TRANSPORT AND SUSTAINABLE DEVELOPMENT: IMPACT OF THE SYSTEMS OF POPULATION MOBILITY AND GOODS ON THE ECOLOGICAL FOOTPRINT IN GALICIA (SPAIN)

ABSTRACT

This paper analyses transport as an specific component of the ecological footprint in Galicia from different perspectives: first, the influence of using an intensive transport of goods on the combustion of fossil fuels to the detriment of other more sustainable fuels; secondly, the mobility habits of the population (both acquired or imposed as there are no alternatives); and, finally, some reflections about the structural reasons of this behaviour.

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1. Introduction and background

While the calculation of indicators of sustainable development begins to spread at national and global levels, its implementation to the regional analysis is still very incipient, especially with regard to those indicators considered as measures of the strong sustainability. Some recent researches have even determined that the ecological footprint in Galicia (Spain) in 2002 reached 7.01 hectares per capita, much higher than the Spanish (4.90) and the world one (2.18). Table 1 shows how its different components are distributed:

Table 1. Components of the Ecological Footprint in Galicia

COMPONENT	Has. PER CÁPITA
Crops	0.25
Pastures	1.94
Forrest	0.39
Sea	1.43
Occupied land	0.07
Absorption area for $C0_2$	2.18
TOTAL	6.26
TOTAL (with biodiversity)	7.01

Source: Martín Palmero (2004)

According to the estimates carried out, the reason why Galicia presents such a high value in this indicator of sustainable development can be found in the very significant deficits in three of the components of the ecological footprint (Martin Palmero, 2004, pp. 85-86).

a. *Crops and pastures* – 2.19 (34.99%) of the 6.26 hectares per capita of the ecological footprint in Galicia (without biodiversity) correspond to this component. This figure is the consequence of the demand of intermediate economic-based uses and of some very specific eating habits of the Galician population; these habits are intensive in those components of the footprint.

b. *Sea* – As it happens with crops and pastures, the geographic configuration, historically linked to maritime activities and characterised by the free access and the common resources, made possible the industrial development depending on marine resources; the special structure of the Galician diet also contributes to this development.

These questions explain the fact that this region appropriates 1.43 sea hectares per capita.

c. *Absorption Area for CO_2.-* This component contributes 2.18 hectares[1] per capita to the Galician ecological footprint (34.81%), much higher than in the rest of the Spanish regions where similar estimates have been carried out, and also higher than the world average (1.02 hectares per capita).

2. Ecological footprint of energy and transport

The first of the reasons to justify the very important contribution of the energy derived from fossil fuels and, hence, from the adsorption area of CO_2, to the ecological footprint in Galicia is, undoubtedly, a location factor. The fact that two power stations dedicated to produce thermal energy and one refinery are located in Galicia makes necessary 10.6 millions of tons of coal and crude oil to be imported. The second question is much related to the domestic consumption of oil products, and, very especially, the one related to the transport sector.

According to the data from the Galician Energy Institute (Instituto Enerxético de Galicia) (2003), the Galician economy consumed 4,317 Ktep of oil products in 2002. This consumption is equivalent to 0.66 hectares per capita, that is, the 30% of the energy component of the Galician footprint. Particularly, the use of fossil fuels in the transport sector accounted for 2,323 Ktep, or what it is the same[2], 54% of the total oil products consumed. This figure is extraordinarily high if it is compared to some similar estimates carried out in other economies or regions: in Australia the rate of fossil fuels consumed by the transport sector is 17% out of the total consumption (Lenzen & Murray, 2001); in the USA this percentage does not exceed 26% (Redefining Progress, 2004); in San Sebastian (Spain) is 27,4% ((Ibáñez Etxeburúa, 2001); and in Santiago (Chile) reaches 30% (Wackernagel, 1998).

[1] It is necessary to point out that the methodology applied to estimate this component breaks it down into the energetic consumption derived from the regional economic activity and the one corresponding to the foreign trade with the rest of Spain and the rest of the world.

