: PDO product, Sustainability assessment, Food chain management.*

*JEL classification: Q01, Q20, Q50*

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### 1 Introduction

The long process of change in the agri-food sector and in models of European food consumption does not appear to be slowing. The key role of food product quality attributes is confirmed by continual use of marketing policies geared to *branding* and *grading* so as to intercept increasingly segmented market demand. In this context of growing segmentation, a key role is played by environmental and ethical dimensions of products within a framework of sustainable development. Policies for the primary sector have targeted the above-described dynamics with greater resolution, recognizing the potential for an effective response to the squeeze in farm profit margins, supporting producers in their effort to leave the perimeter of commodities. From being a merely economic objective, sustainability has thus been enriched with new significance, acquiring along the way ever more dimensions (environmental, social, institutional and economic), with growing recognition on the part of consumers.

However, this process imposes a continuous change for the whole agri-food supply chain, involving all its stakeholders (Bell and Morse, 2003). Supply chain sustainability objectives are indeed the result of joint choices made both by stakeholders within the same supply chain (producers, processors, distributors,

consumers) and by outside stakeholders (institutions and research). The market success of a product will thus depend increasingly on the effectiveness of the strategies that necessarily envisage active participation of all supply chain stakeholders (Fischer *et al.*, 2010). Further, diversity among food supply chains imposes that sustainability must be achieved by identifying more suitable solutions for each supply chain. In empirical terms, these results are reached by adopting more sustainable operative solutions by different actors (producers, industrial processors, wholesalers, retailers, etc.) in order to provide higher value goods to consumers. Changes consistent with an improvement in sustainability in the food supply chain always entail investments whose economic viability is the ability to supply goods with higher value for consumers. That said, not all the feasible sustainable solutions that can be adopted by the supply chain automatically provide higher value food. At the same time, the consumers have to be willing to buy these products at a higher price. The diversity of products and supply chains, as well as the particularity of sustainable product quality and finally the various determinants of consumer behaviour, means that innovative efforts must be well targeted and closely coordinated. The more uncertain and limited the return on investments, the more indispensable is preliminary analysis of such choices.

The search for solutions to promote sustainable development of supply chains thus requires transparency and consensus among all the actors in the chain (Fritz and Schiefer, 2008; NZBCSD, 2003). Solutions identified as the need arises must thus be context-specific, excluding the possibility of replicating operative solutions in whatever circumstance (IIED and Proforest, 2005).

In this context, the role of research becomes crucial to enable the most appropriate solutions to be identified. Such solutions have to be evaluated simultaneously according to their economic implications but also for the improvement in social and environmental dimensions. Furthermore, specific tools, analytical models and consistent indicators to assess sustainability of food supply chains are still far from being consolidated in the literature.

In light of the above considerations, this work will present an effective tool for analyzing problems of a collective nature, suggesting through stakeholder analysis applied to a case study, the implementation of the Stakeholder Priority and Responsibilities' Matrix (SPRM) framework, first developed by Smith (2008). Our intention is to provide simple rules to follow the time evolution of a food supply chain, judging feasible solutions to satisfy inter-dimensional requisites of durable development.

Our methodological framework was specifically applied to the San Marzano tomato (SMZ), assessing the sustainability of a typical Italian local food supply chain. The product is endowed with an origin certification label (PDO), meeting demand within high-value market niches. As a flagship product in Campania (Italy), the SMZ has enjoyed regional funding for interventions targeting research into the variety's genetic resources and lending support for the establishment of its origin certification.

This paper is organized as follows. First, we characterize the problems regarding the methodological framework and the empirical solutions adopted to collect data and analyze the case study. Secondly, we present the specific food supply chain (product, type of food supply chain, spatial and economic context). The analysis concludes with a discussion of the main thoughts on the case study.

## **2 Methodological approach**

Stakeholder analysis began operatively by revisiting the structure of a typical Stakeholder Priority and Responsibilities' Matrix (SPRM) of actors involved in the food supply chain (FSC), as structured by Smith (2008).

