1. Introduction
The present paper concerns the results of an in-depth activity of investigation of the mobility of the goods in the context of the Piedmont territory that involved a significant sample of productive activities [4], but also analysed, under the performance profile, the existing railway infrastructures that are qualified to satisfy, at least partly, the mobility demand. The simultaneous study of demand and mobility offer in the goods sector, represents the first step for the constitution of a planned regional observatory, which would be able to provide the public administrator decision support tools aimed at an aware and effective planning activity, focused in pursuing the fixed objectives.

The investigation activity was realised within the cooperation among different countries promoted by the EU research programme Interreg II. Thanks to the PRIMOLA project (Regional Project for a Durable Mobility of Goods across the Alps), the Swiss Valais and Vaud Cantons and the Piedmont Region started an information and scientific knowledge exchange process aimed at the co-ordination of the transport policies, of the infrastructure management and, in definitive, at the integration of the public services in this sector, building an original and common asset of databases, of intervention programs and of planning tools. The Piedmont represents in this study area the Region which produces and attracts the preponderant traffic flows, and it is furthermore an area of transit of the goods flows from the centre of Europe to the harbours located in Liguria; therefore the aforesaid

The mobility of goods in Piedmont: analysis of the critical issues for the development of the railway transport, with particular reference to the characteristics of the demand and to the network accessibility

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The PRIMOLA research project was focused on the study of the goods traffic streams across the western alpine area, in order to define an optimisation process through a whole of international transport services by rail that could compete with the road mode. An extensive and detailed survey among the enterprises in Piedmont, compared with the actual offer of rail transports, allowed us to have some insights on the critical elements that prevent a more intensive use of trains, as well on the real degree of accessibility of the rail network. In this article we present some results of this comparison between transport offer and demand in Piedmont: among the key elements that were found being a constraint for a modal shift towards the railway, we mention the difference between the perception of the accessibility by the managers and the accessibility itself, the shortness of the average trip, the dispersion of small enterprises on the regional territory and the type of goods moved.

The rest of the paper is organised as follows. In the next paragraph we will operationally describe the investigation in the Piedmont enterprises and we will present a few results related to the adopted logistic organisation and to the use of the railway. In paragraph 3 an analysis of the accessibility of the existing Piedmont railway network is presented as regards the

- the determination of the importance of the competition factors between the modes of transport [1];
- the study of the space and time transformation of the structure of the travel demand (in terms of type of products) in the evolution of the modal split of the transalpine demand [1];
- the performing analysis of the transalpine railway infrastructure [2] [5];
- the development of a new distribution model for the planning of goods transport and commercial services by railway, based on the optimisation of the service both in economic terms and for what concerns its good performance [3].
territorial distribution of the productive activities. In paragraph 4 the investigation field is widened by analysing the evaluations directly or not expressed by the entrepreneurs on the potentialities of the rail transport, in particular concerning the importance of the factors of modal choice, the inadequacy of transport railway in relation to the type of goods to be moved, the subjective perception of the accessibility to the service and the importance of the cost factors. Finally the fundamental results of the research are summed up and possible guidelines towards a policy of rationalisation of the mobility of the goods on regional scale are suggested.

2. The investigation in the Piedmont enterprises

2.2 Selection of the sample and formulation of the questionnaire
The selection of the enterprises to be interviewed was founded on a few functional criteria, in order to identify the factors that lie under the choice of the mode of transport of the produced goods. Therefore the selected enterprises had to meet some qualifying criteria, for example to develop a productive activity involving the handling of goods in supply and in shipment, to be considered at the level of local units in order to be able to identify the location of the enterprises on the territory, to have a minimum limit in terms of number of employees. The extraction field was reduced to 217 out of the 1209 municipalities of the Piedmont, this corresponding to the councils considered by the zoning activity in the model of simulation of the regional mobility arranged by the Piedmont Region for the Regional Plan of Transports. The sample to be extracted was stratified in seven classes of employees of the local units according to the list from the Commerce Chamber, so that from a universe of 6270 local unit we made a random extraction, able to numerically represent in a significant way the different classes.