[2] 1 Ktep. = 41,868 Gj; Emission factor = 65,8 Kg. $C0_2$/Gj; Absorption area = 6.600 Kg. CO_2/Ha.

Finally, it can be stated the ecological footprint of transport reached 0.36 hectares per capita in Galicia in 2002. This figure means the 16.5% of the total footprint of the energy percentage, which, if we eliminate the aforementioned location factor, would be 37.5% of the total footprint.

From the different data above, the following question arises: which objective reasons justify the very high rate of the transport sector in the consumption of fossil fuels and, as a consequence, its strong weight in the ecological footprint in Galicia? To give an accurate answer to this question, it is essential to analyse the structure of this sector in the region and very especially of its sustainable-unsustainable uses, as well as the mobility habits of the inhabitants in this region.

3. Use of transport infrastructures

A first approach to understand the facts that justify the extraordinary ecological footprint of transport in Galicia can be carried out through the evolutionary analysis of the use of some specific infrastructures in recent years.

3.1. Ports

Table 2 includes those data related to the traffic evolution in the Galician ports. As regard with the transport of goods, it should be highlighted this increased 16,9% in Galicia in the period 1995-2003, whereas in Spain there was an increase of 70% during the same period; this different evolution concludes that, if the Galician ports moved the 10.21% of the Spanish economy, this percentage fell to 6.99% in 2003. If these figures are analysed in depth, it is also very significant that Galician ports are clearly importers (22,236 tons, 80% of total imports) and that these imports concentrate on liquid and solid bulk cargoes (7,434 and 11,289 tons, respectively). The landing of fossil fuels (coal for thermal stations and crude oil for refineries) are the most outstanding ones in these figures, what, undoubtedly, highlights the highly specialised role of the landings in the Galician ports (in absolute value). This links the Galician imports to the exploitation of sources of primary energy, with high CO_2 emissions.

Table 2. Evolution of the traffic of goods and passenger in ports (1995-2003)

		1995	1999	2000	2001	2002	2003
GALICIA	GOODS (Thousand Tons)	23,371	24,910	25,993	25,645	27,643	27,332
	BASE 1995 = 100	100	106.6	111.2	109.7	118.3	116.9
	PASSENGERS (Thousands)	12	26	38	27	26	120
	BASE 1995 = 100	100	216.7	316.7	225.0	216.7	1,000.0
SPAIN	GOODS (Thousand Tons)	229,014	330,529	348,505	361,269	377,553	391,182
	BASE 1997 = 100	100	144.3	152.2	157.7	164.9	170.8
	PASSENGERS (Thousands)	13,620	18,862	19,632	20,462	20,135	22,707
	BASE 1997 = 100	100	138.5	144.1	150.2	147.8	166.7
GALICIA - SPAIN (%)	GOODS	10.21	7.54	7.46	7.10	7.32	6.99
	PASSENGERS	0.09	0.14	0.19	0.13	0.13	0.53

Source: Instituto Nacional de Estadística (2004)

With respect to the passenger traffic, the Galician contribution is low: in 1995 only 12,000 passengers were registered (0.09% of the Spanish total) and, although in 2003 this figure increased considerably (120,000), the Galician rate (0.53%) is still relatively low with respect to the Spanish one.

3.2. Airports

In Galicia, in spite of the peripheral location and the existence of three operating airports, the air transport of goods has suffered an important fall in the period 1997-2003 (Table 3). On the contrary, the behaviour of the corresponding values increased 9% in the rest of Spain for the same period. Furthermore, the relative rate of this region in this sector is very low, since the air transport of goods only accounted for the 1.9% in 1997, and it was even lower in 2003 (1.2%). This last figure contrasts with the rate of the Gross Added Value in Galicia (5%), compared to Spain; this difference shows the lack of ability to interoperate of the Galician airport system.

On the other hand, the behaviour of the seaborne transport of passengers was positive for the Galician community, increasing 23% during the period under consideration. Nevertheless, the transhipment of passengers in Spain increased 39.3% during the same period. In 2003, Galicia only accounted for the 1.79% of the total Spanish movements, with a relative loss of 13.4% in absolute terms.

