

Environmental impact of Italian canned tomato logistics: national vs. regional supply chains



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ABSTRACT

The environmental impact of food transportation is site and product specific and depends on the direct relation between origin-to-destination distance and logistic efficiency, as pointed out by the relevant literature. This paper analyses a very specific case, comparing the impacts of transportation generated by the logistics of two brands of Italian canned tomato purchased in Sassari (Sardinia, Italy), one extending over the whole continental Italian territory, the other mainly located in the island of Sardinia. Different sale (supermarket chain vs. independent retailers) and shopping (foot vs. car) modalities are also considered. The contributions to global warming, local pollution and traffic congestion are considered.

The case study shows that the logistics of the national brand is much more polluting than the regional, not only because of the longer distance between origin and destination, but also because the additional distance that is needed to reach logistic hubs is not compensated by higher load factors. Instead, the logistics of the regional brand is based on a very efficient point-to-point organization. This result is generalizable to all regional supply chains featuring high volumes of product. Results of the case study also depend on: a) the high impact of packaging transportation, because of the very low weight/volume ratio of empty cans; b) the high CO₂ emission coefficient of lorries and trailers transportation by ferry (Ro–Ro). The case study also stresses the very high impact of shopping by car.

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1. Introduction

Globalization has generated an exponential increase in food transport. A first cause is the increasing demand for highly processed and packaged products, as well as for exotic or out-of-season products. Another reason is the evolution of supply patterns, with the advent of global producers and big supermarket chains that have influenced the whole agribusiness, upstream and downstream: the consolidation of partnerships between a few big operators caused the marginalization of small local operators and the preference for distant suppliers; the concentration of production and distribution infrastructures in a few “hubs” has increased the distance between production areas and final markets (Böge,

1995); the spread of supermarkets has generated the increased use of private cars for shopping.

Since the mid-1990s several studies have extended the research on the environmental impact of agribusiness to the specific issue of ‘food miles’, i.e. the distance covered by food products (Safe Alliance, 1994). Most ‘food miles’ studies focus on the contribution to global warming, while others consider regional and local atmospheric pollution, noise, congestion, accidents and the impact of infrastructure and vehicle building (AEA Technology, 2005; Andersson et al., 1998; Pretty et al., 2005). At first, shorter food supply chains got wide support (Coley et al., 2008), also in relation to the non-environmental (economic, social, cultural) benefits they can bring about (Ilbery and Maye, 2005; Hinrich, 2003; Sonnino and Mardsen, 2006; Winter, 2003). Other, quantitative studies have confirmed the relevant impact of food transportation on global warming (e.g. Garnett, 2003, reports that 3.5% of the total UK greenhouse gas emissions is due to food transportation), but have also pointed out that there is no inverse relation between distance and sustainability. Because of trade-offs involved in logistics, longer supply chains can be less polluting than shorter ones (Garnett, 2003; Saunders et al., 2006).

The first trade-off – discussed in food miles and Life Cycle Assessment (LCA) literature (Blanke and Burdick, 2005;

Abbreviations: C&C, cash and carry (wholesaler); HGV, heavy good vehicle; LCA, life cycle analysis; LCV, light commercial vehicle; PM₁₀, particulate matter smaller than 10 µm; RDC, regional distribution centre; Ro–Ro, roll on–roll off; t-km, tonne-kilometre (transportation of a tonne of goods over one kilometre); v-km, vehicle-kilometre (movement of a vehicle over one kilometre).

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Carlsson-Kanyama et al., 2003; Dyer et al., 2011; Jones, 2001; Saunders et al., 2006) – refers to the impacts of transportation and production stages, as the choice of closer suppliers may involve the use of inputs whose production is more polluting.

The second – and most important here – trade-off involves the efficiency of logistics (AEA Technology, 2005; Coley et al., 2008; Garnett, 2003; Rizet and Keïta, 2005). Long distance supply chains can have a smaller impact than shorter ones, if the latter are based on smaller vehicles, or on vehicles with lower load factors (Mundler and Rumpus, 2012). Moreover, managers of long supply chains can successfully combine just-in-time (i.e., stock minimization) with high load factors, thanks to multi-pick and multi-drop trips and a limited number of regional distribution centres (RDCs) where goods are grouped and then sorted. It must be stressed that the existing literature mainly discusses the low efficiency of niche supply chains, while there are few studies related to those regional supply chains featuring economies of scale and logistic efficiency thanks to relevant local market share. Finally, one of the main outcomes of the existing literature on food miles is the site-specific and market-specific nature of food supply chains environmental impact. This is why further analysis of new contexts and products is needed.

