

Green Logistics in Italy: new challenge for sustainable development

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1. Introduction

Balancing economic and environmental performance has become increasingly important for organizations facing competitive, regulatory, and community pressures. The term sustainability has begun to appear in the literature of business disciplines and companies also are starting to adopt this term (Aref *et al.* (2005.; Sarkis, 2002; Hill, 2001; Norman and MacDonald, 2004; Carter, 2008).

The term logistics within the field of supply chain management has been widely defined (Bowersox *et al.*, 1986; Christopher, 1992; Signori, 2004, Frankel *et al.*, 2008). In the product and service delivery process, the logistics function is one of the few functions that actually “touches” the customer (Ellinger *et al.*, 2002). Then logistics management is a relevant part of customer service with its contribution to the level service and its ability to do so at least cost to the total supply chain (La Londe and Zinszer, 1976; Christopher, 2005). Also scholars studied logistics as an environmental and social issue, from the development of environmental logistics strategies (Murphy *et al.*, 1996) to the improvement of fuel efficiency and emission reduction from transportation equipment (McKinnon *et al.*, 1993; Stock, 1978) including research about safety in motor carrier, rail, and airline industries (Weener and Wheeler, 1992; Crum *et al.*, 1995; Cantor *et al.*, 2006). It is well known that freight transport increases the amount of pollution, traffic congestion, gas emissions and energy consumption. These environmental problems have also an impact on social issues, such as health, an increase of diseases, accidents (Iannone 2004, Borruso G. *et al.*, 2005).

However, according to Poist (1989), logistics can offer potential solutions to a variety of social issues and environmental problems. These include consumerism, employee education and training, occupational health and safety, hunger and homelessness, and environmental and ecological issues. Poist maintains that logistics is especially well positioned to contribute to environmental and ecological control in terms of packaging issues, pollution control, and energy and resource conservation (Murphy *et al.*, 1995; Stock, 1998; Siviero 2005).

Green logistics is largely studied in literature in the international context; yet very little research exists in order to better understand what the role of green logistics in sustainable issues in Italy.

This article analyzes the state of art of green logistics in Italy, which still constitutes an unexplored field. We developed a conceptual research in which we defined green logistics as the sum of three aspects: reverse logistics, city logistics and intelligent distribution,.

The paper, on the basis of its findings, will also provide new approaches to green logistics that could be implemented in Italy and will constitute our further research.

To summarize, this lack of consideration of green logistics in Italy lead to the following research questions:

1. What are the main pillars of green Logistics in Italy?
2. What are the drivers of Green Logistics in Italy?
3. What is the link between Green Logistics and sustainability in Italy?

2. Methodology

Due to unexplored issue we developed a conceptual paper on green logistics in Italy. The data collection to support this methodology occurred by reviewing a large-scale amount of literature and using secondary data. Major databases were used to search for related articles, such as those provided by major publishers. Then, in particular, an extensive review of the relevant italian

academic literature was developed through initial searches on specific terminology. Literature reviews usually aim at two objectives: first, they summarize existing research by identifying patterns, themes and issues. Second, they help to identify the conceptual content of the field (Seuringa, 2008; Harland *et al.*, 2006). One problem derives from the challenge that it is impractical to read everything. So a focused literature review seems to be a valid approach, as it is a necessary step in structuring a research field and forms an integral part of any research conducted. We would like to identify a few issues and gaps as well as challenges and opportunities for scholars and new research in Italy as well as in Europe.