**Table 1.**  
Typical SRPM assigned to actors within food supply

Sustainable Development priorities	Actors within supply chain					Actors outside chain	
	Farmers and growers	Transport and distribution	Processing and manufacturing	Retailing	Consumers and citizens	Governments	Research and development
<b>1. Safe, healthy products nutrition and information</b>	<b>+</b> <b>+</b>	+ +	<b>+</b> <b>+</b> <b>+</b>	+ + +	+	<b>+</b> <b>+</b>	<b>+</b> <b>+</b>
2. Rural and urban economies and communities	+		+	+		+ + +	
<b>3. Viable livelihoods from sustainable land management</b>	<b>+</b>		<b>+</b> <b>+</b>	+ +		<b>+</b> <b>+</b> <b>+</b>	<b>+</b>
<b>4. Operate within biological limits of natural resources</b>	<b>+</b> <b>+</b>				+	<b>+</b> <b>+</b> <b>+</b>	<b>+</b> <b>+</b> <b>+</b>
<b>5. Minimising energy and inputs, use renewable energy</b>	<b>+</b> <b>+</b>	+ + +	<b>+</b> <b>+</b> <b>+</b>	+ +	+	<b>+</b> <b>+</b> <b>+</b>	<b>+</b>
<b>6. Worker welfare, training</b>	<b>+</b> <b>+</b> <b>+</b>	+ + +	<b>+</b> <b>+</b> <b>+</b>	+ + +		<b>+</b> <b>+</b> <b>+</b>	<b>+</b>
7. Animal welfare	+ + +	+ +	+ +	+ +		+ + +	+
<b>8. Sustaining the resource</b>	<b>+</b>					<b>+</b> <b>+</b> <b>+</b>	<b>+</b> <b>+</b>

+ low, ++ medium; +++ high.

The SPRM represents synthetically the relationships between actors and sustainability targets. It summarizes the degree of responsibility (level of qualitative assessment) assumed by each group of actors involved in the FSC towards the concrete objectives (priorities) in which the improvement in sustainability may be operatively identified.

Adoption of the SPRM can be useful to depict the multi-dimensional connections between the sector's actors in achieving complex goals such as that of supply chain sustainability: sustainable development does not only exhibit several features (environmental, economic and social) but must also be the result of a bottom-up process with the participation of stakeholders (Rubenstein, 1993) operating in a supply chain. The specific context is represented by the double dimension of space-time.

The space dimension refers to the complex cultural, socio-economic and political relations. The latter is formed by the dimension of "time": with reference to the time dimension, priorities and sustainably consistent actions assume specific operative significance for individual actors (the horizon of responsibility, attention and influence of each actor).

As regards the *priorities*, the main objectives of sustainable development for a food supply chain can be identified. They just represent the food sector's contribution to the broader goal of sustainable development. Such priorities involve all the three interrelated dimensions of development. Broadly speaking, a sustainable food supply chain must be able to (DEFRA, 2002): produce safe healthy food responding to market demand; assure access to food for consumers, improve information about products; respect the biological limits of natural resources and guarantee higher standards of animal welfare; reduce inputs, save energy and use renewable energy; advance employee welfare, training and safety; ensure sustainable land management; ensure the viability and economy of rural and urban communities.

Reaching set objectives (priorities) is the result of choices made by actors inside the supply chain (producers, processors, distributors, retailers, consumers) and by external actors (government and researchers). Indeed, the sustainability of the food supply chain is the result of a participatory process. The actors are asked to identify how improvement might be attained, in a way that is consistent with the priorities to be achieved (Bell and Morse, 2003). Each actor is entrusted with *direct* responsibility and an *indirect* degree of influence over other actors. Direct responsibility is related to the problems they face and to the solutions adopted to achieve the required change in the stage of the food chain in which they operate. The power of influence, on the other hand, derives from the role that each actor can exert compared with other upstream and downstream actors. The specific structure of the food supply chain for a precise product implies the weight of direct responsibility for each actor and the intensity of their influence. The willingness of all the food chain players (from farmer to consumer) to extend the responsibility for product quality into social and environmental performance is indispensable to achieve this objective (Smith, 2008 and Sodano, 2007).