We experienced many difficulties during this activity, but this can be well explained considering the fact that the questionnaire was very articulate and that the interviews were taking place at the premises of the local unity. Despite this, 345 complete and reliable interviews were realised, altogether reaching sampling percents to be considered fully satisfying, especially for the smallest firms, thanks to the numerosity of the single universes, while the bigger corporations presented the objective limit of the exhaustion of the universe to be interviewed.

The composition of the questionnaire was carefully planned and aimed at obtaining as many as possible significant data about the productive reality of the Piedmont, the modes through which the goods are moved, the typologies of the goods the enterprises are dealing with, and also the origins and the destinations of the goods themselves. It was articulated in the following six sections:

1. Information about the enterprise;
2. Logistic characteristics of the local unity;
3. Infrastructures and equipment of transport: availability and use;
4. Elements on transport modal choice;
5. Infrastructures problems;
6. Mobility of the goods.

2.2 Organisation of logistics in the productive system of the Piedmont
The productive system of the Piedmont, which has as leading sectors the manufacture of products in metal for 24% and the building of cars and mechanical devices for another 16,5%, is constituted by companies middle- and small-sized: the 72,9% of them, in fact, owns only a local unity and another 14,3% owns two. The prevailing number of the employees of the local units is for the 85,6% beneath 49; analysing the datum concerning the comparison between the previous year and that in which we developed the interview, it can be seen that the number of local units which reach 19 employees rises of 5%, to the disadvantage of companies between 20 and the 99 employees. Such prevalence of middle- and small-sized activities produces higher amounts of traffic with respect to productive systems established principally by big enterprises; such a phenomenon is further strengthened by the high enterprises percent (88,6%) that develops productive or commercial activities, and that for this move goods on the territory.

In relation to these aspects, the difficulty of a system mostly constituted by small firms clearly emerges, as both the level of use of data processing tools in logistics and the organisation of the logistic services changes very much together with the dimensions of the local unit. In general however data processing tools are used by 73,9% of the companies for the preparation of the documents, by 45% for the management of the stocks, by 13,6% for the planning of the journeys and by 9,1% for the vigilance of the shipments.

The logistic services owned by the companies are machines for the handling of the pallets for 52,6% of the local units and equipments for the treatment (shifting or loading) of containers or swap bodies for 35,1%. We have also to consider the fact that 66,3% of the enterprises assigns the operations of loading and unloading to third parties that use in many cases their own tools. The 76,4% of enterprises owns a storage area that is internal or close the establishment, but only 9,2% of them owns an intermediate area with respect to the destinations of the shipments or to the origins of the supplies, where storage longer than three days or changes of mode of transport can be arranged.

The phenomenon of the outsourcing of the transport services shows, in the research, a remarkable importance. If the 78,4% of the enterprises owns in fact one or more vehicles (this percentage ranges from 84,5% for the companies with less than 20 employees, to 40% for those with more than 999 employees), the 90,8% of firms uses vectors owned by third parties (local units with more than 999 employees use make use of third parties services for 100% of their transport).

2.3 Mobility of the goods: origin/destination matrices of the goods flows in terms of moved tons
A noticeable result of the research was the building of the
O/D matrixes of the goods, in supplying and in shipment. Such matrixes considered the flows across different provinces of the Piedmont Region, as well those from the Piedmont to other Italian regions and foreign countries, aggregating the origin of the supplies or the destination of the shipments in homogeneous areas with respect to the infrastructure backbone of the Piedmont, and using the zoning at provincial level for the destinations of the supplies or the origins of the shipments. The result provided 22 matrixes in supply and 22 matrixes in shipment for each of the 23 classes of goods through which we have made homogeneous the data concerning the single goods provided by the interviewers. It has been also possible to draw two matrixes of all the tons moved in supplying and in shipment, and two others of all the dispatches made in supplying and shipment.