3. Main issues and literature review: reverse logistics, city logistics and intelligent distribution

3.1 Reverse logistics

Returns management in Italy was originally studied and approached as an accounting or production quality issue. In the 1970-80s, the notion of reverse logistics in Europe became an issue related to sustainable development; recovery practices were mandated through environmental legislation. EU legislation and its green policy approach created sensitivity about products at the end of their life. Thus reverse logistics came to be seen as a problem of sustainable development (De Brito *et al.*, 2002; Fleischmann *et al.*, 1997). Northern European countries have a history of being involved in green issues, primarily focusing on consumer-level issues of waste, packaging and recycling (Jahre, 1995; Anderson *et al.*, 2005). Recent legislation now mandates that all EU countries follow new legislative directives relating to packaging (Directive 99/31/EC), cars (Directive 00/53/EC), and electrical/electronic equipment (Directives 02/96/EC (WEEE) and 02/95/EC (ROHS)). These European policies stipulate that all member nations follow green policies in terms of reuse, recycling and product recovery.

The European Commission has shown interest in the development of the reverse logistics field by sponsoring international scientific projects through the European working group on reverse logistics, RevLog. This group has focused much of its efforts on issues such as inventory management, particularly in a remanufacturing context (Kleber *et al.*, 2002; Le Blanc, 2006) and issues of network design and product flow management. The RevLog research has intensely focused on quantitative modelling of product recovery related issues. According to the European Working Group on Reverse Logistics (2004), reverse logistics is “the process of planning, implementing, and controlling flows of raw materials, in-process inventory, and finished goods, from a manufacturing, distribution or use point to a point of recovery or point of proper disposal”. Terms such as “sustainability,” “eco-friendly,” “carbon-neutral,” and “environmental footprint” have crept into the public’s vernacular (Drake M.J, 2008).

However, managing returns is also more relevant than in the past and becoming more competitive; some research has shown that product returns are positively related to a customer’s future value to the firm (Venkatesan and Kumar, 2004).

In Italy, research has been limited to issues of sustainable mobility for urban transit situations with some preliminary forays into supply chain and reverse logistics issues (Russo, 2008). Yet, reverse logistics and returns management issues have been absent from academic research and management attention in Italy until very recently. This is primarily due to the small size of 90% of Italian firms where the business priority is forward logistics. However, due to the new green laws being enacted across Europe and changing market opportunities academic interest in reverse logistics and returns management is now developing in Italy. Trying to redress that gap, recently scholars (Mollenkopf *et al.*, 2007) used a grounded theory approach to understand how firms manage both the strategic and operational aspects of return products. They concluded from their analysis of several Italian manufacturer and distributors that the effective management of reverse product flows will

necessarily be a part of European firms' corporate social responsibility (CSR) initiatives in the near future. Then other scholars also tried to improve the body of knowledge around reverse logistics in order to show the problems linked with the recent European Directive (Cagno et al., 2008).

3.2 City logistics

The rationalization of urban freight transport is essential for sustainable economic growth. (Taniguchi, Van der Heijden, 2000). Nevertheless, several problems arise like as traffic congestion and environment and energy conservation. In addition, higher levels of service are required in order to satisfy customers and to face the global competition.

Freight vehicles operating in an urban environment generally emit a greater proportion of certain pollutants per kilometre travelled than other motor vehicles such as cars and motorcycles. This is due to their higher fuel consumption per unit of distance travelled and the fact that many of them use diesel as a fuel (Anderson et al., 2005). Moreover, freight transport and passenger transport systems create a variety of economic, environmental and social impacts. For these reasons city logistic becomes an important tool for a more sustainable logistics. A unique definitions does not exist; however it can be defined as "the process for totally optimising the logistics and transport activities by private companies in urban areas while considering the traffic environment, the traffic congestion and energy consumption within the framework of a market economy" (Taniguchi et al., 1999). Furthermore, city logistics becomes the part of logistics which tries to satisfy the demand for urban transport while ensuring the right level of service minimizing congestion, pollution, accidents and costs of transport. All the possible city logistics solutions can be categorized as weight and size regulations or time regulations (access time and loading time) (Browne et al., 2007).