Some players will inevitably have greater responsibility, thereby assuming a strategic role to achieve the sustainability of the entire supply chain. The strategic actor is often the one who enjoys more market power. Hence the changes consistent with the supply chain objective may involve the transfer of costs incurred by the strategic actor onto the other operators, with adverse effects on the sustainability of the chain itself.

In operational terms, the application to our case study brings about a first adaptation ex-ante of the typical SPRM by means of a preliminary study prior to the field survey. The adaptation took into account the specific nature of the supply chain in question, the geographical context in which it operates, and the needs and sensitivities of the supply chain actors. We identify the actors inside and outside the supply chain that have the greatest responsibilities in the process of building sustainability.

Following the survey conducted with supply chain actors, we drew up an observed SPRM. It includes the opinion of actors vis-à-vis the priorities of the objectives identified and definition of the degree of responsibility to be assigned to each stakeholder in order to achieve the objectives. Their characterizing structure and hypotheses are then presented with reference to the priorities, the actors and considerations that lead to defining the degree of responsibility. Therefore, the importance of the contribution of each actor to one of the objectives which is consistent with developing a sustainable food supply chain is assigned and simultaneously evaluated.

The observed SPRM allows us to identify the intensities of the responsibilities felt by each actor vis-à-vis improvements in the sustainability standards in the FSC. The result consists in identifying the most critical, conflicting points within the FSC for which to set up action for the awareness-raising of each stakeholder and for coordination among them.

**2.1 Data**

In order to make such assessments we followed a procedure that has come to be known as triangulation (Bryman, 1988). Our analysis, in fact, was performed by combining data from various sources and using various survey methods.

As noted by Olsen (2004), “in social science research triangulation is defined as the mixing of data or methods so that diverse viewpoints or standpoints cast light upon a topic. The mixing of data types, know as data triangulation, is often thought to help in validating the claims that might arise from an initial pilot study. The mixing of methodologies, for example, mixing the use of survey data with interviews, is a more profound form of triangulation.” In this light, different data collection techniques and different research evaluation strategies were explored: the findings were thus tested through a crosscheck of different sources of data and methodologies. Three different data sources, both qualitative and quantitative, were used to fully define food chain priorities and actors’ responsibilities. Qualitative data inputs were obtained from three sources, namely semi-structured interviews with key informants, official statistics from secondary data sources, documents on governmental activities and articles published in peer-reviewed journals.

A total of 12 key informants were interviewed, several on more than one occasion. The key informants were chosen from among the whole food supply chain, including farm leaders, food processing managers and technicians (Table 2).

**Table 2.**  
Sample description

		Population (absolute value)	Sample	
			(absolute value)	%
Total Farms, no.		161	34	21.1
Farms, no.	Naples	66	23	34.8
	Salerno	95		
Farms - Total certified production - quantity (100kg)	Naples	1,504,658	480,529	31.9
	Salerno	2,035,868	264,369	13.0
Farms - Total certified production - (cultivated hectares)	Naples	31	11	35.5
	Salerno	56	6	10.7
Farms- Certified production- Average quantity per farm (100kg)	Naples	22,798		
	Salerno	21,430		
Farmers - age	< 40 years old	7	4	57.1
	41-50 years	28	6	21.4
	51-60 years	37	16	43.2
	> 61 years	56	8	14.3
	n/a	33		
Farmers – no. participating in the certification body	for two years	26	3	11.5
	for five years	135	31	23.0
Farms - no. per farm size	< 0.5 ha	122	23	18.9
	0.5 - 1 ha	23	5	21.7
	1-2 ha	11	5	45.5
	>2 ha	4	1	25.0
Farm cooperatives	Numbers	9	6	66.7
	Associated farmers	161	96	59.6

The information obtained from the interviews is “phenomenological” in that it clarifies the perceptions and experiences that people give to events (Bamberger *et al.*, 2006). Interviews seek qualitative information that can be narrated and crosschecked with quantitative data. The quantitative data were obtained from a researcher-administered structured survey (Table 3).

