# AN ESTIMATION OF THE EVOLUTION OF WASTE GENERATED BY DIRECT AND INDIRECT SUPPLIERS OF THE SPANISH PAPER INDUSTRY

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**Abstract**

The generation of waste by the paper industry has attracted great attention over the last decades, among other reasons because the demand for recycled waste paper has considerably increased. However, it is necessary to bear in mind that the paper industry is closely intertwined to the rest of industries in the production system and that its activity exerts both a direct and indirect influence on the volume of waste generated by its supplier industries. The purpose of this study is to shed some light on the evolution of the volume of waste generated by the suppliers of the Spanish paper industry in the periods 2005 and 2010 to validate if this industry and its supply chain have decoupled growth and waste generation. The method used in this analysis is the Economic Input-output Life Cycle Assessment Model (EIO-LCA). Compared to other well-known techniques, like Product Life Cycle Assessment (LCA), these models are less costly and time consuming, among other reasons because they employ publicly available data. In our case we use data from different waste surveys conducted by the Spanish National Statistics Institute and input-output tables extracted from the World Input-output Database. The results obtained show that the waste generated by suppliers amounted to 1,250 thousand tonnes in 2010, an important volume if we take into account that the waste generated by the own paper industry in 2010 amounted to 1,739 thousand tonnes. The analysis of the evolution of the waste generated by suppliers revealed that there is a high degree of concentration, both in terms of industries and in terms of waste categories. Thus, mining and quarrying was the leading supplier industry in terms of waste generation. Mineral wastes were also the main category in terms of waste generation, followed by animal and vegetal wastes. The strong intra-industry relationships existent within own paper industry also had a reflection in the rest of industries and waste categories: the paper industry was the second waste-generating supplier industry in 2010 and paper and cardboard wastes were the third waste category in importance.

**Keywords**

Paper industry
Input-output life cycle assessment model
Suppliers
Waste

## 1. Introduction

Paper industry can be considered as an example to follow. This economic activity has been capable of increasing efficiency and efficacy, it reuses the biomass that papermaking produces, this industry co-generates its own electricity and gives its excess to the national supply and, the paper industry re-incorporates paper waste in the papermaking process. In fact, paper is one of the industries with higher recycling rates. The use of recycled waste paper as a raw material has been growing faster than that of any other material over the last decades (Arminen et al., 2013). According to the European Recovered Paper Council (ERPC, 2014) the recycling rate in Europe grew from 47% in 2005 to 71.7% in 2013. In Spain, according to the Spanish Association of Pulp and Paper Manufacturers (ASPAPEL), the evolution of the use of recovered as percentage of total paper consumption was even more positive, increasing from 62.5% in 2005 to 84.6% in 2013 (ASPAPEL, 2014).

Different reasons explain the growing interest in waste paper recycling such as environmental concerns, waste paper prices or technical progress (Samakovlis, 2003). In addition, it is necessary to precise that waste paper recycling is both supply and demand driven, and, as, a result, shaped by both politics and economics (Berglund et al. 2002). In relation to economic factors, Berglund and Söderholm (2003) affirm that recycling rates are largely economically and not policy determined. Among the major economic factors they point out the demographic features or the competitiveness in the world market. In the case of the demographic characteristics some of the most important variables are the population density and the urbanization rate because they have a direct impact on the cost of collection and recovery. Concerning competitiveness in the world market, this is closely related to the availability of waste paper, which is more and more influenced by China and other emerging economies (Arminen et al., 2015; Hong and Li, 2012; Liang et al., 2012).

Entering into the policy aspect, in Europe the European Declaration on Paper Recycling was adopted in 2000 in line with the objective of building what is called a "circular economy", that is, an economy aimed at using waste as a resource. The Declaration covers 29 countries and the last update was adopted in 2011 for the period 2011-2015. It sets out a target of a 70% recycling rate by 2015 as well as other measures to optimise the management of paper throughout the value chain. It also establishes several enabling policy conditions related, among other policies, to renewable energy policy, the collection systems established by national and local authorities or the trade policy (ERPC, 2011).