In this paper it is not possible to extensively comment such a complex matter, therefore the interested reader is again referred to [4] for more detailed analyses.

2.4 Use of traditional transport services by railway

The utilisation of transport railway changes inside the strips for classes of experts according to what is shown in figure 1. As expected, the more the company is big the greater the use of transport railway is; it is however remarkable that also for middle- and large-sized companies it substantially represents an exception. In fact the real gap rises only for the companies who have more than 1000 employees, but in the Piedmont’s reality, these are only 1,1% of the total.

![Figure 1: The percentage of enterprises that utilise the rail transport is increasing with the number of employees](image)

The structural reasons for such a poor use of railway transports by the companies are referable to mostly well-known leitmotivs, supported moreover by the results of the investigation made:

1) the analysis of the flows of goods in tons through the built O/D matrixes points out that more than the 50% of the supplies and the 67% of the shipments is within the Piedmont (and in the interregional traffic the 25% of the supplies and the 41% of the shipments is dealt inside the province of Turin), so on average the distance is lower than 100 km. Therefore, these transport are not suitable for the railway because of the reduced distance to be covered in relation to the requested loading and unloading times and to the service access modes;
2) the number of suppliers and of customers and the average tonnage of a transport are an indication of the fragmentation of the flows, that in turn makes more convenient the use of small load units. The data obtained from the interviews highlight that above all in supply the amounts transported for dispatch are on average low (even if this datum has a large dispersion index): the average number of suppliers for local unity and above all that of customers is furthermore quite high;
3) the typology of the transported goods can be perceived by the economic actors as more or less "suitable" to be transported by train. We will develop in detail this aspect in paragraph 4, when will examine the evaluations and the perceptions expressed by the enterprises towards the railway transport.

Besides these motivations, it is possible to present some interesting results by investigating an aspect sometimes neglected but equally important, related to the location of the companies on the territory and to the points of access to the railway network. In fact the concept and the perception of accessibility that the entrepreneurs retain was found to be a fundamental aspect.

3. Territorial location of the productive system and of the railway infrastructure

3.1 A comparative analysis of demand and offer of transport by railway

The amount of data picked up through the investigation at the Piedmont companies was considerable and points out a few interesting aspects related to the productive system and to the territory with its infrastructures of transport. Then it becomes interesting to promote a comparison between the entrepreneurial reality, as it emerges from the interviews, and the current offer of transport by train. This is made possible by the fact that among the aims of PRIMOLA listed before there was the analysis of the railway infrastructure in the study area. In this analysis all the most important parameters were assessed to characterise under the technical and performance profile and in terms of traffic the principal railway lines (or potentially such) from the point of view of the goods transports. Specific investigations focused also on the principal goods yards and on many intermodal terminals.

The crossing of the data from these two activities allows drawing a series of useful considerations, upon which effective actions for an improvement of the attractive potential of rail transport can be taken.

On the basis of our elaborations it is possible to develop an analysis on two levels: first of all we can build a set of objective information about the productive system, especially regarding its territorial localisation in relation to the railway infrastructure, the volume and the typology of the traffic
produced and attracted and the structural conditions (dimensions of the plants, logistic organisation) that influence the possibility of a more intense use of rail transport. This type of analysis is the object of the paragraph 3; in the next one the attention will be focused on the choice factors expressed by the contacted entrepreneurs, and therefore the analysis will concern also the evaluations and the individuals' perceptions, which play a determinant role in the modal choice done by the companies.

3.2 Location and accessibility of the goods yards
According to the data of the investigation, the 97.7% of the companies does not use the railway transport and 34.1% even declares not to know what are the nearest ones: only the 6.8% of the sample complains to have sufficient accessibility to this network. Therefore the accessibility would not seem to be the first problem that prevents a more intensive use of the railway at a first glance: however we think that the subject must be examined in detail for its importance.