**Table 3.**  
Structured interview sample composition

Group	Organization	Role
Group one	San Marzano PDO protection consortium	President
Group two	Farmers cooperatives	Director Danicoop
		Director Pomar
		Director Agrigenus
		Director Foce2000
		Director La Strianese
		Director La Ciccianese
Group three	Food industry	Manager LODATO Spa
		Manager Acunzi Srl
Group four	Research and institutions	Head of Research, Cirio
		University professor
		Campania Regional Authority officer

The survey was developed to investigate at farm level the social, economic, environmental and institutional issues determining the sustainability of the local nature-society-economics integrated system in both a short and long-term perspective (Rigby *et al.*, 2001). Because the population size was very small, a snowball sampling design (Goodman, 1961) was used to collect a sample of 34 horticultural producers from the traditional area of SMZ. The data were summarized and *triangulated* with the qualitative information in order to obtain a case and site-specific assessment tool, addressing the many facets of the sustainability concept of the particular supply chain. Table 4 summarizes the information sources used by this study to investigate the roles of the main food chain actors in achieving sustainability goals. The outcome of the above approach provides the structure and completion of the Observed Matrix of actor responsibility (Table5). The SMZ (PDO) supply chain will be briefly discussed in the next section .

**Table 4.**  
Information sources and investigation methods

Actors	Information source	Method
All the actors	Peer-reviewed journals	Sustainable food supply chain formal model development.
	Secondary data	Quantitative assessment
Farmers and growers	Official documentations	Document review
	Peer-reviewed journals	Literature review, developing farm level indicator of sustainable production
	Researcher-administered structured survey	Quantitative assessment
	Semi-structured interviews	Qualitative assessment
Distribution	Semi-structured interviews	Qualitative assessment
Processing and manufacturing	Peer-reviewed journals	Literature review of sustainability assessment methodologies
	Semi-structured interviews	Qualitative assessment
Government	Semi-structured interviews	Qualitative assessment
	Official documentations	Document review
Research	Semi-structured interviews	Qualitative assessment

### 3 The SMZ food chain characteristics

The San Marzano (SMZ) tomato was designated as a PDO (Protected Designation of Origin) product by the European Union in 1996. The designation of origin identifies 41 municipalities in Campania where San Marzano tomatoes can be grown. It corresponds roughly to a limited area between the provinces of Salerno, Naples and Avellino. In June 1999 a consortium was created to protect the San Marzano PDO. The consortium performs the task of coordinating and improving the supply chain, in collaboration with the IS.ME.CERT institute, which has been designated by the Ministry of Agriculture for the control and certification of each can of Tomato San Marzano PDO, throughout planting, processing, and placing the product on the market.

The institution of the PDO brand was only the last step of a long program that the Campania Region began years before, aiming to bring the production of the San Marzano tomatoes back to the area in question. The program started as a project aiming to conserve biodiversity and to enhance the value of typical agricultural production. It included in-situ conservation of the SMZ tomato, rediscovering and improving genetic material.

The re-structured food chain is characterized by its micro size, comprising a total of nearly 200 agents (2009). The main stages of the food chain, production and processing, also take place in an area within a radius of about 25 km, thus qualifying as a strictly local supply chain. The area in question falls mostly within the large metropolitan area of Naples, with a population density of 1,950 inhabitants per km<sup>2</sup>, the highest found in metropolitan areas nationwide and one of the highest in Europe. This makes the chain especially vulnerable to the competition of other economic activities for land resource use. Moreover, the widespread environment of lawlessness involving the suburbs of metropolitan areas (Naples) has a direct effect on the economic relations between the agents and their counterparts that are often informal and brief.

