

A SCHEME TO IMPROVE THE EFFECTIVENESS OF THE BUS SERVICES IN LOMBARDY THROUGH TENDERS

Eliot Laniado

Ferdinando Stanta

Paola Tagliavini

MIP – Politecnico di Milano

INDEX

ABSTRACT	3
1. PUBLIC TRANSPORT IN LOMBARDY	4
1.1. Lombardy	4
1.2. The public transport network	4
1.3. Subsidies and fares	6
1.4. The demand of public transport in Lombardy	7
1.5. The main problems	9
2. THE PUBLIC TRANSPORT REFORM IN LOMBARDY	9
2.1. The Legal and institutional framework	9
2.2. The Local Public Transport reform: new policy options for Lombardy.	10
3. THE SCHEME DEVELOPED BY MIP FOR THE INTER-URBAN BUS NETWORK OF LOMBARDY	10
3.1. The tendering process	11
3.2. The choice of the areas to tender	12
3.3. The public service obligations	15
3.4. Financial resources	18
3.5. Offer evaluation criteria	18
3.6. The simulated tender	21

Abstract

In Lombardy public subsidies to bus companies have increased in the last ten years, while market share and quality of public transport have declined. In 1996, the Lombardy Region began a reform of public local transport. In line with EU regulations, the regional transport acts 13/1995 and 22/1998 aim to improve the effectiveness of the public transport through competition and economic incentives. This paper describes the scheme developed for the tenders.

In the present concession system, the routes and the schedules for each service are decided by the Region. The reform calls for tenders for a network divided into areas. The areas must be homogeneous in terms of transport demand and attractive for the tenderisers. Their size is chosen to make the management of the services affordable for sufficient competitors.

A methodology has been developed to support the grantor in setting the following service requirements for each area: the links to be included in the network and the minimum number of seats to be assured by each route. Further requirements concerning fares, environmental and quality standards, and the information provided to users and to the transport authority are also set.

The effectiveness of the planned services is encouraged by economic incentives: part of the subsidy is paid only if specific objectives set by the public authorities are met.

The criteria to compare the offers are complex, because of the need to evaluate not only the tendered price, but also the effectiveness of the network and schedule proposals, as well as the usefulness of the additional routes and seats served or the improved quality. A Decision Support System (DSS) software application based on multi-criteria analysis automatically chooses the best project, ensuring a transparent procedure. The reliability of this evaluation system has been tested in simulated tender involving representatives of Lombardy bus companies.

1. Public transport in Lombardy

1.1. Lombardy

The Lombardy region is located in the northern part of Italy. It is 23,855 sq. Km. large and hosts 9 million inhabitants. Lombardy contains the central section of the Alps and part of the Padana plain.

One of the largest urban conglomeration in Europe stretches around the city of Milan, where the population density is 1,413 inhabitants/sq. Km. The mountains in the north, covering the 40.6 % of the whole area, are a residence for only the 11% of the Regional population, with a density between 55 and 300 inhabitants/sq. Km.

From the administrative point of view Lombardy is divided into 11 Provinces (ranging from 780 to 4,800 sq. Km) and 1,546 Municipalities.

Provinces	Number of Municipalities	Area (km ²)	Population (1991)	Density (inhab/ km2)
Bergamo	244	2,721	930,854	337
Brescia	206	4,782	1,048,370	219
Como	163	1,288	792,412	383
Cremona	115	1,770	326,797	185
Lecco	90	816	296,374	363
Lodi	61	782	185,680	237
Mantova	70	2,338	369,104	158
Milano	188	1,980	3,903,391	1,413
Pavia	190	2,964	489,189	165
Sondrio	78	3,211	175,756	55
Varese	141	1,198	795,391	664
<i>Lombardy</i>	<i>1,546</i>	<i>23,855</i>	<i>8,831,264</i>	<i>370</i>

Table 1 – The Provinces of Lombardy

1.2. The public transport network

Urban and inter-urban bus lines, metros and local railways form the public transport network in Lombardy. In 1996 there were in Lombardy 827 inter-urban bus lines, and the bus service resulted in 146,727,662 bus*kilometers. All the lines, except for the 13 “Regional” inter-city bus lines, are operated under provincial concessions by private or public owned transport companies.

Urban transport service (114,833,859 bus*kilometers in 1996) is operated directly by the Municipalities or by municipal-owned companies. Milan provides 82% of urban transport in Lombardy.

The railway network is 1,670 km long and 25,680,000 of local train*kilometers are produced. There are two operators for the local trains: the company owned by the Lombardy Regional Administration,

called "FNM" and a department of the national railway company "FS", which will become soon a subsidiary. FS operates also the high speed and intercity trains and the trains linking two different regions under a national concession.

A main feature of Lombardy is the big number of companies operating the bus services: they are 147 (69.4% private owned). The majority is very small (81.7%), i.e. operate up to 2,500,000 bus*km, only 3.5% operate more than 10,000,000 bus*km and one is very big (more than 100,000,000 bus*km).

In the following tables some data about the urban and inter-urban transport services are listed.