Table 3. Evolution of the traffic of goods and passengers in the airports (1997 – 2003)

		1997	1998	1999	2000	2001	2002	2003
GALICIA	GOODS (Thousand Tons)	8.4	9.6	5.7	10.9	8.6	7.3	6.9
	BASE 1997 = 100	100	114.3	67.9	129.8	102.4	86.9	82.1
	PASSENGERS (Thousands)	2,213	2,202	2,300	2,592	2,683	2,512	2,721
	BASE 1997 = 100	100	99.5	103.9	117.1	121.2	113.5	123.0
SPAIN	GOODS (Thousand Tons)	528.6	541.6	589.9	611.4	578.8	569.4	576.8
	BASE 1997 = 100	100	102.5	111.6	115.7	109.5	107.7	109.1
	PASSENGERS (Thousands)	108,960	116,124	126,345	138,690	142,651	141,240	151,733
	BASE 1997 = 100	100	106.6	116.0	127.3	130.9	129.6	139.3
GALICIA - SPAIN (%)	GOODS	1.59	1.77	0.97	1.78	1.49	1.28	1.20
	PASSENGERS	2.03	1.90	1.82	1.87	1.88	1.78	1,79

Source: Instituto Nacional de Estadística (2004)

3.3. Railway

In Galicia and Spain the railway transport of passengers in long distances shows different behaviours: whereas in Galicia this transport decreased 10% in the period under consideration (Table 4), in Spain it increased 19.8%. One of the main reasons for this would be the opening of highways connecting with the Castilian plateau, what would bring about the replacement of this mean of transport by the road transport.

In the period 1997-2000 the use of the railway at a regional level had a more positive behaviour: it increased 17% in Galicia, very similar to the Spanish one (19.8%). However, it must be highlighted the limited importance of this mean of transport in this region, since it only accounted for the 3.52% of the use Spain gives to the regional trains.

Table 4. Evolution of the railway transport (1997 – 2000) (In thousands)

		1997	1998	1999	2000
GALICIA	LONG-DISTANCE TRAINS	523.8	537.2	477.3	473.4
	BASE 1997 = 100	100	102.6	91.1	90.4
	REGIONAL TRAINS	2,529.8	2,884.0	3,042.3	2,960.0
	BASE 1997 = 100	100	114.0	120.3	117.0
SPAIN	LONG-DISTANCE TRAINS	12,378.5	13,510.0	13,875.5	13,462.5
	BASE 1997 = 100	100	109.1	112.1	108.8
	REGIONAL TRAINS	22,322.0	24,369.0	24,817.3	26,745.0
	BASE 1997 = 100	100	109.2	111.2	119.8
GALICIA - SPAIN (%)	LONG-DISTANCE TRAINS	4.23	3.98	3.44	3.52
	REGIONAL TRAINS	11.33	11.83	12.26	11.07

Source: Instituto Nacional de Estadística (1997, 1998, 2000, 2001)

3.4. Urban public transport

It is also worth highlighting the analysis of the evolution of the use of the urban public transport as it is considered a sustainable mean of transport. Table 5 shows the degree of use of this mean during the period 1998-2003.

The main assessment obtained from the data must refer to fact that the demand decreases in Galicia and Spain. In a period of five years, this demand practically decreased 5%. This phenomenon is specially relevant in the Galician economy: firstly, it should be taken into account that from 1991 to 2002 the population residing in Galician municipalities with less than 10,000 inhabitants passed from 42 to 66.20%; secondly, the concentration of inhabitants in the seven big Galician towns is increasing (35.76% in 2002) (González-Laxe, 2004); and, lastly, in the Galician urban areas there are not other alternative sustainable systems of urban public transport, as it can be the underground that are increasingly present in other Spanish towns.