Figure 1 shows the structure of the supply chain: 161 farms are organized into nine cooperatives, supplying yearly about 3,500 tons of fresh San Marzano tomatoes to the 14 food producers. Three million cans are subsequently placed on the market.

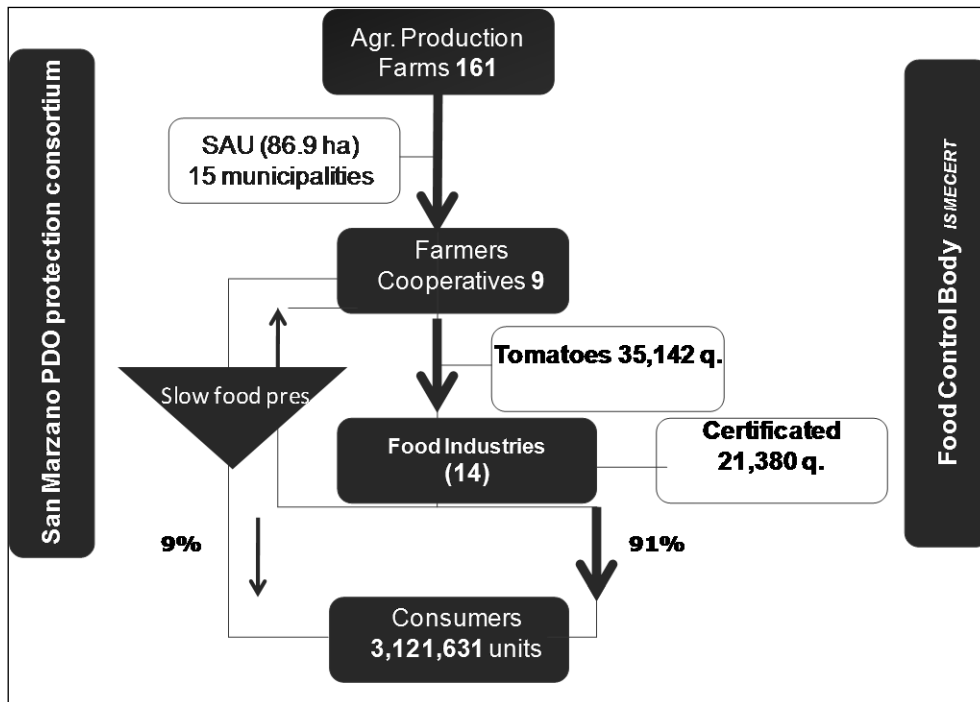


Figure 1. San Marzano PDO, Food supply chain (2009)

The land cultivated under SMZ PDO is currently 88 hectares, distributed over 15 municipalities. In recent years there has been a decrease in the number of farms, favoring the selection of more efficient businesses. At the same time, that decline has led to a fluctuating supply of fresh production to the processors (Figure 2, Figure 3). An essential role of coordination between the agricultural phase and processing is provided by producers' cooperatives. These are the cooperatives marketing the fresh product which play the important role of single interlocutor between farmers and canning firms. The structure of the supply chain is long, with very rigid relations. Once the product has been processed and canned, 91% is sold through the traditional chain of retailers while about 9% of the production is placed directly on the market through the direct sales of some cooperatives.