Thus, in spite of all the recent efforts made to increase recovery rates and the fact that the use of recovered paper is currently higher than the use of wood pulp as a raw material (Arminen et al., 2015), a rising demand for paper and paper products causes a direct increase in all inputs employed during the production process (that is, not only goods but also services), and, as a result, an increase in the volume of waste generated by the industries that supply these goods and services. As was noted in previous analyses (Del Río González, 2005; Ruiz-Peñalver et al., 2014) one of the main characteristics of the Spanish paper industry is the comparatively higher reliance on inputs from other industries in its production process so the multiplier effect on waste generation can be expected to be higher than in other industries with weaker inter-industry relationships. However, it is necessary to highlight that the Spanish paper industry have decoupled growth and waste generation. In fact, data provided by the World Input-Output Database (WIOD) show that in 2005 the Spanish paper industry output (at basic prices) was amounted to 39,153 million US dollars and in 2010 was 51,982 million US dollars, an increase of 32.77%. Nevertheless, in 2005 the total waste generated by this industry was 1,737 thousand tonnes while, in 2010 was amount to 1,739 thousand tonnes, which is an increase of 0.12%.

Over the last years a growing number of studies have examined the environmental impact of the paper industry. For instance, many life cycle assessment studies (LCAs) have compared the environmental impact of the three main waste paper management options: recycling, incineration and landfilling. In their literature review Villanueva and Wenzel (2007) conclude that LCAs illustrate the environmental benefits of recycling over incineration or landfilling. Economic Input-output Life Cycle Assessment Models (EIO-LCA) combine LCA with Economic Input-output analysis (EIO) and they are faster and less expensive (Nakamura and Kondo, 2002). Moreover, EIO-LCA models include indirect and feedback relationships among the different industries of the economy (Hendrickson et al., 1998). The purpose of this paper is to shed some light on the recent evolution of the waste generated by the suppliers of the Spanish paper industry. The importance of this paper is to validate if as well as the Spanish paper industry, its supply chain has decoupled growth and waste generation. If the supply chain of paper industry fulfils it, the papermaking process can be considered as an example to follow by other industries to get sustainable development in terms of waste generation. We begin by presenting the data employed and the methodology applied. Next, we describe and discuss the results obtained. Finally, we summarise the main conclusions reached.

## 2. Materials and methods

Environmental regulation and awareness, particularly at the producer level, have contributed to increase the publication of waste statistics. In Spain, the data on the generation and treatment of waste are collected on the basis of the Regulation on waste statistics (EC) No. 2150/2002, amended by the Commission Regulation (EU) No. 849/2010. Waste generation statistics are broken down by source type (business or households) and waste categories.

Concerning the source type, waste generated by businesses is broken down by economic activity in categories based on the Statistical classification of economic activities in the European Community (NACE). To date, the Spanish National Statistics Institute (INE) has conducted four major groups of surveys: the survey on waste generation in agriculture, the survey on waste generation in fishing, the surveys on waste generation in the industrial sector and the surveys on waste generation in the service sector and construction. The first two surveys had an experimental nature and only covered the periods 2003-2006 and 2004-2006, respectively. In the two latter cases, the surveys are conducted every two years.

The creation of value added is the criterion for the allocation of waste generation to NACE activities. We have to note, however, that in the survey on waste generation in the service sector and construction the activities related to financial intermediation, public administration and compulsory social activity are excluded.

In relation to waste categories, data are collected according to the European Waste Classification (EWC-Stat) which is a substance-oriented nomenclature. The waste categories employed in this paper are as follows: 01 Chemical compound wastes, 02 Chemical preparation wastes, 03 Other chemical wastes, 05 Health care and biological wastes, 06 Metallic wastes, 07 Non-metallic wastes (except Paper and cardboard wastes), 07.2 Paper and cardboard wastes, 08 Discarded equipment, 09 Animal and vegetal wastes, 10 Mixed wastes, 11 Common sludge, 12 Mineral wastes and 13 Solidified, stabilised or vitrified wastes.

As for input-output data, we employ the national input-output tables for Spain included within the WIOD which covers 27 EU countries and 13 other major countries for the period 1995-2011. The national input-output (IO) tables are in current prices and distinguish 34 industries. The main advantage of the WIOD is that it offers the possibility of conducting temporal comparisons as the tables for all periods are harmonised (Timmer et al., 2015). Additionally, in the case of Spain the tables are more recent than those published by the Spanish National Statistics Institute whose most recent symmetric IO table corresponds to 2005. Because IO tables are aggregated as 34 industries, the most of waste data had to be aggregated in the same manner. This is not the case of paper industry, printing and publishing industry, because they appear aggregated in all the waste generation surveys. The NACE industries distinguished were the following:

Table 1. NACE industries.