To do this, we "virtually" assigned each local unit to the nearest goods yard that is qualified in furnishing goods transport services. The underlying assumption is that the local unit would refer to that goods yard for any kind of service it needs. It is possible then to define for each goods yard an attractiveness index, given by the percentage of local units of the sample that has been assigned to that particular goods yard (see figure 2). These indexes in some way qualitatively allow identifying a hierarchization of the plants on the basis of their capacity to attract traffic. The weight of the Turin system, characterized by a strong concentration on the Trofarelo-Settimo railway line and by ramifications as far as Alpignano, Chivasso and None is easily noticed. Alongside, the other three basins of traffic generators (and attractors) are around Cuneo, (which is characterized for not having a predominant centre); the area comprising the four north-east provinces, where the strong attractiveness of the goods yard in Candelo is partly balanced by the plants in Borgomanero and Romagnano Sesia, and the zone which gravitates around Alessandria, where the goods yards of Tortona and Acqui exceed the others.

To avoid any misunderstanding, we want to point out that the indexes of attractiveness shown in the figure do not have any relation with the traffic that really is served, nor with the hierarchization of the plants according to the scheme of exercise of the railways currently being used, but they only refer to their physical position with respect to the location on the territory of the local units.

It is now interesting to try to understand if accessibility problems to the railway service really subsist, or if instead its poor utilisation is due to different causes. This is a very complex study, since to investigate the accessibility to such a system of transport (with 64 goods yards qualified for goods traffic) on an as wide and heterogeneous area as the Piedmont requires a remarkable effort of analysis, both considering the morphological profile and the settlement arrangement.

To simplify the problem, we chose to consider the distance separating the built-up areas of the councils in which the premises of the local units are located from the goods yard of reference as a measure of the accessibility, without taking into account other factors such as the performances of the road link (type of road, presence of built-up areas to be crossed, traffic conditions), the offer of accessory services or the adequacy of the opening times of the goods yard. Besides these limitations, it is clear that inside the territory of each council the true localisation of the local unity makes these distances not exactly the real ones; it seems in any case fairly reasonable to suppose that these data on average represent in a correct way the reality.

The results of the elaborations are synthetically shown in figure 3. It can be seen that over the 43% of the Local Units is placed in a council in which there is also a goods yard: for this the distance was conventionally taken equal to a kilometre, even if the dimension of the built-up area can define different access times. Another 45% is settled in councils without goods yards, even if the nearest one is reachable with a trip of less than 15 kilometres. Finally about the 9% of the sample is placed in a council which is beyond 20 kilometres far from the nearest goods yard, but we cannot correlate this percent to the 6.8% of local units which declared to have problems of accessibility without doing further statistical analyses. Nevertheless it seems reasonable to confirm that the enterprises that would meet the problem of the lack of access to the railway network if they were willing to use this transport mode are sufficiently a small minority.
Finally it can be instructive to make a comparison between the accessibility to the railway and to the motorway networks. Almost the 65% of the local units is placed at a distance from the nearest tollbooth inferior to 10 kilometres, and less than 6% makes a trip of over 30 kilometres to reach the motorway. An disaggregate analysis on a territorial basis furthermore points out that a good part of these last ones is concentrated in the provinces of Cuneo, Asti and Vercelli. On the whole then the accessibility to the two systems of transport would seem comparable, but the 65.9% of the companies signals to have accessibility problems to the motorway network, while, as we said, an analogous problem in the case of the railway is raised from the 6.8% of the sample. It is evident then that other factors of evaluation which condition the judgement of the enterprises lie behind these data and that it is necessary to revise the idea of accessibility itself, not exclusively considering the physical and territorial factors, but taking into account a series of behavioural variables which condition the modal choice in a determinant way (see paragraph 4).

3.3 Mobility generators basins and goods yards

The analysis led in paragraph 3.2 is based on the idea of accessibility of the local unit to the railway network. However since it is well known that one of the conditions which must be realised to make the railway transport more convenient is that the volumes to be transported are sufficiently high, it can be interesting to assign to every goods yard of the Piedmont not only the local units, but rather the induced traffic flows, expressed in tons. The figure 4a shows the result of this further elaboration.