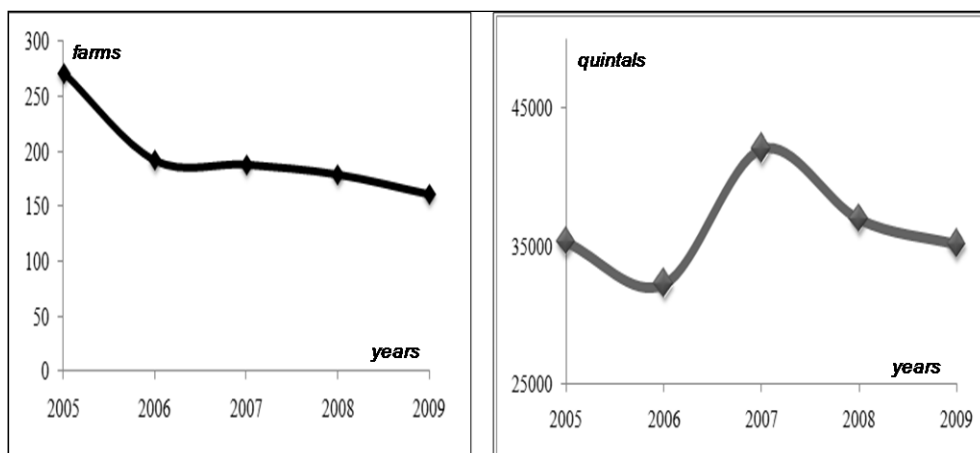
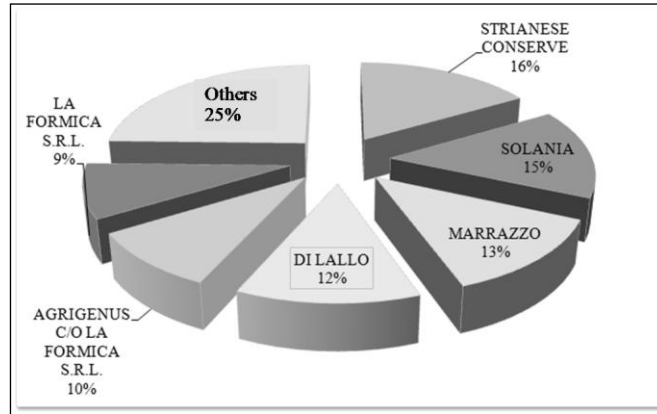


Figure 2. San Marzano PDO: number of farms and quintals produced per year





**Figure 3.** San Marzano PDO: Food producers and production shares (2009)

Several motivations exist for investigating this food chain in greater detail. First, although the intrinsic characteristics of the SMZ food supply chain were considered ideal for sustainable development, this actually appears quite far from the truth. The European origin label offers opportunities and imposes special constraints, and the production phase is influenced by the result of several phenomena and factors. Production follows a standard process with strict regulations, so major changes are not possible in either agricultural production or industrial processing. The regulations restrict the use of genetic material to two local ecotypes. The area of production and processing are also identified and precisely defined. The adopted traceability system allows all the actors in the chain to be identified.

As suggested above, in such a densely populated production area, there is considerable competition between agricultural and domestic uses of the land. The local labor market is characterized by the presence of illegal foreign workers and the widespread use of informal labor contracts. Most of the farms are very intensive, with high use of inputs, reducing the quality of irrigation water and showing marked soil degradation.

#### 4 Results

This section reports the observed behavior of the SMZ food chain actors towards sustainability goals. The “observed” SPRM, for the specific food chain, is shown in table 5. The analysis cannot be considered fully exhaustive, since only the actions of the principal actors were assessed: it is worth recalling that the objectives of sustainability are not always mutually compatible. Achieving each objective, as we discussed above, requires the involvement of all active actors in the food chain. For the above reason we prefer to proceed by providing a reading of the matrix described in section 2, line by line, analyzing the contributions and shortcomings of the actors objective by objective.

**Table 5.**  
Observed Matrix of actor responsibility: SMZ (PDO) supply chain

Sustainable Development priorities	Actors within supply chain					Actors outside chain	
	Farmers and growers	Transport and distribution	Processing and manufacturing	Retailing	Consumers and citizens	Governments	Research and development
1. Safe, healthy products nutrition and information	+	+ +	+ + +	+ + +	+	+	+ +
2. Rural and urban economies and communities	+		+	+		+ + +	
3. Viable livelihoods from sustainable land management	+		+	+ +		+ + +	+
4. Operate within biological limits of natural resources	+ +				+	+ + +	+ + +
5. Minimising energy and inputs, use renewable energy	+	+ + +	+	+ +	+	+ + +	+
6. Worker welfare, training	+	+ + +	+	+ + +		+ + +	+
7. Animal welfare	+ + +	+ +	+ +	+ +		+ + +	+
8. Sustaining the resource	+					+	+ +

+ low; ++ medium; +++ high.