| Code | Industry | Code | Industry |
|---|---|---|---|
| 1 | Agriculture, Hunting, Forestry and Fishing | 18 | Construction |
| 2 | Mining and Quarrying | 19 | Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel |
| 3 | Food, Beverages and Tobacco | 20 | Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles |
| 4 | Textiles and Textile Products | 21 | Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods |
| 5 | Leather, Leather and Footwear | 22 | Hotels and Restaurants |
| 6 | Wood and Products of Wood and Cork | 23 | Inland Transport |
| 7 | Pulp, Paper, Paper , Printing and Publishing | 24 | Water Transport |
| 8 | Coke, Refined Petroleum and Nuclear Fuel | 25 | Air Transport |
| 9 | Chemicals and Chemical Products | 26 | Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies |
| 10 | Rubber and Plastics | 27 | Post and Telecommunications |
| 11 | Other Non-Metallic Mineral | 28 | Financial Intermediation |
| 12 | Basic Metals and Fabricated Metal | 29 | Real Estate Activities |
| 13 | Machinery, Nec | 30 | Renting of M&Eq and Other Business Activities |
| 14 | Electrical and Optical Equipment | 31 | Public Admin and Defence; Compulsory Social Security |

| Code | Industry | Code | Industry |
|---|---|---|---|
| 15 | Transport Equipment | 32 | Education |
| 16 | Manufacturing, Nec; Recycling | 33 | Health and Social Work |
| 17 | Electricity, Gas and Water Supply | 34 | Other Community, Social and Personal Services |

As Suh and Kagawa note “recent developments have situated LCA, a key sub-field of industrial ecology, as one of the areas that most extensively utilize IOA (Input-Output Analysis)” (Suh and Kagawa, 2009, p. 48). The product Life Cycle Assessment (LCA) is a structured method to quantify the environmental impact of the full life cycle of a product, from the extraction of resources to production, use, recycling and/or disposal of waste. Several methodological frameworks have been introduced to implement LCA. Probably the most known is the harmonisation that gave place to the international standards ISO 14040 and ISO14044 within the *International Organisation for Standardisation* (ISO), but there are also other initiatives such as those of the *Society of Environmental Toxicology and Chemistry* (SETAC), the *U.S. Environmental Protection Agency* (EPA), the *United Nations Environmental Program* (UNEP) or the *European Platform on LCA* coordinated by the European Commission. This platform published in 2010 within the *International Reference Life Cycle Data System (ILCD) Handbook* a *General guide for Life Cycle Assessment-Detailed guidance* which details the ISO 10444 provisions and differentiates them for three main types of decision levels: the micro level, the meso/macro level and accounting (European Commission et al., 2010).

One of the major strengths of LCA is its simplicity. However, there are critical issues in these models, especially the fact that the assumptions and, as a consequence, the results provided, can be different depending on the analyst (De la Rúa Lope, 2009; Karmperis et al., 2013; Morrissey and Browne, 2004). In particular the simplifications that have to be made to the model, like the omission of resources or pollutant releases from higher order upstream stages, cause significant losses of information commonly known as “truncation problems” (Lewandowska and Foltynowicz, 2004; Hawkins, 2007).

Inspired by the pioneering pollution abatement model developed by Wassily Leontief in the 70s (Leontief, 1970), hybrid models combining process modelling and economic input-output analysis have been developed (Costello et al., 2011; Hawkins, 2007; Hawkins et al., 2007; Hendrickson et al, 1998; Hendrickson et al, 2006; Hendrickson et al, 2008; Joshi, 2000; Suh, 2004; Suh et al., 2004). Rebitzer et al. (2004) point out that LCA and EIO are not mathematically different although there are differences in four major aspects: data sources (unit process versus economic national accounts), commodity flow units (physical units versus economic value), level of process/commodity detail and covered life cycle stages (complete life cycle versus pre-use or consumption stages). Obviously, the EIO-LCA models also present disadvantages, many of them related to the simplifying hypothesis adopted in EIO analysis such as the assumptions related to domestic and imported technological and economic structures (Hoekstra and van den Bergh, 2006; Miller and Blair, 2009; Nakamura et al., 2007; Peters and Hertwich, 2006; Suh, 2004). In addition, the classification of industries of the tables aggregate disparate products within the same industry and focuses on upstream burdens ignoring the effects of product use (Joshi, 2000).

In our analysis we employ a straightforward approach to estimate waste generation (Ruiz-Peñalver et al. 2014). The EIO-LCA lengthens the Leontief´s demand model. Equation (1) is the basis of it.

$$X = (I-A)^{-1} y \qquad (1)$$

In an economy with *n* industries, *X* is the final output which depends on *y* which is the final demand (final consumption, gross fixed capital formation and exports). $(I-A)^{-1}$ is the total requirement matrix or Leontief inverse matrix. *I* is the identity matrix. *A* is the technical coefficients matrix and represents the inputs that each industry requires from others per dollar of output. Therefore, the Leontief inverse matrix represents the total requirements per unit of final demand. Therefore, Equation (1) represents the multiplier effect that the production of a good or a service exerts on the total economy as it takes into account all the elements of the supply chain.