Province	Passengers (year)	Operational costs (EUR)	Incomes (EUR)	Incomes/Costs	Subsidies (EUR)
PROV BG	19,481,552	43,104,241	18,393,863	40.3%	26,451,077
PROV BS	17,385,772	44,114,989	17,152,692	35.0%	29,433,305
PROV CO	10,183,305	24,281,480	8,824,193	30.9%	13,826,733
PROV CB	3,773,775	11,669,780	3,917,663	35.3%	7,904,095
PROV LC	3,589,876	8,536,736	2,757,503	45.9%	5,399,894
PROV LO	4,242,039	11,879,577	4,595,706	36.9%	7,824,494
PROV MI	55,875,753	138,198,230	32,577,372	28.3%	60,481,653
PROV MN	4,444,206	13,132,130	4,226,366	36.1%	7,691,485
PROV PV	6,336,219	18,910,571	6,453,846	32.0%	11,793,659
PROV SO	3,157,079	4,338,313	2,572,308	43.3%	3,000,626
PROV VA	6,967,150	16,886,281	5,528,875	37.8%	9,417,827
REGLOM	16,004,735	32,171,013	15,039,615	46.6%	21,181,286

Table 2 – Bus inter-urban services (year 1996)

Municipality	Passengers	Operational costs (EUR)	Incomes (EUR)	Incomes/Costs (EUR)	Subsidies (EUR)
MILANO	368,218,728	459,168,610	229,612,647	50.0%	224,566,483
BERGAMO	5,980,716	27,261,867	9,798,467	35.9%	4,229,151
BRESCIA	14,076,191	10,609,708	4,528,136	42.7%	9,926,383
CREMONA	2,274,397	8,143,144	3,081,332	37.8%	2,131,053
PAVIA	5,263,823	6,703,375	3,022,993	45.1%	3,930,393
VARESE	4,424,246	9,215,046	4,173,961	45.3%	3,379,964
COMO	5,639,805	4,338,497	1,521,519	35.1%	3,842,266
LODI	917,656	2,607,300	830,459	31.9%	654,671
LECCO	902,574	3,204,366	1,142,278	35.6%	1,559,379
MANTOVA	1,559,130	1,240,001	808,610	65.2%	1,327,838
SONDRIO	160,846	395,477	105,961	26.8%	121,116
TOTAL	409,418,112	532,887,395	258,626,368	AVERAGE 41.0%	495,043,635,984

Table 3 – Urban transport (year 1996)

Operator	Passengers*km	Operational costs (EUR)	Incomes (EUR)	Incomes/Costs (EUR)	Subsidies (EUR)
FS	2,800,000,000	299,906,521	90,483,248	30.1%	196,253,621
FNM	860,000,000	132,419,548	29,288,270	22.1%	103,291,379
TOTAL	3,660,000,000	432,326,070	231,910,000,000	AVERAGE 26.1%	299,545,001

Table 4 – Railways (year 1996)

1.3. Subsidies and fares

The incomes from the fares cover up to 47% of the operating costs for the inter-urban buses, up to 50% in Milan and up to 30% for the railways; so, the main source of finance for public transport companies are the **subsidies**.

Each mode receives subsidies in a different way:

- The railways are subsidised by the national Government. The number of trains*km to be subsidised are agreed in a public service obligation agreement. There is no competition or tendering to settle the amount of the subsidies. From 1999 on the Regional administration will finance the local railway services in place of the Government.
- The extra-urban buses are subsidised by the Region. Additional services must be financed by the requiring institution (Province). The subsidies are paid depending on the bus*km produced and the "Standard Cost" of each bus company. Public service obligation agreements are coming in further to the new regional public transport act: so the tenders will decide the amount of the subsidy.
- The urban transport is subsidised both by the Region and the Municipalities. The main source of finance for the capitals of the Provinces is the Region, while the municipalities pay additional subsidies. On the contrary, the Municipality is the main payer in the other cities. The amount of subsidies is set according to the need to finance the operation costs not covered by the fares. In the next few years the public service obligation agreements are foreseen also for the urban transport.

As regards the local public transport **fares**, in Lombardy the operators decide them according to the criteria set by the Region. The Lombardy fares act establishes the minimum fare. In such a way the regional administration should be guaranteed that the companies raise from the users a minimum amount of incomes.

The fares increase with the length of the travel. Discounted fares are set for commuters (weekly and monthly passes), with a discount up to 60%. There are also discounted tickets for the following public transport users: elderly people, students (mainly only for urban services) and disabled people.

Integrated fare systems are in force in many of the metropolitan areas of Lombardy. The major is the Milan metropolitan area fare system, called SITAM (Sistema Integrato Trasporti Area Milanese). It is managed by the urban transport company ATM and many of the rail and road public transport operators whose routes reach the Lombardy regional capital have become affiliated with it. The fares to reach a given place in the hinterland are determined according to the area the destination belongs to or to the number of zones one travels through from the city boundary to reach his destination. Railways are not integrated with buses yet because of the gap between the levels of the fares.

Lombardy Region is also developing an automatic ticketing project. Local integrated fare systems will be established in each urban area. Afterwards all the local systems will be connected. Smart cards will be the means of payment.

1.4. The demand of public transport in Lombardy

Lombardy is mostly an urbanised area, where the mobility rate is very high, except for the mountains (see table 5). The congestion due to traffic, the pollution and the environmental impacts are the main issues related to the present status of the transport system. One of the reasons is that the modal split is unbalanced towards the private transport (passengers transport) and the transport by road (freight). In the urban centres the near paralysis of traffic is a reality not only in the regional capital.

MOBILITY	INTER-URBAN	URBAN	METROPOLITAN AREAS	
	Daily internal commuter inter-urban trips in the Provinces	Daily internal commuter trips in the provincial capitals	Daily commuter trips entering in the provincial capitals	Daily commuter trips outgoing from the provincial capitals
Bergamo	214,893	42,832	59,929	18,212
Brescia	195,344	83,882	64,043	17,684
Como	106,156	33,156	35,939	14,276
Cremona	43,475	29,711	14,510	6,533
Lecco	57,865	17,949	20,235	5,889
Lodi	22,367	14,896	11,680	7,803
Mantova	56,467	21,001	25,566	5,154
Milano	828,352	619,913	470,331	95,892
Pavia	69,002	31,643	32,554	8,583
Sondrio	30,103	9,554	9,618	1,521
Varese	159,285	33,515	30,810	13,414

Table 5 – The mobility in Lombardy (1991)

From 1981 to 1991 the population of Lombardy did not increase, but it spread in the areas all around the main cities. The transport demand increased for the inter-urban trips and decreased for the urban ones (see Table 6).