*Red indicates greater responsibility than expected, while green indicates smaller.*

Two goals were excluded, given the peculiarities of the food supply chain in question. Comparing the typical SPRM, we explicitly excluded objectives considered least crucial for the specific food chain: those of “animal welfare” and “rural and urban economies and communities”.

#### **4.1 Safe healthy products, nutrition, and information**

The provision of a transparently healthy and balanced nutrition, with consumers being fully informed of what has been supplied, is one of the main objectives to be achieved for a sustainable food chain. In the case of SMZ PDO our analysis confirms that the product adequately responds in terms of safety. The food chain benefits from traceability throughout the product cycle, from the farm to the packaging stage. This is possible mainly due to the industry’s small size, but which is still able to supply 3 million units of canned products sold annually in 2009.

The safety is also assured by tomato acidity: processed tomatoes are less susceptible to bacterial infections comparing to other processed fruit and vegetables. In addition, several studies indicate that the presence of anti-oxidant lycopene may contribute to protection against carcinogenic substances: lycopene bioavailability in processed tomato products is even higher than in unprocessed fresh tomatoes (Shi and Maguer, 2000).

These characteristics are ably exploited by SMZ processors essentially for marketing reasons, associating the features of a healthy product by advertising the typical characteristics of a local, certified quality product. For example, one producer advises SMZ canned tomatoes to be used as a “beauty mask”. The words “prevention & health” with a complete list of the “principles of healthy diet” stand out on the packaging.

According to the stakeholders’ opinion, much of the responsibility still lies with the agricultural phase. Our survey shows that the fresh product is obtained by very intensive use of technical equipment and extensive use of chemicals with serious environmental impacts. Furthermore, agricultural production takes place in very urbanized areas, exposing the product to the risk of pollution contamination.

#### **4.2 Viable livelihoods from sustainable land management and operating within the biological limits of natural resources**

This goal hinges on the shared willingness of food chain agents to manage the land and other natural resources in a sustainable manner. Although the goal’s direct responsibility mainly concerns the farm phase when environmental resources are exploited, it is not the exclusive responsibility of farmers. The stakeholders confirm that other agents may affect goal achievement directly or indirectly.

Food processors may practice discriminatory prices on raw materials by imposing a grid of product evaluation, taking account of more sustainable production techniques (organic, integrated pest management). Indirect action may be exercised by the governmental institutions rewarding farmers with a subsidy for the production of positive externalities, or by research, providing more effective technical solutions.

That said, on analyzing the specific food chain, the main part of the problem is that this aspect is not really considered as a problem by the interviewees.

The production regulations of the denomination of controlled origin of the SMZ do not include any guidelines on “good environmental practice”. Furthermore, the size of the SMZ food chain represents by itself a strict limitation to solve the problem through the market. The SMZ industry is already suffering from an inadequate supply of fresh product. Hence, differentiating the product further in terms of natural resource use and preservation seems really an impracticable option to the processors. Therefore, the research points out that there were no attempts (such as price adjustment) to make a more sustainable use of the natural resources by farmers. As stated above, SMZ land resources also suffer competition from non-agricultural uses.

#### **4.3 Reduce energy consumption, minimize inputs, renewable energy**

The processing phase is without any doubt the SMZ supply chain stage where there is a higher consumption of energy and other inputs. Unlike the previous goals of sustainability, all the agents involved recognize the need to reduce energy consumption, especially in terms of cost savings. Despite being aware of the problem, the processors are not effectively ready to meet the goal at least in the short term. The interviews also showed that the current economic crisis does not allow companies to plan future investments in this direction.