Also in this case about the 43% of the tons of generated or attracted traffic has its origin or destination in a council endowed of a goods yard qualified for providing transport services to customers. While however in the case of the figure 3 the distribution for superior distance classes was quite uniform, in this case the trend is more irregular, with a peak between 6 and the 9 kilometres and other peaks of less intensity in correspondence of determinate values. These differences between the two histograms show that it exists a number of companies, luckily limited, which produce big traffic volumes but that are positioned in not a too favourable way with respect to the accessibility to the railway network. Most of these however are less than 10 kilometres far from the nearest goods yard, and therefore it should be possible in many cases (and also convenient, considering the traffic volumes) to take actions aimed at the promotion of the railway, for instance through adequate terminal services or, even by building rail connectors.

This remarks has an even greater importance if we focus the attention only on the tons of the incoming international traffic, which is, as it can be noticed, the type of traffic more suitable to the railway transport. In fact it is usually mainly constituted by raw materials and semi-finished products in quite big stocks, characterized by medium and long distance travel paths. In this case (figure 4b), the tons that have destination in a council with railway goods yard decrease to less than 35%, while they climb up to 43% those that are
going to councils 6 to 9 kilometres far from a goods yard.

4. Analysis of the evaluations and of the needs expressed by the entrepreneurs

4.1 Relative importance of the elements of choice of the transport mode

The questionnaire that was distributed to the local units contained also a section whose aims were the investigation of the problems met by the entrepreneurs concerning transport-related activities and the determination of the key elements that contribute in the daily choice of the transport mode. Besides the confirmation of some well-known trends, other data also emerged that are worth further analysis.

As expected, the most important factors influencing mode choice were cost, speed and safety. Asked to rate a set of potential choice factors from 1 (most important) to 5 (irrelevant), the entrepreneurs assigned an average mark for these three elements that is comprised between 1.5 and 1.8 for the national transport, whereas for international flows the importance of safety (rating: 1.5) is slightly increased with detriment of the punctuality (rating: 2.0). From these data we believe that it is clear enough in which direction we must work for a relaunching of the rail mode. We have to point out however that these marks must be seen as stated preferences of the interviewed, because if this were not the case some contradictions would emerge, mostly for what concern the judgement on the transport costs.

4.2 Perception of the critical factors of rail and intermodal cargo transport

4.2.1 Answers to questionnaires

The more and more widespread outsourcing of the transport duties, even if they are a part of the production cycle, together with the predominance of small-sized enterprises in the study area, explains the insufficient perception and the underutilisation by the same enterprises of the intermodal transport mode. On one hand, they entrust all the transport-related activities to specialised haulage firms, and so they do not know how these are effectively organised; on the other, each enterprise in most cases cannot generate the minimal amount of traffic volumes that is required for autonomously filling a container or a swap body.

The enterprises that declare that they do not use intermodal transport with containers are the 73.2%. Among the ones that use it, export shipping containers are mostly used (16%) and more than 10 units per month are sent (40%). Among the 82.2% that does not utilise other forms of intermodal transport (swap bodies, semitrailers or rolling highway), 55.7% declares that these do not fit with the typology of goods that are distributed and 23.1% states that the distribution is essentially on short distances, while only 4.9% believes that the costs are too high.

The reasons for not using the traditional rail transport are more complex, as beyond the three ones previously stated, that are indicated respectively by the 60.1%, 24.1% and 7.1% of the sample, there are also motivations such as high transport times, organisational complexity of the service offered and absence of goods yards near the destinations (figure 5). Looking at the modal choice related to import and export matrices, it can be pointed out that in the case of import flows within Italy the trend is to do the transport by road using vehicles owned by the supplier, whereas for international import and all kinds of export flows third parties transport by road is mostly used, and so the chances for rail, intermodal and plane modes slightly increase.

![Figure 5: Reasons given for not using the rail transport mode](image)

In the following we will analyse the aforesaid reasons given by the entrepreneurs, trying to see to what extent they are an effective barrier against a more intensive utilisation of the rail transport.