This paper analyses a very specific case, comparing the environmental impacts generated by the logistics of two Italian brands of canned peeled tomatoes (hereafter: canned tomatoes) purchased in the city of Sassari (Sardinia, Italy). The former extends over the whole continental Italian territory, while the latter is mainly located in Sardinia. Different sale (supermarket chain vs. independent retailers) and shopping (foot vs. car) modalities are also considered, thus generating eight different supply chains whose impacts are analysed in terms of global warming, local pollution and traffic congestion generated by transportation. Indicators used are, respectively: the emissions of CO₂; the emissions of particulate matters smaller than 10 µm (PM₁₀); the number of vehicle-kilometres (v-km) in urban areas during peak hours.

Our analysis considers only a part i.e. that referred to logistics of the total environmental impact of the analysed supply chains. Narrowing the scope of the study – compared to LCA allows us to further detail the impact of a phase which is still widely debated. On the other hand, it must be specified that the other stages of the supply chains we consider have very similar characteristics; therefore, the limited scope of the study should not affect the ranking of their environmental impacts.

Our work contributes to food miles research with a comparative study of an Italian case (scarcely studied until now), with the analysis of a product that is typical of the Italian diet and whose very long tradition has influenced the spatial organization of its industry. While the existing literature is almost entirely dedicated to fresh products, the choice of a transformed product can further enlighten other issues, such as the clustering of production and processing activities, or the specific impact of packaging transport. Finally, our case study deals with a rather uncommon type of supply chain, almost exclusively confined within regional borders but covering a high share of the local market, so that we can compare national and regional supply chains both featuring economies of scale and logistic efficiency.

Tomato products are one of the main outputs of Italian agribusiness. With 15% of the global market, Italy is the world's largest producer of processed tomato. National production is mainly concentrated in Apulia, Southeast Italy, but there are also large extensions of tomato crops in the North of the country. With regard to the processing industry, the southern Italian region of Naples is the historic centre of the tomato processing industry, with the region of Bologna (North) as a more recent location. As well as having high volumes of export (Pritchard and Burch, 2003), this processing industry covers the entire national market, with product penetration reaching

98.5% and an average consumption of canned vegetables of 24 kg per family per year (Ismea, 2007). Canned vegetables are mostly sold through supermarket chains (Ismea, 2007), that have 95.4% of market share, while smaller independent stores cover 3.7% of sales.

The following section describes the essential elements of the assessment methodology (more details are provided in Appendix A). Results are given in Section 3 and discussed in Section 4. Section 5 draws some conclusions.

2. Methodology

2.1. Supply chains: overview

The analysis of the supply chain of canned tomatoes refers to the logistics of three stages: production and distribution to RDCs and cash and carry wholesalers (C&Cs); final distribution to supermarkets and independent stores; and shopping by consumers. Impacts of every transport segment of each logistics stage are measured.

Eight canned tomato supply chains are considered (see Fig. 1). Supply chains differ in:

- Production location: Sardinia vs. continental Italy.
- Distribution channel: supermarket chain vs. independent retailers.
- Shopping transport mode: foot vs. car (only shopping on foot has been considered in the case of independent retailers, because this is the most representative way of shopping for this kind of stores);

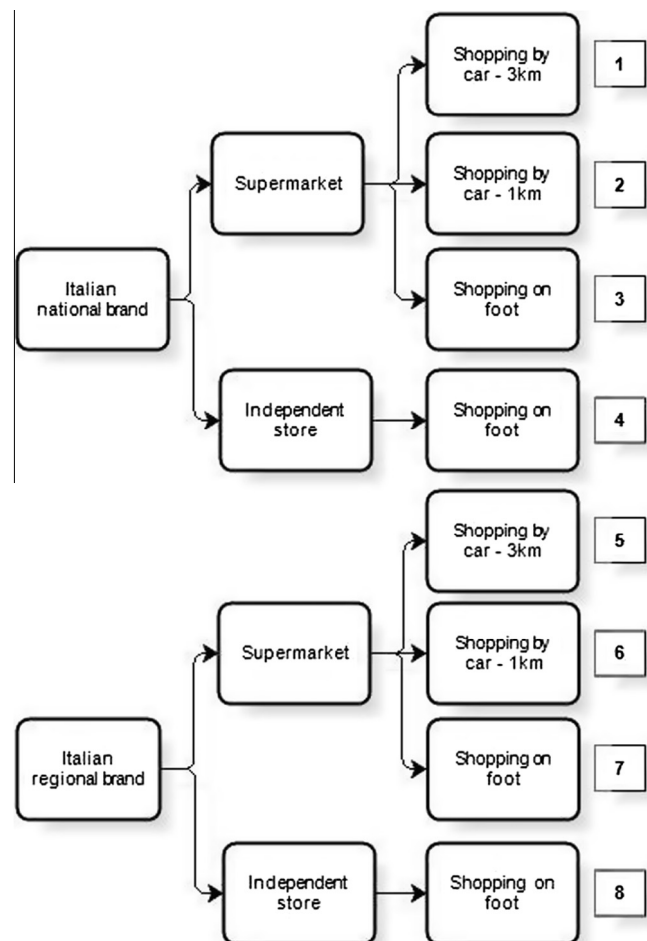


Fig. 1. Canned tomato supply chains.

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