Table 5. Evolution of the number of passengers using urban transport (1998 – 2003)

		1998	1999	2001	2002	2003
GALICIA	PASSENGERS (Thousands)	60,721	56,814	57,900	56,909	57,736
	BASE 1998 = 100	100	93,6	95,4	93,7	95,1
SPAIN	PASSENGERS (Thousands)	1,789,278	1,732,231	1,737,949	1,685,766	1,708,282
	BASE 1998 = 100	100	96.8	97.1	94.2	95.5
GALICIA - SPAIN (%)		3.39	3.28	3.33	3.38	3.38

Source: Instituto Nacional de Estadística (2004)

3.5. Motorways

A very significant factor of the degree of intensity of the use of intensive transport systems to carry fossil oils and, as a consequence, responsible of the absorption area for CO_2, can be observed through the evolution of the road movement of vehicles. This dynamics can be appreciated in a very significant way through the average daily intensities (ADI) of vehicles that have travelled on Galician motorways in the recent years, as it is shown in Table 6.

Table 6. Evolution of the average daily intensity (ADI) of vehicles per day on Galician motorways (1998-2003)

	1998	1999	2000	2001	2002	2003
LIGHT VEHICLES	21,381	23,141	23,566	25,962	27,137	32,126
BASE 1998 = 100	100	108.2	110.2	121.4	126.9	150.3
HEAVY VEHICLES	1,917	2,025	2,436	2,348	2,492	2,861
BASE 1998 = 100	100	105.6	127.1	122.5	130.0	149.2
TOTAL VEHICLES	23,298	25,166	26,002	28,310	29,629	34,987
BASE 1998 = 100	100	108.0	111.6	121.5	127.2	150.2

Source: Instituto Nacional de Estadística (2004)

As it can be observed, during the period 1998-203 the ADI of light vehicles increased 50.3%, reaching 32,126 vehicles per day in 2003. The traffic of heavy vehicles (49.2%) had a parallel behaviour. Altogether, the ADI of vehicles travelling on Galician motorways was 34,987 in 2003, a very high figure if it is compared to the ADI of all the Spanish motorways in the same year (22,586 vehicles per day).

4. Transport of goods and population mobility

Taking the above analysis on the degree of use of some of the Galician transport infrastructures as the starting point, it can be observed a horizon, significant at least, about the negative intensity of the use of those infrastructures that, in principle, are not compatible with a sustainable development. The statistical analysis of the means of transport used to carry goods, as well as the movements and systems the population uses to travel, can be definitive for the aims of this research.

4.1. Flows of goods: railway vs. road transport

From the results of the Permanent Survey on regional exchanges of goods between the Spanish communities (*Encuesta Permanente de Transporte de Mercancías por Carretera 2000 – EPTMC),* carried out by the Ministry of Development and compiled by the National Statistics Institute (INE, 2004), the importance of each mean of transport can be accurately analysed as regards with the movements of goods in Galicia. Table 7 has been elaborated from the aforementioned sources.

Table 7. Flow of goods to/from Galicia according to the way of transport (2002)

		RAILWAY (A)	%	ROAD (B)	%	TOTAL	%	% A/B
TO GALICIA (Thousand Tons)	GALICIA	454.92	37.4	95,130.00	89.7	95,584.9	89.1	0.5
	REST OF SPAIN	716.47	58.8	8,940.00	8.4	9,656.5	9.0	8.0
	EUROPEAN UNION	40.95	3.4	1,984.00	1.9	2,025.0	1.9	2.1
	OTHER COUNTRIES	5.34	0.4	40.00	0.0	45.3	0.0	13.4
	TOTAL	1,217.68	100.0	106,094.00	100.0	107,311.7	100.0	1.1
FROM GALICIA (Thousand Tons)	GALICIA	454.92	24.3	95,130.00	90.4	95,584.9	89.3	0.5
	RESTOF SPAIN	1,387.64	74.2	9,254.00	8.8	10,641.6	9.9	15.0
	EUROPEAN UNION	26.46	1.4	804.00	0.8	830.5	0.8	3.3
	OTHER COUNTRIES							
	TOTAL	1,869.02	100.0	105,188.00	100.0	107,057.0	100.0	1.8