4.2.2 Average length of the trip

Among all the reasons given, the first one is related to the distribution of the goods predominantly on short distances and can be looked as "objectively justified", being also confirmed by the analysis of the O/D matrices that have been built. For this, it can be looked as a true obstacle that prevents a more intensive use of the rail mode, and the 24% of local units that indicated this answer is a sort of threshold for which the rail alternative to road transport is hard to realise.

Of course it can be inferred that these enterprises are mostly those that generate the 50% of supplying and 67% of dispatching flows that do not exceed the boundaries of the Piedmont, according to what has been stated in paragraph 2.4. The disaggregate analysis of the distribution of trip lengths by kind of goods and by local unit dimension has shed some light on a far more complicated situation, that introduces further factors concurring in the interpretation of the values that have been found. The reader is referred to [4] for a complete analysis of this aspect.

4.2.3 Inadequacy due to the kind of goods being transported

We turn now our attention on the stated inadequacy of the rail and intermodal transport modes related to the kind of goods. This is a result quite hard to interpret correctly, as it is based on a subjective evaluation, even if in any case it should be the expression of an "experienced" point of view on this subject. Quite striking is indeed the result related to the intermodal
transport, as the haulage firms generally consider it as a response enough flexible to the enterprises' needs. It is ordinary to believe that the goods that are mostly adapt to rail transport are those with a low value per weight unit, but we have to point out that within PRIMOLA activities the evolution of the transport demand across the Alpine Area has been analysed with the Constant Market Share technique (1). Quite surprisingly, the predominant factor of the decline of the rail transport was found to be the concurrence among different transport modes, which is moreover manifested in a market that does not correctly imputes the negative externalities. In this situation, road transport had the opportunity and the capacity of penetrating all the market segments of the transalpine mobility, even those, like bulk goods transports, that are traditionally looked as naturally oriented to rail. We believe that this result is an important indicator of the fact that the idea of "compatibility" between some kind of goods and a transport mode is in many cases arbitrary.

In order to try to evaluate if the enterprises move goods that are really not well suited for rail transport, or if this answer is influenced by other factors, the local units were grouped by kind of goods exported and imported, qualitatively evaluating how much each merchandising class is well suited for rail transport. The result of this elaboration is represented in figure 6. As expected, the enterprises that have import goods that are "well suited" for the rail transport are more than those with export flows of this kind, as the industrial system in Piedmont typically transforms raw materials or semi-processed products in final goods. For this, we must focus our attention on figure 6b, as the demand in the questionnaire was referred to dispatches: compared to a 60% of negative opinions concerning the suitability of the kind of goods, less than half moves products that can be effectively considered hardly or not at all suitable. It is anticipated that there are margins of incertitude, above all for the category "on average suitable" (even if we adopted quite a restrictive point of view) as our evaluation is purely qualitative, but it is hard to believe that the opinions expressed are completely well grounded.

Among the possible explanations of this discrepancy, we can mention:

1) The average dimensions of the local units, that can generate scarce traffic flows, although in this case the opinion considering rail and intermodal transport as inadequate should be imputed to specific operational conditions of that enterprise, more than to the kind of goods being moved;
2) The prevalence of short-distance trips as already mentioned;
3) The structure of the transport demand, that is quite branched (many destinations reached by one route) and for this it is scarcely adaptable to the rail or intermodal transport mode;
4) In the case of the intermodal transport, a scarce knowledge of the transport mode itself, that was also directly experienced during the interviews.

In all cases, more targeted actions are needed to make the entrepreneurs fully aware of the potentialities of the cargo rail services currently being offered. These actions should be widespread and tailored on the exigencies of the single operator, and should focus on the opportunities and conveniences in using transportation modes alternative to the road.