In the following 7 years this trend goes on; on the other hand a lot of people come from the third world countries and east Europe to the cities of Lombardy. In such a way the mobility rate does not decrease as a whole, but the rate of use of public transport declines steadily (buses) or stays the same (railway).

Commuter trips	1981	1991	Differences
Total	3,372,683	3,718,740	+10.3%
Urban	1,894,368	1,747,495	-7.8%
Inter-urban	1,478,315	1,971,245	+33.3%

Table 6 – The mobility in Lombardy in the decade 1981-91

Modal split of the inter-urban trips	1981	1991	Differences (trips)
Feet	1%	1%	+12%
Railway	15%	15%	+33%
Bus	23%	14%	-15%
Car	51%	64%	+66%
Other	10%	6%	+20%
	100%	100%	

Table 7 - Modal split of the inter-urban trips

These data show that the fall down of the use of the inter-urban buses is related to the scattered population. In fact the effectiveness of the public transport is maximum in the densely populated areas. The percentage of workers using the public transport fell down from 63.3% (1981) to 42.2% (1991), while the students rate raised from 36.7% to 57.8%. In fact most of the students can not drive, so in many cases they use necessarily the public transport.

The supply of public transport was not reduced during the last few years, but this strategy did not stop the decline of the number of users.

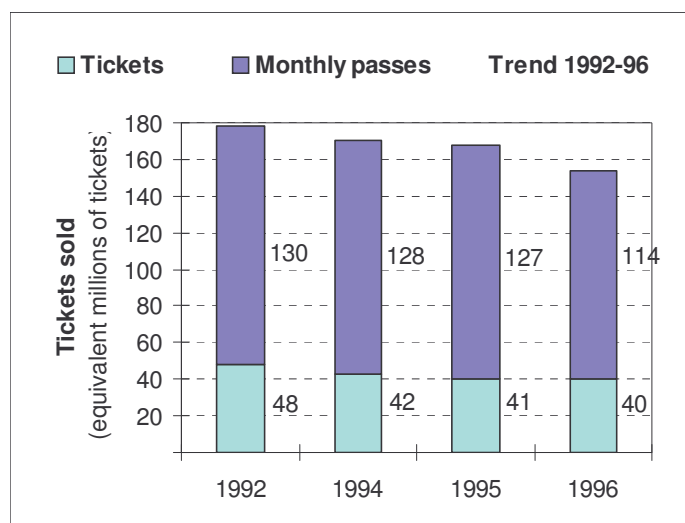


Figure 1 - Trend in total tickets sold during the nineties (monthly-passed have been transformed into equivalent one-trip tickets)

1.5. The main problems

The local public transport reform during the nineties must cope with the need of improving both the effectiveness and the efficiency of the public transport system.

The main problems are the following:

- The competences on the extra-urban public transport planning and financing are shared out between the Government (railways), the Region (subsidies) and the Provinces (buses): there is lack of co-ordination and there is not financial liability of the Provinces for the services they plan.
- The concession-based system - the concessions do not have time limit - protects the transport companies from the competition by new entrants.
- The subsidies depend on standard costs, tailor made on the costs of the present companies. In such a way the higher are the costs, the bigger is the subsidy. This method of paying the subsidies discourages the producers to become more efficient. On the other hand the whole amount of the subsidies is the same every year in spite of the increase of the wages.
- Quality standards, objectives such as the improvement of the public transport patronage, and incentives are not present in the present concession system.

2. The public transport reform in Lombardy

2.1. The Legal and institutional framework

In this paragraph the legal and institutional framework for the implementation of the Local Public Transport (TPL) reform in Lombardy is outlined shortly.

In Italy the **National Government** has competence on the international and inter-city road and public transport networks (plane, railway, bus and ship). At the national level the guidelines of the transport policy are defined in the General Transport Plan (PGT).

The Italian Government delegates the planning and ruling of the regional transport system to the Regional Administrations (article 117 of Italian Constitution). Partly own resources and partly State transfers finance the costs of the delegated activities.

According to this principle the **Regional Administration** of Lombardy has competence on:

- a) the strategic planning of the whole regional transport network;
- b) planning, financing and managing (after the reform) the railway regional service;
- c) money transfers to Provinces or Municipalities to subsidy the bus inter-urban services;
- d) planning, financing and managing the regional road network.

The Provinces have competence on:

- a) planning and financing the bus inter-urban network, outside the large conurbations;
- b) planning, financing and managing the local road network.

At an urban policy level, as concerns the public transport, the **Municipalities** have competence on planning, financing and managing urban transport by bus, tram and underground.

2.2. The Local Public Transport reform: new policy options for Lombardy.

As shown above, during the last years the public subsidies to bus companies increased while the market share and the quality of service decreased. To cope with this problem the Regional Government of Lombardy with the Regional Act 13/1995 started a complete reform of the TPL system. The Regional Act 13/1995 stated the principle that all the inter-urban bus network should be divided into areas, within which the bus licences are tendered out, according to the Directives and Regulations set by the European Union (Directive 1831/1991).

The main objectives were:

- to redraw the whole inter-urban bus network;
- to improve the effectiveness of TPL by the competition among bus operators to gain the concessions;
- to reduce the amount of Regional subsidies to bus companies.

A National TPL reform act came from the Government in 1997, while Lombardy was preparing the implementation of the 1995 act. The national acts (“Bassanini” Act n.59/1997 and D.Lgs. 19/11/1997 n. 422), together with the new regional one which carried out them (Regional Act n.22/1998), added new matters to the reform process:

- the decentralisation of the planning and regulation competences: local railways from the Government to the Region; extra-urban buses from the Region to the Provinces; inter-urban buses in the metropolitan areas from the Provinces to the main Municipality;
- the extension of the bidding system to the urban and railway services.