Using the surveys mentioned above (INE, 2009a, 2009b, 2009c, 2009d, 2012a, 2012b), we construct a diagonal matrix of waste generation *R*, each element of its diagonal is the amount of waste generated per dollar of industry j´s output. In our case, we focus on the paper industry, so if we multiply this matrix by the output of the paper industry obtained by the Leontief´s demand model, we obtain the total volume of waste generated by this activity directly and indirectly per dollar of output, $W_t$, as follows:

$$W_t = R\,(I-A)^{-1} y \qquad (2)$$

Equation (2) can be disaggregated to differentiate between the waste generated by direct suppliers of the paper industry ($W_d$) and by indirect suppliers ($W_i$) as follows:

$$W_d = R\,(I+A)\, y \qquad (3)$$

$$W_i = R\,[(I-A)^{-1} - (I+A)]\, y \qquad (4)$$

**3. Results and discussion.**

Before entering into the analysis of the waste generated by direct and indirect suppliers of the paper industry, we examine the multiplier effect that the Spanish paper industry exerted on its supply chain. Table 2 shows the obtained results. As it shows, the production related to the multiplier effect is bigger in 2010 than 2005. Therefore, the most of the suppliers of the Spanish paper industry had a higher level of production in 2010 than 2005. However, what amount of waste do the suppliers generate because of providing paper industry?

Table 2. Production associated with the multiplier effect that the Spanish paper industry exerted on its supply chain.

| | Production related to multiplier effect 2005 | Production related to multiplier effect 2010 | Difference | Percentage change |
|---|---|---|---|---|
| 1 | 689.87 | 770.35 | 80.48 | 0.12 |
| 2 | 89.24 | 80.84 | -8.40 | -0.09 |
| 3 | 313.77 | 370.29 | 56.52 | 0.18 |
| 4 | 186.53 | 87.77 | -98.76 | -0.53 |
| 5 | 4.97 | 3.06 | -1.92 | -0.39 |
| 6 | 577.72 | 580.13 | 2.41 | 0.00 |
| 7 | 6,312.82 | 6,227.09 | -85.74 | -0.01 |
| 8 | 476.67 | 462.73 | -13.94 | -0.03 |
| 9 | 699.54 | 912.98 | 213.45 | 0.31 |
| 10 | 472.00 | 484.96 | 12.96 | 0.03 |
| 11 | 176.76 | 186.47 | 9.71 | 0.05 |
| 12 | 1,591.76 | 1,825.05 | 233.28 | 0.15 |
| 13 | 588.06 | 557.89 | -30.17 | -0.05 |
| 14 | 157.43 | 151.49 | -5.95 | -0.04 |
| 15 | 173.19 | 104.90 | -68.29 | -0.39 |
| 16 | 435.39 | 472.99 | 37.60 | 0.09 |
| 17 | 2,171.43 | 3,776.46 | 1605.03 | 0.74 |
| 18 | 1,007.28 | 1,165.62 | 158.34 | 0.16 |
| 19 | 600.93 | 679.02 | 78.09 | 0.13 |
| 20 | 2,152.34 | 2,615.69 | 463.35 | 0.22 |
| 21 | 1,351.72 | 1,664.60 | 312.88 | 0.23 |
| 22 | 255.95 | 283.44 | 27.50 | 0.11 |
| 23 | 2,316.63 | 2,317.59 | 0.96 | 0.00 |
| 24 | 38.57 | 42.65 | 4.08 | 0.11 |
| 25 | 57.03 | 71.55 | 14.52 | 0.25 |
| 26 | 1,279.51 | 1,445.99 | 166.48 | 0.13 |
| 27 | 914.42 | 873.63 | -40.79 | -0.04 |
| 28 | 1,012.78 | 1,541.41 | 528.63 | 0.52 |
| 29 | 895.63 | 879.59 | -16.04 | -0.02 |
| 30 | 3,192.71 | 4,250.99 | 1,058.28 | 0.33 |
| 31 | 258.02 | 365.84 | 107.82 | 0.42 |
| 32 | 151.14 | 163.62 | 12.48 | 0.08 |
| 33 | 121.26 | 141.54 | 20.28 | 0.17 |
| 34 | 1614.22 | 1703.63 | 89.40 | 0.06 |
| Total | 32,337.29 | 37,261.82 | 4,924.53 | 0.15 |

Source: Own creation from WIOD.