Besides the analysis based on the number of enterprises, it can be interesting to consider the tons, related to the traffic flows, classified on the basis of the kind of transport, regional, national or international, and of their suitability towards the rail mode. The resulting charts are shown in figure 7: these give us an idea of what could be the modal split not considering the other limitative factors. We point out that the

![Local units with supply flows differently fitting the rail mode](image)

![Local units with dispatch flows differently fitting the rail mode](image)

*Figure 6a,b: Percentage of local units that have supply (a) and dispatch (b) flows differently fitting the rail transport mode. This evaluation has been obtained exclusively considering the kind of goods being transported.*
kind of goods that are by themselves more adapt for being transported by rail are also those that travel mostly within the regional boundaries: this is an even stronger trend for supplying flows. By this we can infer that the responses of the entrepreneurs are not only affected by an evaluation of the adaptability of the kind of goods moved, but implicitly refer also on the characteristics of the transport itself, such as the average distance.

4.3. Perception of the accessibility of the rail network
Another interesting and expressive analysis concerns the perception that the interviewed have on the accessibility of the rail network. Of course the point is not only to evaluate the physical distance between local units and goods yard on the basis of what has been presented in paragraph 3. Our focus now is to take into account a set of key factors that contribute in making the rail transport felt as "far away" even on a psychological point of view. Coming back to the responses given to explain the underutilisation of the rail transport, 12% of the sample has declared that it does not have an access to the network "near enough" the plant, 13% complained its absence near the destination and 7% said that there is not an adequate transport supply. These three percentages in the case of the multimodal transport decrease to values around 3-4%.

These data, compared to the aforesaid considerations on the highway network, make us fully aware of the difference between the idea of accessibility as an exclusively physical factor and the one implied by the economic actors. Actually the rail network in Piedmont has quite a remarkable density, higher than that of most of the other Italian regions and European countries, even if it has many problems related to its obsolescence. On the whole regional territory 64 goods yards are officially enabled to receive and dispatch goods to external customers, whereas only 15 intermodal terminals exist, most of which concentrated in few key areas.

The railway is more diffused than the intermodal terminals on the territory and has a number of network gateways approximately the same as the highway accesses, but is perceived as much less reachable. For this, we believe that the current idea of accessibility among the entrepreneurs is influenced by the evaluation of different factors, in accordance with the formerly analysed mechanism concerning the suitability of a kind of goods in being transported by rail. In this case it is likely that the idea of accessibility implied by the economic operators includes elements that can be driven to the idea of "user-friendliness" or "service usability", or even to the possibility of truly interacting with a corporation so articulate as the Italian Railways both on a technical and on a commercial point of view. These elements can explain why 15% of the sample affirmed not to use the rail transport for its organisational complexity (see Figure 5). In this case a further advantage of using the road transport or dedicated operators is evident and actions involving different ambit, not only the infrastructure issues, must be taken in order to ameliorate the potentialities of the rail mode also under this point of view.

4.4. Incidence of the transport cost on the modal choice
In the last part of the questionnaire, an evaluation of the incidence of the transport cost on the final value of the product was required. There were five possible answers, ranging from <1% till >15%. The responses after data processing are of several kinds, as because it is a datum that is strictly connected to the kinds of products and to the dispatching matrices, and through this to the modal choice. Nevertheless, while some evaluations were possible for the road transport, for rail transport the scarcity of flows did not allow to draw conclusions really significant.

As the transport cost is a determinant (but not unique) factor in the modal choice (see. Paragraph 4.1.), we can suppose that
when it raises the other elements that contribute to the final decision and to fix the price, such as the flexibility or the rapidity, relatively loose weight, and so the rail mode, namely more rigid both in spatial and in temporal terms and less rapid, would draw a benefit.

To check if this mechanism is true we plotted in figure 8 the percentage of local units for each class of influence of the cost of an international transport on the total production costs, for the different transport modes. Some prudence is necessary in considering these data, as we already mentioned that in the sample there is a scarcity of tons travelling by rail. Nevertheless, such a mechanism seems not to exist: both in supplying and in dispatching flows the goods moved by rail have an incidence of the transport cost on average lower than those travelling on road.