The aim of adopting a sustainable urban logistics is to ensure an effective and efficient functioning of economical activities within the city centre as well as to reduce the negative effects on the environment and waste of resources. There is a need for a compromise between the maximisation of positive logistics externalities, vitality and development of cities and the minimization of negative externalities, in order to protect the environment and improve overall quality of life (Maggi 2007). To solve this problem, several city logistics initiatives have been proposed in Italy; first of all it is important to distinguish between two different typologies: changes implemented by governing bodies and company-driven changes.

City logistics also means to find the way to reach the customer using the least distribution space, where to establish supermarkets, hypermarkets and commercial centres which chooses appropriate suburb areas and save space using technological solutions (Borghesi et al., 1997).

This implies that a combination of company initiatives and government policies will be necessary in developing a sustainable urban freight system. There are at least three different freight transport typologies in the city: from outside to inside the city, from inside to inside and from outside to outside the city (Conti, 2005). These tools lead to decrease the traffic congestion, pollution and better resource use. However some critical points occur with city logistics: it needs public funds for the projects, as well as an increase in costs for service users, such as shop keepers, increase in lead time with possible delays in delivering goods (Payaro, 2006).

3.3 Intelligent distribution

Due to the problems that affect the quality of life, health and safety as well as environment, freight transport needs to be rationalised in an "intelligent" way. This can imply the use of low impact vehicles, multimodal transport, as well the use of information technologies.

In Italy, the 2007 Budget Law recognises cut taxes for people who buy low environmental impact vehicles (Maggi, 2007).

Several researchers have investigated cooperative freight transport systems (Taniguchi et al., 2000), that allow a reduced number of trucks to be used for collecting or delivering the same amount of

goods. This leads to a considerable reduction of travel time for trucks, person work-hours and total costs.

Intermodalism is not a mode of transportation, but a system of coordinating different modes of transport for a shipment. It requires cooperation and coordination among a diverse group of companies on a level that is seen in other industries. Another distinctive aspect about intermodal carriers is their sophisticated information system, as they need to process a lot of information under time pressure and in coordination with other carriers (Long, 2003). The international literature has highlighted the advantage that an intermodal system achieves thanks to the reduction of single means of transport costs involved (Liberatore, Miller, 1995; Vellenga et al., 1995). On the other hand, intermodality presents some critical points related to costs for the lack of integrated networks and the risk implicated when diverse means of transport and carriers are involved, which can generate a damage of goods or a reduction on level of service (Russo, 2007).

In addition, ITS (intelligent transport systems) constitutes a fundamental tool for mobility and safety management: it is a combination of information technologies and transport system telecommunication, which collects, elaborates, manages and transfers vehicles relating data and integrating the numerous users in an “intelligent” manner. At the same time it reduces the environmental impact of transport and improves the quality of life.

The main aims of ITS are: improvement of information exchange among players and their coordination; distribution in an optimal way traffic and widespread information in real time about congestion level in urban areas, orientation of freight carriers trips; better use of public loading and unloading areas and optimizing the check of full loading rate (Maggi,2007).

4. Italy: green logistics highlights

4.1 Reverse logistics

Recalls, commercial returns, wrong deliveries, warranties, repairs and refurbishment of life returns are some of the many example of returns that firms face. Reverse flow has historically been an undervalued part of supply chain management, but it is currently gaining much more attention due to its impact on profit margins, companies’ environmental image and corporate social responsibility. There are a lot of aspects, supply chain actors, and internal and external forces linked with returns flow, so it would be better to consider not only reverse logistics but also the whole process managing returns from cradle to grave.

Environmental business in several industrial sectors is rapidly changing within the last few years.

Consumers are more demanding, product life cycles are shortening, competition is growing, and firms are trying to get new sources of revenue and create new ways to be more efficient.

In accordance with PWC research (2008) European companies prioritise areas such as product quality, on-time delivery, clear product information and attractive marketing & packaging as key aspects of the consumer experience. Managing the customer returns process is essential and reverse logistics therefore plays a key role in maintaining and improving customer satisfaction levels. Value increase from a sustainability perspective leads to human, environmental and economical benefits. Proactive recalls and proper disposal avoid potential environmental or human harm, preventing the company from possible legal claims and feed into a positive and transparent corporate image. At the same time environmental issues are one of the key factors for EU policy and consequently also for Italy.