3. The scheme developed by MIP for the inter-urban bus network of Lombardy

In the following pages we describe shortly the scheme developed by MIP as consultant of the Regional Administration of Lombardy in 1996-97, after the approval of the Regional Act 13/1995. The Regional administration has not implemented this scheme yet, because of the new regulations of 1997-98 and the request of adjustments. In 1997 a tender was simulated, which the associations of the bus operators took part to.

Two types of actors are involved in the restructuring process. **Active** actors are directly involved in the decision process. They are the Region and the eleven Provinces. **Passive** actors affected by the policy are the National Government, the Municipalities, the bus companies, the trade unions, and the users.

Each actor involved in the decision process, directly or indirectly, has a number of general objectives related to the restructuring process of public transport in Lombardy. These objectives are listed in the following table.

GENERAL OBJECTIVES	National Gov.	Lombardy Region	Provinces	Municip.	Bus Companies	Trade Unions	Users of public bus
Economic effects							
Efficiency of expenditure	✓✓✓	✓✓✓	✓✓				
Minimise subsidies		✓✓	✗		✗		
Maximise incomes		✓✓			✓✓✓		
Minimise job losses	✓✓✓	✓✓				✓✓✓	
Effects on people							
Accessibility to social, health, school.. facilities		✓✓✓	✓✓	✓✓✓			✓✓✓
Minimise trip time		✓✓	✓✓	✓✓✓			✓✓✓
Improve quality of public transport		✓✓✓	✓✓	✓✓✓			✓✓✓
Effects on Local Public Transport system							
Increase users of public buses		✓✓✓	✓✓				
Improve intermodal co-ordination	✓	✓✓✓	✓				
Manageability of the system		✓	✓✓✓		✓		

✓ = weak interest; ✓✓ = medium interest; ✓✓✓ = strong interest; ✗ = strong opposition

■ active actor

□ passive actor

Table 8 - List of general objectives related to policy actors¹.

Conflicts may occur either between the Region and the Provinces or between active and passive actors: two examples:

- ✓ between the Regional Government and the major bus companies about the level of competition;
- ✓ between the Regional Government and the Provinces about the gross amount of the subsidies to give to each Province.

3.1. The tendering process

The competition to the market is the way for improving the effectiveness of the inter-urban bus services chosen by the Regional Act 13/95. The bus companies compete to win the licences to produce all the bus inter-urban services inside a "Homogeneous Area" (area licences). The areas are chosen by the Regional Administration.

¹ DTCS EC Fourth Framework programme research project, "Case study: restructuring the public transport in Lombardy", by Elena Foresti, Eliot Laniado, Simona Muratori and Paola Tagliavini, MIP-Politecnico di Milano

Zoning is a specific division of Lombardy in geographical areas that are as much as possible homogenous in terms of transport demands.

Setting the boundary of the areas is a critical choice. On the one hand, areas should be large enough to make them economically attractive for the applicants. Large areas would also simplify the management of the process, which is a responsibility of the Provinces. On the other hand, the larger the areas, the lower the competition between bus companies, because large areas would favour the major bus companies and make it difficult to operate for small companies. This would probably result in a low level of savings for the Regional Administration. In general, the choice of zoning will have effects on the economic efficiency of the transport network, on the level of service to the public and also on the employment level in the bus companies. For this reasons zoning is a key step of the process (see paragraph 3.2).

As regards the kind of **tender**, a flexible procedure was developed (see paragraph 3.3). This means a net cost tender where:

- a) the commissioning body decides the basic service requirements;
- b) the tenderers submit an operating plan for the bus network in order to fully meet the present transportation demand and to increase the availability of public transport in the area;
- c) the operators become responsible of the patronage and the quality of the service.

The **evaluation** step is based on fully transparent and predefined criteria. The scores are calculated using the multicriteria methodology. The indicators and the weights reward the quality and the effectiveness instead of the underbid percentage (see paragraph 3.5).

3.2. The choice of the areas to tender

There are two main steps in this decision process:

- ✓ **the zoning step** is the development of several zonings using an operational research approach. The fundamental concerns that drive the evaluation of zoning options were first expressed by the Region and then discussed together with the Provinces.

The general objectives are related to four fundamental concerns, and represent both passive and active actors.

Concerns for the zoning are:

- **consistency**: each area must contain the highest possible number of trips with origin or destination inside the area, i.e. must be consistent in terms of transport demand;
- **accessibility**: in each zoning solution, accessibility to public facilities (social, health, schools, etc.) must be guaranteed within each area;
- **competitiveness**: areas must be large enough to facilitate competition among bus companies which apply for areas licences;

- **equilibrium:** all areas must be attractive for the applicants and must guarantee homogeneous distribution of public facilities.

A list of constraints is also included:

- the areas must be connected;
- there cannot exist areas which extend over two or more Provinces (this would make the management of the system difficult in administrative terms);
- each area must contain at least one of the main stations of the Regional railway network.

The *policy options* (zonings) within each Province are then generated by means of mathematical programming using the software P.He.S.C.A. (Parallel Heuristic Set-Covering Algorithm; Caimi *et al.* 1996)

P.He.S.C.A. requires the definition of: the “zoning centre” for each area. This is the municipality that directs the zoning process. It is chosen on the basis of the ability of generating and/or attracting several transport flows, of having a high population and a high concentration of facilities (like hospitals, schools, recreational facilities...). The algorithm aggregates municipalities into areas around each zoning centre, so that the resulting area is as compact as possible and maximises the transport flow within the area.

- ✓ In **the evaluation step** the alternatives (zoning options) are evaluated with a multicriteria methodology and the "best" zoning is chosen. This proposal is then submitted to the Regional Government.

A set of area indicators is used to describe each area in a zoning option. They describe the demand and supply of transport, the accessibility of public facilities (such as schools, hospitals, social and health centres), the population distribution and the area morphology. They are calculated from a comprehensive database constructed for this purpose, interacting with a Geographical Information System (GIS).