Source: Instituto Nacional de Estadística (2004)

The commentaries and remarks that can be obtained from the figures in Table 7 would be the following ones:

1. Galician Transport: In 2002 the transport of goods in Galicia increased to reach 95.6 millions of Tons, of which only 455 thousand (hardly 0.5%) were carried by railway. This question shows that almost the total of the interregional flow of products was carried out by road, since the train turned out to be inefficient. Moreover, the intensity of the traffic of goods, due to the special dispersion of Galician population, was one of the highest one of the Spanish regions with 3,308 T/Km., only surpassed by Andalusia, Castile-Leon, Catalonia and Valencia (Ministerio de Fomento, 2003A, 162).

2. Transport of goods from Galicia: In 2002 107.3 millions of Tons of goods were carried from Galicia, of which (not including the interregional flow) only 11.7 (10.9%) went to the rest of Spain, the European Union and other countries. Again the road transport was by far the most used (89.1%); moreover, the railway transport only accounted for the 8% of the movements to the rest of Spain, and 2.1% to the rest of the European Union. The special structure of the railway lines determined that the 76% of the goods carried by railway went to Castile-Leon, Madrid and Aragon.

3. Transport of goods to Galicia: The above remarks can practically be applied to the traffic of goods that arrived in Galicia in 2002: 11.4 millions of Tons per year arrived in Galicia from the rest of Spain and the European Union. 10

millions of them (88%) were transported by road. The railway only had a relative presence in the traffic of the rest of Spain (15% of the total transported goods). Castile-Leon, with 69% of this percentage) was the region that transported more goods to Galicia by this mean of transport.

As a consequence, according to the observed data, it is easy to reach two conclusions: firstly, the domestic transport of goods in Galicia is exclusively structured on intensive means as regards the use of fossil and non-sustainable fuels (95% was road transport), and this means the presence of the railway is symbolic; secondly, in the interregional flows between Galicia and the rest of Spain, as well as the ones to or from the European Union, the road transport is also absolutely higher, accounting for the 90,62% of movements.

4.2. Home and public equipment and habits of the population

In spite of the trend population has to concentrate in towns, in Galicia there are more than 30,000 population entities, what accounts for the 45% of the Spanish ones, although the Galician region only covers the 5,8% of the Spanish territory (González-Laxe, 2004). That is the reason why it has 631 Kms of roads per 10,000 inhabitants, compared to the 392 Kms in the rest of Spain; per every 10,000 Km^2 the difference is also conclusive: in Galicia this ratio stands at 584 kilometres of road, whereas in Spain it stands at 324 (Instituto Galego de Estatística, 2003).

The above data are a solid line of argument to hold the fact this peculiar population structure with these specific settlement partners, together with the lack of adequate and efficient public transport infrastructures, have made population get used to depending on their own private mean of transport, more intensive in fossil fuels.

A. Home equipment

The increasing number of cars in Galicia during the last six years has been spectacular: as it is shown in Table 8, there has been an increase of 15% in this period, accounting for 453/1,000 inhabitants in 2003, higher than the Spanish average (437) in the same year. According to Eurostat figures, Galicia has more cars than some countries in the

EU, some of them with a very higher per capita income, such as the United Kingdom, Finland, Netherlands, and Denmark, among others.

Table 8. Evolution of the number of cars per 1,000 inhabitants (1998-2003)

	1998	1999	2000	2001	2002	2003
GALICIA	393	410	421	435	447	453
BASE 1998 = 100	100	104.4	107.2	110.8	113.6	115.3
SPAIN	406	424	435	449	460	437
BASE 1998 = 100	100	104.4	107.1	110.6	113.4	107.7
% GALICIA - SPAIN	96.8	96.8	96.9	96.9	97.0	103.6

Source: Ministerio de Fomento (2003B)

This enormous increase of the number of private cars can be confirmed through the data of the Survey on the mobility of residents in Spain during the period 2000-2002 (*Encuesta de la Movilidad de las Personas Residentes en España 2000-2002 – MOVILIA*), carried out by the Ministry of Development (2003B). In fact, as it can be appreciated in Table 9, whereas in Spain the 18% of inhabitants does not own a vehicle, in Galicia this percentage is only 14,5%; and it must also be highlighted the fact that the 45,4% of Galician population owns more than two, when this percentage only reaches the 36,2% in Spain.