WEEE (waste from electrical and electronic equipment) requires responsibility for the take-back and recycling of products discarded by end users. ROHS (restriction of hazardous substances) bans the use of certain substances in electrical and electronic equipment products placed on the European market. The stated objectives of the WEEE directive are “to improve waste management processes,

eliminate hazardous substances, increase recycling capacity, and introduce harmonizing legislation” (Mcintyre, 2007, Zuidwijk & Krikke, 2008).

So the EU recently enforced new restrictions on manufacturers and importers of electrical and electronic products. There are specific restrictions about packaging and packaging waste; at least 60% of weight of packaging waste is to be recovered or incinerated at waste incineration plants with energy recovery and 55% and 80% of weight of all packaging waste must be recycled.

So the European Union is paying significant attention to green issues especially about hazardous materials, packaging, end-of-life solid waste and high energy consumption.

Those laws create additional compliance costs, operational and strategic, for consumer electronics industry. However, the legislation is interpreted a little differently for each member.

Sustainability has become of high importance in reverse logistics the environmental and social impact of consumer behaviour receives growing public attention and consumer awareness of recycling is increasing. At the same time more stringent national and European regulation on waste disposal requires an efficient system that enables proper disposal of post-consumer goods, taking into account environmental and human aspects. Documentation and reports on sustainability initiatives to show environmental consciousness is not a differentiator anymore but a hard requirement (PWC, 2008). The role of reverse logistics is more relevant than in the past as a strategic decision or as a new restriction for business. Reverse logistics is necessary for the completion of the industrial eco-cycle, product stewardship, and the extension of products’ and materials’ life, or closing the loop (Presley *et al.*, 2007). Another relevant practice is the design for x, the practice of incorporating different tangential factors into the design of a product that are intended to better integrate the new product with downstream activity. In short, dfx is a total lifecycle design practice that takes into account the costs and benefits of each and every design decision in the different life-cycle phases of a product, considering both the short and long term ramifications, from a manufacturing, supply chain, compliance and sustainability view point.

Also within a firm’s point of view there are interesting opportunities to reduce costs and to be a green organization. Firms that lease their products, such as office equipment and computer manufacturers, also focus on asset recovery initiatives to reclaim their end-of-lease products. Many of these products (or at their parts) still have useful life that can be offered to other customers at very little up-front cost. The firm has already paid for the raw materials once, and doesn’t have to re-procure or totally transform them again in order to gain additional revenue. Appliance and electronic goods manufacturers are prime examples of organizations that are taking advantage of this and also the environment of this type of non-traditional supply. reworking raw material is more typical in plastic, glass and paper industry.

One of the most interesting business case in Italy that it is trying to link reverse logistics and sustainability is a no-profit company called “Last Minute Market”. So the western economies produce a growing quantity of food surplus. this surplus is present everywhere in the food chain, from agricultural production to the retail system. For these companies surplus represents actually a cost (transport and destruction of the products), while for society as a whole, a negative externality (environmental pollution and disposal). In this picture the part of the (potential) demand is played by a number of charity associations or non profit organizations that assist directly and indirectly poor and marginal people. Linking surplus (supply) and deficit (demand) could counterbalance this “imbalanced” food market. A way to provide such a linkage is to create an intermediate body that acts as a counterpart for both supply (for profit organizations) and demand (non-profit organizations). The scheme in which the exchange is performed works throughout as a gift transfer between the profit and non profit organizations. Last minute market. This system was tested in different industry sectors from food to books and pharmacy.

4.2 City logistics

In the Italian context, various city logistics projects have been designed but later have failed to be implemented. The only well consolidated project is the cityporto in the city of Padua.