Zoning descriptors, obtained by aggregating area indicators, are used to compare the policy options. They describe the performance of each option at the level of a whole Province (which is a set of areas). The aggregation can be the average value, the best or the worst value (minimum or maximum), or the difference between maximum and minimum. For each one of the concerns mentioned above, two numerical descriptors are defined (see Table 9).

CONCERNS	Descriptors	
CONSISTENCY	X1	Minimum percentage of internal trips related to total trips of the area
	X2	Average short time outgoing trips related to short time entering and internal trips
ACCESSIBILITY	X3	Percentage of areas with at least 3 different types of high degree schools
	X4	Maximum distance from a municipality without social and health facilities to a municipality with social and health facilities
COMPETITIVENESS	X5	Number of areas
	X6	Average number of bus companies potentially excluded from tenders (based upon companies dimension)
EQUILIBRIUM	X7	Percentage of areas containing at least one hospital
	X8	Maximum gap (maximum - minimum) of potential growth of bus services among the areas (Passengers*km bus/Passengers*km car)

Table 9 Concerns and zoning descriptors.

For each possible policy option, the impact profile is the set of eight numerical scores corresponding to each of the eight descriptors used. Impact descriptors relate only to impacts within each Province, and disregard impacts on other Provinces and on the entire Region.

To make it possible to compare the alternatives a value function is set for each descriptor. In such a way the range of the values of the descriptors goes from 0 to 1.

A qualitative analysis of impacts shows that wide areas tend to maximise the indicators of consistency (for large areas the number of commuting trips inside the area is large), while small areas are associated to high levels of competitiveness (the number of companies which compete in small areas can be large).

Figure 2 shows an example of comparison among zoning options using a radar chart.

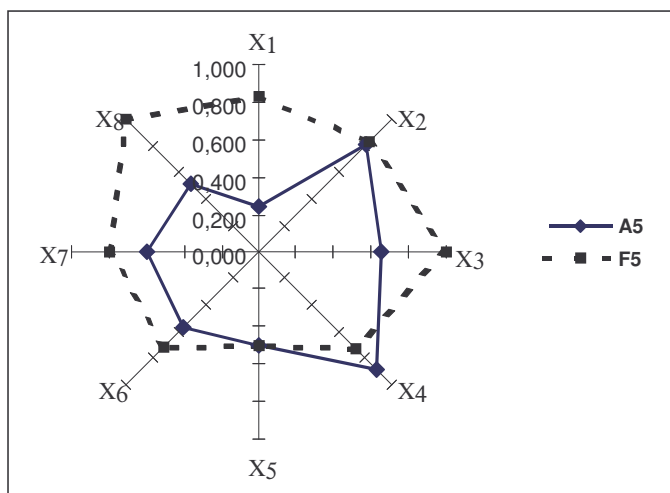


Figure 2 - The radar chart shows the performances (partial values) of the policy options A5 and F5 on the eight descriptors (Province of Pavia).

In table 10 the proposal submitted to the Regional Government is described, with the number of areas chosen for each Province.

Province	Number of Homogenous Areas
BERGAMO	7
BRESCIA	5
COMO	2
CREMONA	2
LECCO	3
LODI	3
MANTOVA	2
MILANO	10
PAVIA	6
SONDRIO	3
VARESE	8
TOTAL	51

Table 10 - Concerns and zoning descriptors.

3.3. The public service obligations

The following step of the tendering process is the decision, for each area, of the public service obligations. They are, according to the EU directives, the requirements of the public bodies for the transport service to be produced within a Homogeneous Area.

The public service obligations are the minimal level of service a transport operator must meet for its offer to be considered in a bid for tenders. The evaluation criteria are then set in such a way to award the tender to the offer with better quality, more services and lower fares than the public service obligations.

The proposed public service obligations are the following:

- transport requirements;
- fare requirements;
- quality requirements;
- information to the passengers;
- information to the commissioning local authority.

The bid identifies as **transport requirements** at first the connections that must be guaranteed between couples of Municipalities inside the area and to destinations outside it.

For each connection the bid specifies the minimum capacity in terms of available seats to be supplied for every peak time during the day. The location of particular stops in some municipalities is also specified (i.e. hospitals, railway stations). The minimum capacity is not required on the new

connections. The operator must guarantee also off peak trips on the required connections without capacity constraints.

In addition to these transport requirements the participants must deliver a project for an innovative transport service (transport-on-demand) to be available inside the area on the weakest connections and during the off-peak hours.

Inside a given area, a direct line must guarantee the connections between the Municipalities. Exchange is possible only on the connections to Municipalities outside the area.

COM_O	COM_D	KIND OF CONNECTION	A_F1	R_F2	R_F3	A_F4	R_F4	A_NOF	R_NOF
Origin to be connected	Destination to be connected	I→inside the area E→destination outside the area	Minimum capacity during morning peak time from O to D	Minimum capacity during noon peak time from D to O	Minimum capacity during evening peak time from D to O	Trips during the off-peak time are requested from O to D	Trips during the off-peak time are requested from D to O	Trips are requested from O to D without time constraints (new connections)	Trips are requested from D to O without time constraints (new connections)
Arcene	Treviglio	I	155	60	95	Yes	Yes		
Brembate	Dalmine	E	79	50	29	No	No		
Arcene	Canonica d'Adda	I						Yes	Yes
Treviglio	Arcene	I	3	3	0	Yes	Yes		
...						

Table 11 - example of transport requirements from the simulated tender.

Quality Requirements. Technical standards are set for the vehicles used by the operators: average and maximum age, emissions in atmosphere, accessibility to disabled people. To avoid the excessive starting cost of renewing the bus fleet, quality requirements can be accepted also as aims to be reached in fixed times. The reliability, punctuality, comfort and safety guaranteed must be declared to the users in a "Service Chart".