Table 9. Number of inhabitants owning some vehicles (thousands)

	GALICIA		SPAIN	
	TOTAL	%	TOTAL	%
NONE	393.8	14.5	7,184.5	18.0
ONE	1,093.1	40.2	18,321.7	45.8
MORE THAN ONE	1,234.7	45.4	14,474.9	36.2
TOTAL	2,721.6	100.0	39,981.1	100.0

Source: Ministerio de Fomento (2003B)

B. Access to public transports

A very significant indicator that measures the availability of public transports is the time population needs to access this transport from their own homes, what is undoubtedly a very good indicative of the use of public transport. Table 10 includes the times needed to access public transports, both in Galicia and Spain.

Table 10. Population with access to public transports according to the time needed to access them (minutes)

		GALICIA		ESPAÑA	
		TOTAL	%	TOTAL	%
TIME NEEDED TO GO WALKING TO THE NEAREST URBAN TRANSPORT	WITHOUT URBAN TRANSPORT	1,668.3	61.3	12,618.9	31.6
	< 15	935.0	34.4	26,042.5	65.1
	15-30	39.7	1.5	1,017.5	2.5
	> 30	78.6	2.9	302.1	0.8
	TOTAL	2,721.6	100.0	39,981.0	100.0
TIME NEEDED TO GO WALKING TO THE NEAREST INTER-URBAN TRANSPORT	< 15	1,546.4	56.8	26,409.0	66.1
	15-30	582.6	21.4	8,747.4	21.9
	> 30	523.6	19.2	4,002.7	10.0
	N/S	69.0	2.5	821.9	2.1
	TOTAL	2,721.6	100.0	39,981.0	100.0

Source: Own elaboration from Ministerio de Fomento (2003B)

The first consideration that can be carried out, with regard to urban transport, is that in Galicia the 61.3% of population does not have any access to this kind of transport. This percentage is practically twice the Spanish one (31.6%). With these figures, we can conclude that in Spain the 65.1% of inhabitants have access to public transport in less than 15 minutes from their homes, whereas in Galicia only the 34.4% does. As it is obvious, the use of public transport is practically nonexistent when the time needed to go walking to the nearest urban transport is over 30 minutes. And secondly, the interurban transport is also worst in Galicia than in the rest of Spain: in this region only the 56.8% of population has access to this transport in 15 minutes, and this percentage in Spain is 66.1%.

As a result, it is evident that Galician citizens have not got any availability to public transport from their homes, and this brings about its inefficiency, and, consequently, the lack of alternative solutions for the displacements, as it is analysed above.

C. Habits of population mobility

As a rule, Galician population behaves very similarly to the rest of Spanish population with regard to mobility. As it is shown in Table 11, in Galicia the 64.5% of inhabitants travel on working days; in Spain this percentage is 65.5%. During the weekend, almost half of population moves (50.7% in Galicia and 51.1% in Spain).

Table 11. Population according to displacement

		GALICIA		SPAIN	
		TOTAL	%	TOTAL	%
WORKING DAYS	WITH DISPLACEMENTS	1,755.7	64.5	26,173.2	65.5
	WITHOUT DISPLACEMENTS	965.9	35.5	13,807.9	34.5
	TOTAL	2,721.6	100.0	39,981.1	100.0
WEEKEND DAYS	WITH DISPLACEMENTS	1,379.7	50.7	20,431.3	51.1
	WITHOUT DISPLACEMENTS	1,341.9	49.3	19,549.8	48.9
	TOTAL	2,721.6	100.0	39,981.1	100.0

Source: Ministerio de Fomento (2003B)

One of the main reasons to verify the effect that mobility habits have on sustainability (by means of their effect on the ecological footprint of energy) is the detailed analysis of the means of transport used by population. As it can be appreciated in Table 12, in Galicia there are 5.3 millions of displacements on a working day (7.04% of the Spanish total). This percentage is slightly higher during the weekends (7.12%).