An important role in this context is also played by distribution. The supply food chain appeared rather virtuous upon analyzing its structure. Production, distribution and processing phases take place entirely in

a 50km x 50km area, involving very low values in terms of food miles. Retailing shows more problems. Only 10% of the canned production is sold through direct sales in the local area by cooperatives, since it is a niche product market. The remaining 90% reaches both national and international markets through conventional large distribution channels. Export competitiveness of the product is usually seen as a signal of the crowning quality of a product. In this case, it became a weakness in reaching this sustainability objective.

#### **4.4 Worker welfare, training, safety, and hygiene**

The success in attaining favorable social welfare conditions represents the fundamental components of the social dimension of sustainability. Its achievement especially concerns the working environment and conditions.

The main responsibility on this issue has to be attributed to stages that require more labor-intensive processes. According to the survey results, the labor demand in agricultural production is met mainly by the farmer and his family during the year, except for harvest time. This period is concentrated into a few weeks per year, and requires a large number of workers per hectare under cultivation. In this case, due to the temporary nature of the tasks involved, labor contracts tend to be informal and often do not respect the minimum wages set through collective bargaining agreements on a provincial basis. Moreover, this problem is not recognized by the food chain agents, given the huge unemployment rate that affects the area. The seasonality of agricultural production has indirect effects on the processing stage as well. In this case, although our analysis revealed the presence of long-term employment contracts, the work requirements included non-specialized skills, without entailing any need to provide further training or refresher courses for employees.

## **5 Final remarks**

There are many methods suited to studying sustainability, some focusing on environmental effects (life cycle analysis, carbon accounting, ecological footprinting, material flow analysis), on the distance between the various production phases and consumption (food miles), on analyzing risk (HACCP studies) or examining the production process (life cycle analysis and stakeholder analysis). Since each method focuses on a limited number of aspects or moments of the production process, the choice of method must be suitable for identifying the aspect of sustainability considered most relevant and important.

Awareness of the difficulty of achieving a rapid across-the-board improvement in sustainability standards shifts the onus onto the social responsibility of all firms operating along a supply chain, linked by a complex game of conflict and cooperation. The appeal for social responsibility calls for an increase in efforts to create sustainable products which consumers already have a willingness to buy, which must be satisfied and encouraged, but also to seek solutions that raise sustainability standards when such conditions do not exist.

To prevent the drafting of such standards by firms resulting in stricter impositions for the weaker links in the supply chain, with the risk of further economically and socially destabilizing effects for groups of actors in the supply chain or for operators in certain geographical areas, such standards should be reached by agreement and consensus. It is necessary to mediate between conflicting interests, in some cases draw up context-specific rules and measures, establish their priorities and work out procedures to measure the level of sustainability reached. Multi-stakeholder initiatives that allow such outcomes are the end-result of a process of building reciprocal trust between actors, which testifies that sustainable development is endogenous to supply chain relations.

Two key findings emerged from our research. First, the results allow effective application of the "Stakeholders Priority and Responsibilities Matrix" as elaborated by Smith (2008).

We provide a useful tool to track the time evolution of the sustainability of SMZ food supply chains. Though the matrix of actor responsibility can be considered a useful tool, it needs to be adapted to the specific characteristics of each food supply chain. Secondly, we performed consistency evaluation between the adoption of quality strategy (brand of origin) and sustainable development of the sector.

Despite its intrinsic characteristics and its organized, well-defined structure, the SMZ food supply chain is unable to address sustainable objectives without massive intervention and public support. A clear policy framework could catalyze the actions of food supply actors, supporting social relations and increasing trust. Similar results were obtained in a stakeholder analysis of Scottish food supply chain by Leat *et al.*, (2010). In our case the driving role of the government is a necessary pre-requisite to achieving goals of sustainability. This can be done by developing "daughter strategies": providing good practice guidelines,

food standards, food and health action plans and environmental action plans. In terms of sustainability, it is not sufficient to show desirable food chain characteristics unless there is a fully collaborative relationship between the actors. Identifying shared goals is essential to assign and implement coordinated actions, pooling responsibility for product quality into social and environmental dimensions.

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