The quality of the service to be offered, specified in the "Service Chart", must better a minimal standard still under discussion. An example could be the following. The operator must guarantee at least 95% of the trips planned. He must, in case of accident or failure, guarantee a replacement bus in 20-30 minutes (reliability). The occupancy of the buses must not exceed the 80% of their maximum capacity on more than 85% of trips (comfort). Less than 10 % of trips may be more than 5 minutes late or 2 minutes early, less than 0.5% may be more than 15 minutes late. One could also envision a standard of cleanliness of buses and stations and availability of information and tickets.

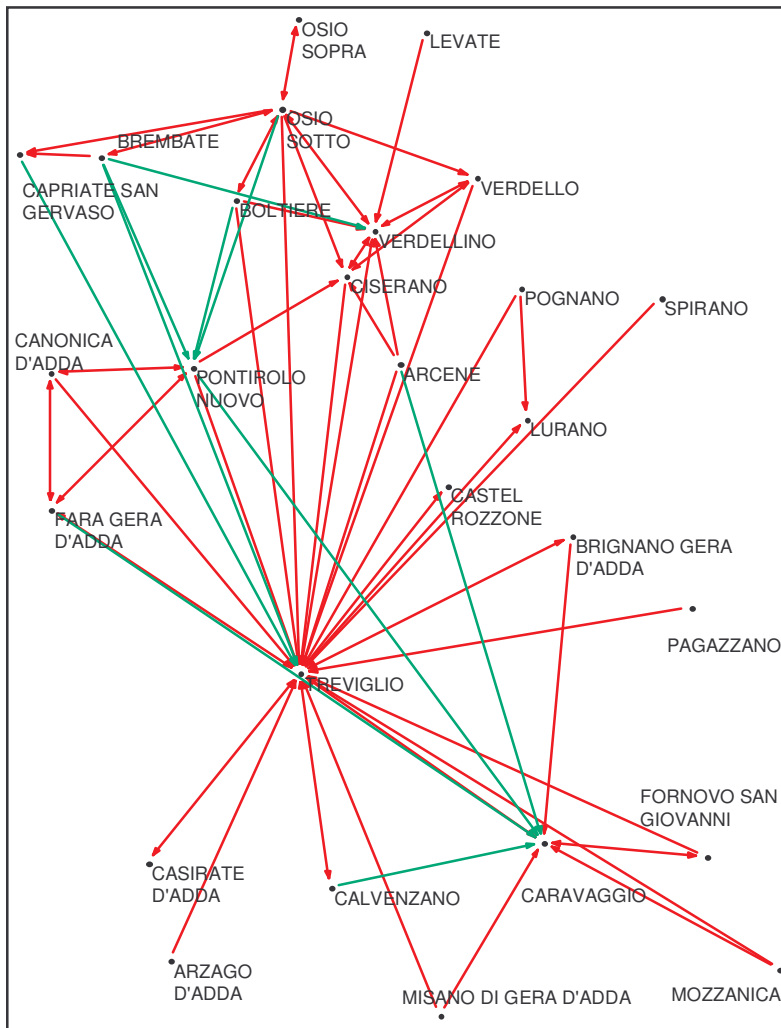


Figure 3 - Chart of the transport requirements in the simulated tender (red and green arrows).
The new connections without capacity constraints are marked by green arrows.

Other requirements. A new regional regulation will decide the maximum **level of the fares**. It is under discussion whether the Provinces decide unified fixed fares or the tenderers can include the level of the fares in their offer, under the maximum set by the Region.

The operator must guarantee a good level of **information to the passengers**. The information must be available on board (route, acoustic stop signals) and at stops (route, timetables, coincidence, fares, and ticket distribution).

The **local authority** commissioning the service must be kept up to date on transport demand and service management. The data must be sent on a regular basis using a standardised electronic format, set for the *MISTRAL* regional information system. The **information** collected will be used to monitor the application of law 13/95, to regularly review and update requests in calls for tenders and to define public funding for successive calls.

Both technical and management requirements can differ from one area to another depending on land characteristics and demand type.

This way of defining the service requirements aims to leave the operator free to plan, with its deeper knowledge of operating costs and transport demand, the most cost effective and efficient way to organise the transport service to respond to the public requests. Each bus operator answering the bid must, as a consequence, define a precise operating plan, specifying the number of lines, the routes, timetables and stops and the type and capacity of the vehicles.

3.4. Financial resources

Law 13/95 changes transport financing from the “Standard Cost” basis of law 151/81 to new financing procedures.

The Regional Government will define the share of its budget dedicated to transport services. This share will be divided between the services and will constitute the maximum commitment for the service. Once a company has been selected, that company’s bid constitutes the only commitment the Regional Government has to finance the transport services described in the contract.

Lastly, the funds for public transport in the Homogeneous Areas could be divided in two. A first part, tentatively the 90% of the total, could be guaranteed to the operator of the service. The smaller portion could be used as an operator performance **incentive**, that could be dispensed in proportion to some indicator of improved service. As an example it could be proportionally distributed to percentile increase of passenger *km.

3.5. Offer evaluation criteria

Multicriteria analysis will allow the comparison between the various offers answering the call. In order to guarantee the fairness and transparency of procedures, the system will be completely pre-defined. The offering company will know the criteria in advance, and will be able to score its own offer before submission.

The evaluation proceeds in two steps: first, the offers are checked against minimum service requirements and discarded if not compliant, then the remaining offers are scored.

	ALPHA	BETA	GAMMA	MIP1	MIP2
Number of lines (number of trips in the morning peak time)	8 (249)	8 (-)	8 (-)	17 (382)	17 (185)
Length of the bus network	889 KM	889 KM	889 KM	1,068 KM	1,016 KM
Bus*km	1,620,000	3,070,200	2,900,000	3,019,081	1,501,881
Average age of the buses (years)	4	4	8 - 9	5.2	5.2
Average capacity of the buses (seats)	55	55	72	69	69
Cost (EUR/1,000)	4,002.37	5,096.73	4,698.15	5,065.07	2,832.96
Cost of each kilometre produced (EUR)	2.47	1.66	1.62	1.68	1.89

Table 12 – The operating plans proposed by the participants to the simulated tender.