Table 12. Displacements according to the mean of transport

		GALICIA		SPAIN		% GALICIA SPAIN
		TOTAL	%	TOTAL	%	
WORKING DAY (Thousands)	ON FOOT OR BYCICLE	1,367.9	25.64	26,400.1	34.86	5.18
	CAR OR MOTORBIKE	3,141.6	58.89	36,781.1	48.57	8.54
	URBAN BUS OR UNDERGROUNG	208.3	3.90	6,146.8	8.12	3.39
	INTERURBAN BUS	151.1	2.83	2,101.1	2.77	7.19
	TRAIN	1.3	0.02	1,291.4	1.71	0.10
	OTHERS	464.6	8.71	3,013.8	3.98	15.42
	TOTAL	5,334.8	100.00	75,734.3	100.00	7.04
WEEKENDS (Thousands)	ON FOOT OR BYCICLE	830.5	23.04	17,302.2	34.16	4.80
	CAR OR MOTORBIKE	2,627.3	72.88	29,480.1	58.20	8.91
	URBAN BUS OR UNDERGROUNG	52.5	1.46	1,969.0	3.89	2.67
	INTERURBAN BUS	34.0	0.94	784.4	1.55	4.33
	TRAIN	3.7	0.10	391.4	0.77	0.95
	OTHERS	56.8	1.58	729.1	1.44	7.79
	TOTAL	3,604.8	100.00	50,656.2	100.00	7.12

Source: Ministerio de Fomento (2003B)

With regard to the mean of transport used on a working day, it is obvious that in Galicia the predominant ones are car or motorbike (58.9%)[3], whereas in Spain this percentage is

[3] The percentage of private car used to travel to work or to school/university is 60.1%.

48.57%. As a consequence, the habits of use of public transports are especially low in Galicia: only 3.9% of displacements are by urban bus when in Spain is 7.19%, and, moreover, the use of train is practically nonexistent in this region (0.02% of total). Likewise, the use of private car in Galicia is predominant at the weekends (72.88%), whereas in Spain this percentage is 58.20%.

The use of private car in Galicia is still higher if the inter-municipal displacements are analysed as it is shown in Table 13. In this case, the 84.4% travel in private cars on working days (72.5% in Spain) and the 96% at the weekends (88.4% in the rest of Spain).

Table 13. Inter-municipal displacements according to the mean of transport

		GALICIA		SPAIN		% GALICIA SPAIN
		TOTAL	%	TOTAL	%	
WORKING DAY (Thousands)	ON FOOT OR BYCICLE	4.6	0.7	236.0	2.5	1.95
	CAR OR MOTORBIKE	575.0	84.4	6,944.3	72.5	8.28
	URBAN BUS OR UNDERGROUNG	2.4	0.4	377.5	3.9	0.64
	INTERURBAN BUS	54.6	8.0	851.5	8.9	6.41
	TRAIN	0.4	0.1	571.2	6.0	0.07
	OTHERS	44.5	6.5	594.6	6.2	7.48
	TOTAL	681.5	100.0	9,575.1	100.0	7.12
WEEKENDS (Thousands)	ON FOOT OR BYCICLE	1.1	0.2	126.4	1.7	0.87
	CAR OR MOTORBIKE	575.9	96.0	6,456.5	88.4	8.92
	URBAN BUS OR UNDERGROUNG	3.9	0.6	113.7	1.6	3.43
	INTERURBAN BUS	15.9	2.6	327.1	4.5	4.86
	TRAIN	1.0	0.2	178.4	2.4	0.56
	OTHERS	2.3	0.4	104.7	1.4	2.20
	TOTAL	600.1	100.0	7,306.8	100.0	8.21