This is due to the enormous economical and managerial difficulties: the overall situation is not prosperous for the lack of government funds. Unlike many attempts and experimental projects which have failed, we assist to an increase in cities where there is a lively willingness to solve the problem of urban logistics.

Moreover, due to the general economic crisis, there is an overall perception of diminishing willingness to accept further restrictions of regulation and most of all, increasing cost derived from sustainable projects. (Spinedi, 2008). All the previous city logistics projects, both in Europe that abroad, have in common the purpose to meet environmental aims, traffic congestion and gas emission, maintaining the economical activities growth and improving the quality of life.

The main city logistics solutions experienced in Italian cities are: restriction about time and weight of vehicles to enter into the city. The most adopted solution is LTZ (Limited Traffic Zones), an area within the city centre where vehicles are not allowed and controlled access by electronic gates. The principal examples are in Parma, Verona, Milan, where certain size and weight vehicles cannot enter into the city centre with also time restrictions for them.

Ferrara is the city which has totally banned cars to enter inside the city centre, for 24 hours except residents and people working in public services. For all the other people a permission fee is requested and a 80 percent of discount is guaranteed for those who use low impact vehicles, such as electric and gpl vehicles. This solution has been adopted by Siena as well, in fact since the 60's, the city centre has been a pedestrian area, adopting LTZ too.

Another city logistics practice to rationalize traffic in urban area is the establishment of specific loading areas with time restriction for loading and unloading goods. This is the case of Rome and Milan, where it is allowed to load and unload goods in a specific time and exclusively in proper blue areas. (Goggi, 2002).

A more radical solution to reduce traffic congestion and pollution problems within the cities is the creation of UDC (Urban Distribution Centre) outside the centres, a point to collect and deliver goods using most of the time low impact vehicles to enter into the city centre. Examples can be found in Ferrara, where the municipality has created logistics platforms called ECOPORTO 1 and 2 (this one is still in construction). These platforms are useful to collect goods from the suburbs areas (Ecoporto 1 is located in the South while Ecoporto 2 will be in the North of the city) and to distribute them in the city centre with low impact vehicles or in Genova, where an Hub, called "progetto M.E.R.Ci", has been realized by the environment executive department in 2003, which distributes all kinds of goods (except from fresh goods, values, pharmaceutical and newspapers) using low impact vehicles. In Siena has been planned a project (ALIFE) to optimize the collection and delivery of foods through two distribution platforms (one in the north and one in the south of the city) plus an electronic access which controls vehicles entering into the city .

However the most successful case of UDC is the City Porto of Padua (realized in 2004), and its adoptions of low impact vehicles. Thirty-three private companies belong to the project; all the vehicles adopted for the transport are methane fuelled. There is also an ICT system to track goods using GPRS radiofrequency. In every moment shopkeepers can connect to the web and check where the goods are located. Thanks to it, pollution and congestion have been reduced and the city assists an optimisation of distribution operations. From January 2005 to December 2007 deliveries have raised of 21 percent. The interested area covers a pedestrian area LTZ of about 150.000 metres squared. The implementation of Cityporto has provided a reduction of Co2 of 153 Kg per day; a decrease of 163 Kg of NOx, 16.3 Kg of SOx, 174 million of micro grams PM10 per day. If we consider the economic advantage of the project, this will be around 756.000 Euros (estimation of benefits in 5 years of project) (Payaro, 2006).

Parma has provided two kind of solutions: transit points plus ecological vehicles. A similar solution has been adopted by the city of Verona with the Easy Shopping project (Spinedi, 2008).

This project implies that goods collection is located in one of the transit point outside the centre, where a private company is provided to distribute goods in the centre, fixing the itinerary and time delivery. The operator will inform the operative centre which will give him information about available loading areas, suggesting the itinerary and alternatives loading areas (Sardi, 2002).