The criteria proposed to evaluate the offers are:

- A. coverage and capillarity of the service offered;
- B. quality;
- C. cheapness for the commissioning authority.

One or two indicators are defined for each of the above points, which can be measured from the operating plan submitted by the companies.

The indicators to evaluate the **main service (conventional)** are:

A. Coverage and capillarity:

A1. **Capacity.** The proposed indicator is the maximum number of passengers served by the lines as designed by the operator. This indicator measures the number of potential users that the services provided by the operating plan submitted by each participant is able to host in the buses. The indicator is calculated using the data of a OD matrix which estimates the transport demand in the Homogeneous Area. The participants are made aware in advance of this OD matrix and the rules to calculate the indicator.

A2. **Service during the off-peak times.** The indicator is calculated multiplying the number of connections where services during the off-peak times are proposed, by the number of trips for each connection.

B. Quality:

B1. **Speed:** average speed over all the lines.

B2 **Frequency:** number of trips proposed for each connection multiplied by the length of the connection.

B3 **Age:** average age of the vehicles.

The indicator to evaluate the **innovative service** is the **capacity**: number of seats daily offered multiplied by the number of hours the service is available during the day.

The indicator to evaluate the **cheapness** is the **underbid percentage**.

INDICATOR	ALFA	BETA	GAMMA	MIP1	MIP2
Capacity (conventional) (n° of bus users)	6,112	-	-	6,329	5,143
Off-peak service (n° of connections*n° of trips)	641	-	-	1,075	561
Speed (km/hours)	31	-	-	36	35
Frequency (n° of trips * length of the connection)	132	-	-	165	91
Capacity (innovative) (n° of seats* n° of hours)	214,200	214,200	214,000	97,658	97,658
Underbid percentage	22.5%	1.3%	9.0%	1.9%	45.1%

Table 13 – The indicators calculated to evaluate the offers in the simulated tender.

Each indicator is the argument of a utility function, which gives to admissible values of the indicator an adimensional value between 0 and 1, measuring the “satisfaction”. For example, in the case of coverage and capillarity, the utility function could be linearly increasing from value 0 at the minimum passenger number requirements, to value 1 at a 30% increase in passengers from the minimum number.

It is then necessary to **weight** the indicators, giving each of them a relative importance. In the case examined, coverage and capillarity could have the greatest importance (50%), followed by quality (40%) and lastly by cheapness (10%).

INDICATOR			WEIGHT
Coverage and capillarity	Main service (conventional)	Capacity	40%
	Innovative service	Capacity	10%
Quality		Off-peak service	10%
		Speed	15%
		Frequency	15%
Cheapness		Underbid percentage	10%
			100%

Table 14 - Weights

It is now possible to give an overall score to each offer, obtained by the weighted sum of each indicator measured by its utility function. The offer with the highest score wins the bid.

To guarantee transparency the call for tenders must report the utility functions and relative weights of the criteria.

3.6. The simulated tender

A simulation of a tender took place in 1997 with two participants: MIP and the representatives of the bus companies of Lombardy. The simulation was very useful to test the procedure and to make both the operators and the commissioning bodies aware of the skills needed in a competitive context.

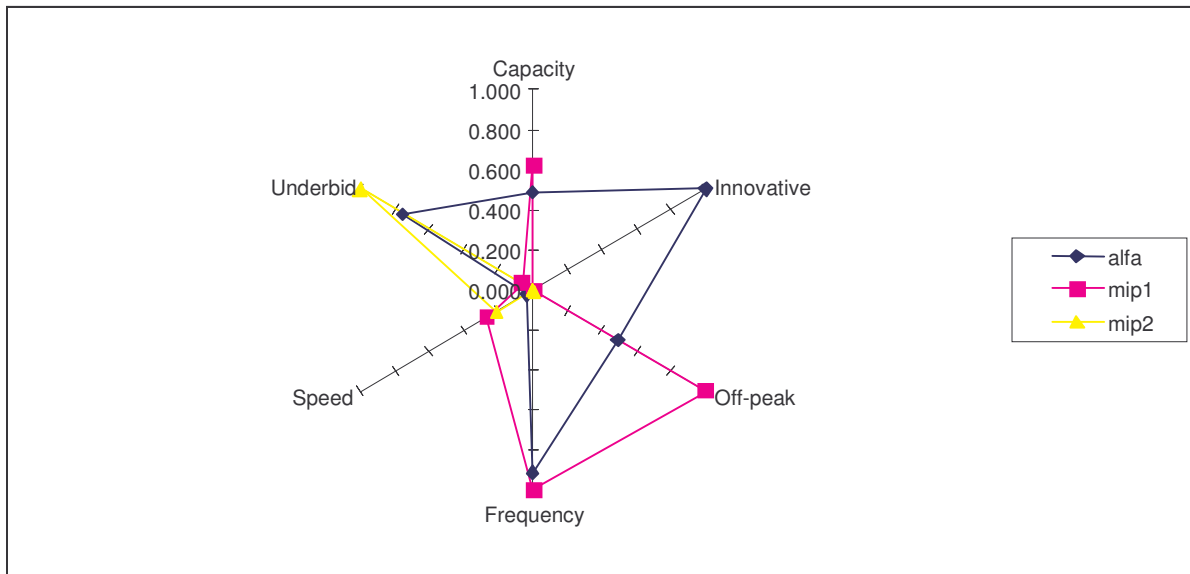


Figure 3 – Comparison among the offers using a radar chart. The score for each indicator is obtained through value functions.

OFFER	SCORE	PLACINGS
ALPHA	0.562	1
MIP1	0.545	2
MIP2	0.134	3

Table 15 – The scores in the simulated tender (in bold the winner).