5. Conclusions

In this article the possible elements that obstacle a more intensive use of the rail transport of goods in Piedmont have been examined. Many of these factors are well-known to both transport researchers and operators of the sector, nevertheless a detailed poll among the enterprises that move goods and that are located in the regional territory, together with an in-depth analysis of the characteristics of the rail infrastructure, gave a more detailed and original insight. There have been many critical points in such a complex database, particularly concerning O/D matrices, for aspects such as the homogenisation of the typologies of goods and of measure units through which to quantify the flows, or the congruence among the percentages related to the areas of origin of goods, both in supplying and in dispatching. These shortcomings however do not affect the main findings of the research, even if they might influence some quantitative measures.

The factors to consider to give a complete description of the interactions between travel demand and supply are various and highly interrelated: in this paper some of the possible analyses have been presented, whose results can be summed up in the following points:

1) The industrial system in Piedmont is characterised by an high number of enterprises, whose dimensions are medium, small and very small: this in turn implies a travel demand much dispersed, besides in kind of products, both in spatial and in temporal terms;

2) The outsourcing of the transport services, particularly concerning the dispatches, is almost the ordinary organisational scheme; delegating a third party to carry on these activities induces a certain disinterest in most of the enterprises, moreover if they are medium and big, on the mechanisms through which this is exploited.

3) The prevailing use of the road transport by the couriers produces a saturation of the means and of the services currently offered, whereas there is no interest in saturating rail services that, generally speaking, are offered by less dynamic and market sensitive actors;

4) An analysis on O/D matrices clearly outlines an economy strongly based on a regional scale, with a prevalence of flows with short travel distance;

5) The average number of customers and also of suppliers per enterprise is high and this is a consequence of the fact that many factories are mostly assembling components: this in turn generates a further fragmentation of the flows;

6) Considering the average distance between the nearest goods yard and the factory, both the accessibility and the diffusion on the territory of the railway network seem to be satisfying; there is however a group of big enterprises that generate consistent traffic volumes that could be better linked;

7) Many entrepreneurs believe that the kind of transport services that they need cannot be accomplished by rail because of the type of goods that have to be moved, but an analysis of the flows decomposed by merchandise classes

**Figure 8a-b: Influence of the transport cost for import (a) and for export (b) flows on the value of the final product for different transport modes**
seems not to confirm this evaluation. It is more likely that
the opinions expressed by the sample include different
considerations (flows structure, need for rapidity etc.). This
seems to be indirectly confirmed for example by the fact
that most of the transports of goods suitable for rail
services are within the Piedmont;
8) The rail network accessibility is comparable both in
quantitative and in topologic terms with that of the
highway network, but the entrepreneurs feel the first as
nearly inferior; it is likely that also in this case some
exogenous elements are influencing their opinions;
9) It has not been observed a positive interrelation between
the incidence of the cost of transport on the value of the
product and the intensity of utilisation of the rail services.

Considering the results of the PRIMOLA project, we believe
it is relevant to stress on the necessity of setting up and
completing through the years plans aimed at the local
reorganisation of the industrial system. This action
should lead to the creation or the enforcement of “manufacturing
districts”, localised near the most important gateways of the
rail and highway networks. This districts should have
dimensions sufficient to express a specialised transport
demand of a consistent entity; in this way, many informatics
and logistic services could be shared and rationalised and
there could be much more room for rail transports. The
actual, highly fragmented arrangement of the industrial
system in Piedmont allows a high degree of flexibility and
efficiency; on the other hand, it also causes a difficulty in co-
operating in order to better use more evolved forms of logistic
services.

On the supply side, a stronger co-ordination among different
enterprises and even different dealers could lead to a better
railroad equilibrium, that in turn could cause a diminution of
the transport costs, together with a reorganisation of the
dimensions, of the fleet and of the kind of services offered by
the haulage firms. In this way a positive effect on the
environmental impacts induced by the whole of the
transportation activities could be expected, and this issue is
particularly crucial in the Alpine Area.

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