Another solution is road pricing, a fee for entering into certain streets of the city. The first Italian city that introduced it was Genoa in 2003. This system has decreased traffic of the 38 percent (in the experimental period from march 2003 to August 2003) and 50 percent of people has chosen public transport (Cuti, 2003). Unfortunately, the experimentation is ended in 2004 due to a reduction in public funds), but now it might be implemented again.

A similar case is in Milan which which has been implemented since 2008: the Ecopass programme that consists of a fee paid by vehicles owner, that pollute more. It refers to the European Directive 2004/35/CE on environmental responsibility, and it is applied to polluting vehicles, which do not follow specific standards. These vehicle classes are responsible for the 90% of total PM10 emissions. The Ecopass fee has to be paid for vehicles which enter inside the city centre and varies on the basis of the class to which the vehicle belongs from about 2, 5, to 10 Euros.

4.3 Intelligent distribution

Italian intermodality has various concentration nodes for managing transports that are called inland port, to whom are also added sea ports (where there are many logistic services) among the country (Ottimo, Vona, 2001). The success factors of intermodal transport can be summarized as follows: more efficiency and cost saving compared to the mere road transport; more acknowledged operators; respect of standards (train standard, logistic network, intermodal logistics net, etc.); economical development in areas where intermodality is adopted (Bussolo, 1997). The EU reckons that for each euro spent on intermodal transport, the indirect and direct benefits are six euros.

A successful case of integration between IT and logistics is the project DRUL for the city of Siena: an innovative platform has been experimented which enables to coordinate different players, improve the planning of logistics activities and offers advanced e-commerce services.

Three projects have to be reminded, financed by European Commission: EDRUL (eCommerce Enabled Demand Responsive Urban Logistics) which has developed an IT platform, MEROPE which has involved 14 cities of Mediterranean areas, whose aims have been to investigate and develop evaluation models and IT to manage logistics in urban areas. Finally AGATA has enabled the coordination among players who distribute through a multiservice virtual agency (Maggi, 2007).

5. Conclusion

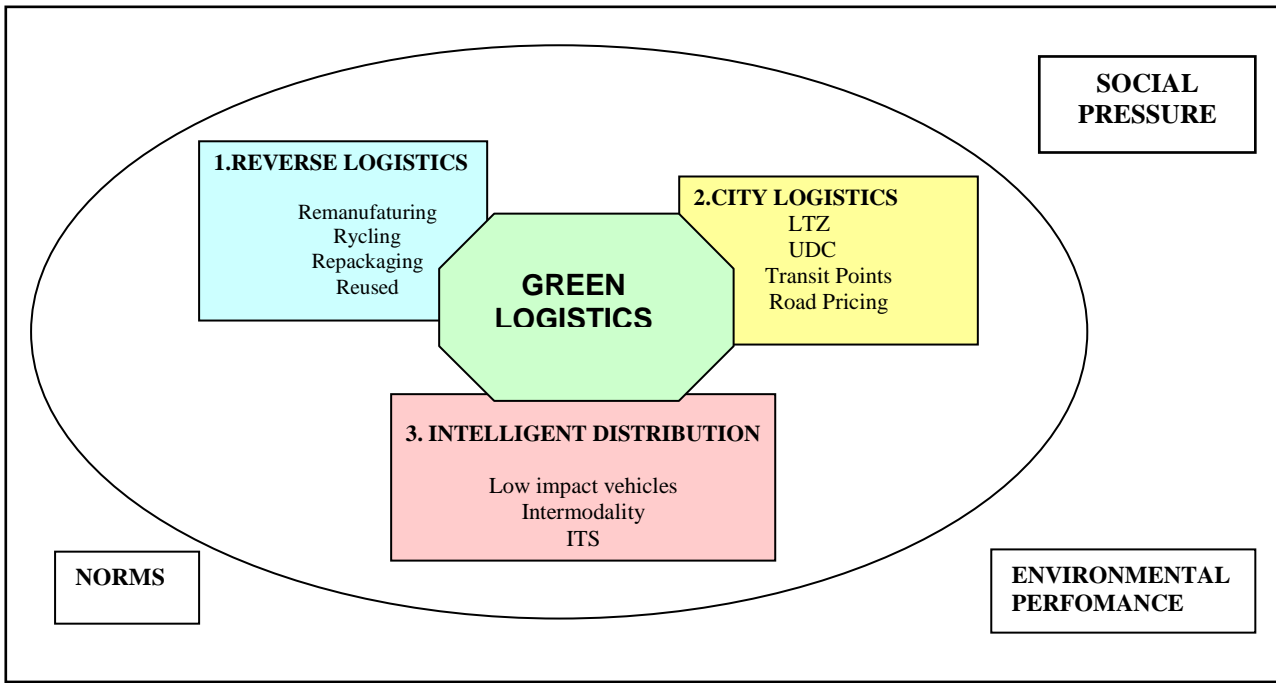
A sustainable organization is a firm that contributes to sustainable development by simultaneously delivering economic, social and environmental benefits – or what has been labelled as “the triple bottom line” or 3BL (Norman and MacDonald, 2004).