The main results were:

- ✓ this kind of tendering process is feasible;
- ✓ it is difficult to develop a transparent and completely predefined evaluation system without using complex indicators and methodologies;
- ✓ the Italian operators are not used to large restructuring interventions, so they find it difficult to draw the offer (especially to plan the new network).

Ferdinando Stanta

PERSONAL DETAILS

Place of birth *Genoa*
Date of birth 6/14/1966
Nationality Italian
Marital Status Unmarried

EDUCATIONAL QUALIFICATION

Master: Public Transport Management and Economics (Free University Carlo Cattaneo of Castellanza) in 1995; Freight Transport and Logistics (ISTIEE: University Institute in Trieste) in 1995.

Degree: Economics (date 12/10/1992) University of Florence (108//110).

Qualified as Accountant and Tax Advisor.

Languages: English good, German good.

Software: Microsoft Office.

PROFESSIONAL INTERESTS AND SPECIALISATION

Planning of freight and passenger transport; Organisation and management of transport companies; Environmental economics.

WORK EXPERIENCE

■ 1996-...■

Researcher for **The Centre in Environmental Economics and Management of “Consorzio MIP – Politecnico di Milano”**.

The Centre in Environmental Economics and Management was founded in 1992 as a part of the MIP University Consortium. MIP includes the Politecnico di Milano, Assolombarda (the industrial association of Lombardy, Italy) and the Milan Chamber of Commerce, together with leading national and international industrial groups operating in Italy. The consortium aims to integrate the knowledge-based expertise of the academic area with the operative skills of the participating business and economic institutions.

The Centre in Environmental Economics and Management focuses its research on introducing rational elements in decision processes regarding transport, environment and territory. From its research projects the Centre develops decision methods based on multi-criteria analysis and negotiation procedures, able to support the public bodies. Main skills of the centre are: planning and organisation of public services through the application of operational research tools and decision support systems; study and design of innovative transport systems; development of mathematical models for the management of renewable resources; analysis of environmental regulation criteria (taxes, subsidies, environmental

norms); development of software tools and methodologies to assess environmental impact.

■ **1996-97-98 ■ Politecnico di Milano**

Teacher of Macro-Economics in the Applied Economics for Engineering course

■ **1997 ■ LIUC, Castellanza (VA) – Regione Lombardia**

Seminar on the restructuring of public transport in Lombardy

■ **1995 ■ LIUC, Castellanza (VA)**

Development of a Project Financing Scheme for the “Guasticce” Inter-modal railway yard (master thesis).

■ **1994-95 ■**

Accountant and tax advisor in Florence.

■ **1992 ■ Ferrovie dello Stato (Italian National Railways)**

MAIN WORKS

■ **1996-97 ■ Lombardy Region - Transport and Mobility Division**

PAOLO: support to the restructuring process of the public local transport system in accordance with the regional law n. 13/1995. Main activities: the planning of the transport services and the organisation of the tenders.

■ **1996-98 ■ EU research project DG VII (Transport)**

TransPrice: (Trans Modal Integrated Urban Transport Pricing for Optimum Modal Split): study of the money circuit and the front loading issues in the pricing projects.

■ **1997 ■ EU research project DG XII (Environment)**

DTCS: (Spatial Decision Support for Negotiation and Conflict Resolution of the Environmental and Economic Effects of Transport Policies): the Italian case study (the Lombardy Region).

■ **1997 ■ Italian Government: Ministry for the Environment**

OZONE: survey of the best available technologies for the ozone protection and definition of the procedures and the international laws for their promotion.

■ **1998 ■ Lombardy Region - Transport and Mobility Division**

PAOLO 2: methodologies for the organisation of the bus service tenders, the rationalisation of the public funds expenditure, the evaluation of benefits and requirements for an innovative automatic fare collection system; the choice of the minimum level of transport services (DLgs n.422/97).

■ **1998 ■ EU research project DG VII (Transport)**

AFFORD: (Acceptability of Fiscal and Financial Measures and Organisational Requirements for Demand Management). Main activities: study of the level of the fares and the institutional and legal issues of the pricing systems in the urban areas.

PUBLICATION, CONFERENCE ATTENDANCE AND PAPERS GIVEN

1. L. Divieti, E. Laniado, F. Stanta, Integrated urban transport and pricing policies: TransPrice Project, SIDT '97 The Analysis Methodologies, the project and the transport system evaluation, Bologna, 1997.
2. L. Divieti, F. Stanta, R. Parma, G. Ugazio, Classification of the Lombardy Bus Lines, Transport in Lombardy, 2° special insert: «The Public Transport Reorganisation», Milan, 1997.
3. E. Laniado, F. Stanta, R. Parma, G. Ugazio, The Regional Bus Lines of Lombardy, Transport in Lombardy, 2° special insert: «The Public Transport Reorganisation», Milan, 1997.
4. E. Laniado, F. Stanta, P. Tagliavini, The organisation of the Bus Service Tenders , Transport in Lombardy, 2° special insert: «The Public Transport Reorganisation», Milan, 1997.

Ferdinando Stanta

Mr Ferdinando Stanta is senior researcher for the Centre in Environmental Economics and Management of “Consorzio MIP – Politecnico di Milano”. The Centre was founded in 1992 as a part of the MIP University Consortium. MIP, which includes the Politecnico di Milano, Assolombarda (the industrial association of Lombardy, Italy) and the Milan Chamber of Commerce, together with leading national and international industrial groups operating in Italy. The Centre in Environmental Economics and Management focuses its research on introducing rational elements in decision processes regarding transport, environment and territory. From its research projects the Centre develops decision methods based on multi-criteria analysis and negotiation procedures, able to support the public bodies. Mr. Stanta in 1996-98 developed for the Regional Administration of Lombardy, together with Professor Eliot Laniado and Ms. Paola Tagliavini, a scheme to support the restructuring process of the public local transport system in accordance with the regional reform act. He takes part to EU research projects on road pricing transport and transport planning and teaches Macro-Economics in the “Applied Economics for Engineering course” in Milan.