Source: Ministerio de Fomento (2003B)

Table 14. Number of interregional trips according to the mean of transport (Thousands)

	TO GALICIA		FROM GALICIA	
	TOTAL	%	TOTAL	%
CAR	8,553.7		7,863.3	83.86
BUS	1,213.8	11.13	912.5	9.73
TRAIN	355.3	3.26	403.0	4.30
PLANE	468.2	4.29	147.1	1.57
OTHERS	317.2	2.91	51.3	0.55
TOTAL	10,908.2	100.00	9,377.2	100.00

Source: Ministerio de Fomento (2003B)

Finally, the analysis of the interregional of flows of travellers according to the mean of transport used does not leave little room for doubt: the 83.66% of the trips from Galicia are in private cars, and the 78.42% to Galicia (Table 14).

5. Conclusions

First of all, some structural elements must be highlighted as the responsible ones of the ways of production and distribution in Galicia, what has a very direct effect on the guidelines of sustainable development in this region. These structural elements, among others, are the following ones:

- The present economic situation in Galicia is characterised by the intensive use of the existing and available natural resources. The high population dispersion increases the demand of intermediate inputs necessary to sustain the productive base.
- The peripheral character of Galicia shows accessibility indexes that are lower than the respective indexes in the central regions and, therefore, the levels of commercial interchange are very far from the Spanish averages.
- The combination of internal and external factors strengthens the close links among the different urban locations in Galicia, it develops economies of internal agglomeration and there are processes of disindustrialisation of the rest of the non-urban areas.
- The vulnerability of Galician economy is very high, since it depends on basic imports and on the intensive use of its own resources; and that is why there is a constrainment of the model that affects sustainability. In this sense, the high value of the indicator of the ecological footprint is the result of an economy based on very individualised and barely integrated decision-makings by the economic agents. A good proof of this are some evidences, such as the enormous growth of the number of private vehicles, the lack and non-availability of public transport, and the high indexes of population displacements.
- The aforementioned magnitudes, as a whole, take us to consider Galician present situation as a paradox with a complex explanation: on the one hand, Galicia exports almost half of the electricity produced, as well as the half of the oil products; and, on the other hand, Galicia has to increasingly import to generate these energetic

products. Moreover, the non-existence of productive processes with criteria of energetic efficiency and the economic-based performance measures make these processes demand a lot of energy based on the extraction of fossil fuels. In this sense, Galician industries have to develop their lines of transformation to take products with greater added value to the market; so that transport and energy have less impact on the final value of these products. Likewise, the new business areas in this region should present these characteristics.

Secondly, this document proves that the reason for the high CO_2 emissions is the high energetic intensity, or, what it is the same, the inefficient ways when it comes to using energy. The 54% of the final consumption of oil products in Galicia is used in transports, and the mobility of people and goods is practically carried out by means of private vehicles (cars and trucks). In this sense, the following questions should be highlighted:

- Considering the present situation in Galicia, users practically have in their hands the ability to transport themselves, using means of transport that are environmentally inefficient since users lack suitable substitutes. The same happens to the transport of goods.
- The system of regional transport has to develop in more efficient and sustainable ways, promoting the use of trains, short sea shipping or others. The creation of intermodal areas among the different transport systems can be an adequate option.
- Railway should form a wide network and be mainly electric. It is paradoxical that Galicia hardly uses electric energy for this transport system, in spite of being net exporter of it.

Finally, it should be highlighted the importance of the indicators of sustainability as sources of information and, consequently, of their importance when it comes to making decisions (Moffat, 1996). In this case, the individualised analysis of the components that make up the ecological footprint in Galicia (i.e. energy and transport) allows to show hidden dimensions in the globalised economic processes, what confirms the highly unequal distribution of natural resources at a regional, national and international level. Another question to take into account is that, although there are much defined structural determinants, the systems of distribution of goods and population mobility in Galicia

are subject to parameters of high private profitability, but there is hardly social or environmental profitability, what extremely conditions the sustainability in this region.

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