As seen in this definition, green logistics is closely linked to sustainability: in fact it contributes to a reduction in pollution, traffic congestion and as a consequence it improves the quality of life and also reduces health diseases due to a reduction of air pollution. We developed a conceptual framework which defines green logistics as the sum of three pillars: reverse logistics, city logistics and intelligent distribution. Reverse logistics from the environmental perspective supports environmentally sound practices such as recycling, remanufacturing, reuse and recall. The basic principle is that the lengthening of a product’s or material’s life typically has environmental benefits.

City logistics as well as the Intelligent Distribution System are still in an experimental phase of environmental policies of Italy except for a few cases. Further improvements can be done: the

possible solutions can be onerous and radical, such as night urban freight transport, UDC (Urban Distribution Centre), pick up and delivery points, new freight transport systems; or less onerous such as time regulations (loading time/ access time), controlling transport load factors, parking fees, night deliveries, vehicle weight and size regulations, road pricing (Taniguchi, 2000).

Fig. 1 Green Logistics Framework in Italy



Regarding the need for its development is principally linked to the opportunity it gives to implement a systemic approach, where information, management and control work together with the result that there is an optimal use of infrastructures and vehicles: they are an important tool for the implementation of sustainable mobility.

It seems necessary to get results through a strong coordination by the government. In Italy the most effective approach is top-down, where green practices are imposed by norms/law or restriction. The approach of bottom-up is possible if the business interests of the firms match the imperatives of the environment (case of reverse logistics).

However, there are a few cases where the willingness to be greener comes from the single firm: Fiat for instance, the Italian automotive firm has implemented a project called “ecodrive” that consists of an easy-to-use software guideline that suggests to customers how to drive more efficiently in order to reduce the CO2 emissions polluting less and using less fuels.

Furthermore Pirelli, in 2005 has founded Pirelli Ambiente, a company able to offer the market an extensive range of products with a low environmental impact and extremely high technological content. Thanks to the collaboration with Pirelli Labs - the Group's advanced research centre - the company's continual commitment is to design increasingly ecocompatible products and processes and innovative solutions, for example technologies that reduce emissions of harmful gases or produce renewable energy sources. Pirelli Ambiente is formed of three companies that specialise in different business areas: Solar Utility, Renewable energy and Site Remediation. These are two examples of how the entrepreneurial culture has been changing and turning into a more sustainable way; not just for following a government restriction or norm but from inside the company or from a customer request.

Several limitations to the research should be noted, so future research needs to extend beyond a conceptual paper and also investigate with quantitative research how green logistics should be a business priority for firms and for the government in Italy. Future research also can build a route in

order to identify synergies between companies and the government in green logistics policy as a tool to be more sustainable with a mutual advantage.

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