Once we have obtained the production associated with the multiplier effect of the Spanish paper industry on its suppliers, we are going to study the distribution of the total waste generated in the Spanish economy and in the paper industry in 2005 and 2010 by sector and by waste category.

First, Table 3 provides a summary of how the waste generated within the Spanish economy was distributed in terms of sectors in the years 2005 and 2010.

Table 3. Total waste generation by sector, 2005-2010.

| Sector | Thousand tonnes | | Share | | Percentage Change |
|---|---|---|---|---|---|
| | 2005 | 2010 | 2005 | 2010 | 2005/2010 |
| Agriculture | 18,979 | 15,151 | 21.42 | 19.76 | -20.17 |
| Mining | 28,958 | 31,732 | 32.69 | 41.38 | 9.58 |
| Manufacturing (exc. Paper) | 29,690 | 17,080 | 33.51 | 22.27 | -42.47 |
| *Paper* | *1,737* | *1,739* | *1.96* | *2.27* | *0.11* |
| Services | 9,226 | 10,981 | 10.41 | 14.32 | 19.02 |
| Total | 88,590 | 76,683 | 100 | 100 | -13.44 |

Source: INE.

Overall, the volume of waste generated reduced over the period analysed: in 2010 the total generation of waste in Spain amounted to 76,683 thousand tonnes compared to 88,590 thousand tonnes in 2005.

It could be said that this decrease of the volume of waste generation is due to the fact that the number of industries in 2010 was inferior than in 2005 because of the economic downturn caused by the crisis. Therefore, less production should generate less waste. Nevertheless, the most important sector in terms of waste generation was mining followed by the manufacturing sector: in 2010 around 66% of total waste was generated by these two sectors. However, they experienced very different trajectories over the period analysed: while the amount of waste generated by manufacturing considerably diminished there was an increase in the volume of waste generated by mining. The agriculture sector accounted for around 20% of total waste generation. The minor contributor was services. It is important to highlight that firms under 10 employees were included in the 2010 survey but not in 2005 survey so this mainly explains the increase in the contribution of services to waste generation. Focusing on the paper industry, the waste generated increased very slightly over the period 2005-2010 from 1,737 to 1,739 thousand tonnes. However, as the total volume of waste generated in the economy diminished, the contribution of the paper industry grew from 1.96% to 2.27%. In this case, the Spanish paper industry had a different behaviour because the number of paper mills in the analysed period was balanced. Therefore, the increase of growth and the decrease of waste generation between 2005 and 2010 is explained by the high investment in high technologies carried out by the Spanish paper industry to reduce the waste generation (ASPAPEL, 2014).

In addition to the waste generated in the different sectors we examine the breakdown of waste by waste category. Table 4 shows the waste generated in the total economy and in the paper industry in 2010 by waste category. The waste categories referred to are based on the statistical nomenclature EWC-Stat, version 4.

Table 4. Total waste generation by waste category, 2010.

| Category | Thousand tonnes | | Share | |
|---|---|---|---|---|
| | Total | Paper | Total | Paper |
| 01 Chemical compound wastes | 922 | 83 | 1.20 | 4.80 |
| 02 Chemical preparation wastes | 264 | 0 | 0.34 | 0.00 |
| 03 Other chemical wastes | 1,209 | 268 | 1.58 | 15.40 |
| 05 Health care and biological wastes | 439 | 0 | 0.57 | 0.00 |
| 06 Metallic wastes | 2,402 | 16 | 3.13 | 0.89 |
| 07 Non-metallic wastes (exc. 0.7.2) | 3,460 | 75 | 4.51 | 4.30 |
| *07.2 Paper and cardboard wastes* | *2,644* | *577* | *3.45* | *33.21* |
| 08 Discarded equipment | 981 | 0 | 1.28 | 0.01 |
| 09 Animal and vegetal wastes | 18,726 | 0 | 24.42 | 0.00 |
| 10 Mixed wastes | 2,888 | 489 | 3.77 | 28.13 |
| 11 Common sludges | 324 | 165 | 0.42 | 9.48 |
| 12 Mineral wastes | 42,373 | 66 | 55.26 | 3.77 |
| 13 Solidified, stabilised or vitrified wastes | 51 | 0 | 0.07 | 0.01 |
| Total | 76,683 | 1,739 | 100 | 100 |

Source: INE.

As can be seen in Table 4, the total waste generated is strongly concentrated: more than 55% of total waste is mineral wastes, that is, waste generated from construction and demolition, and, especially, from extractive industries. The second waste category in importance was animal and vegetal wastes that accounted for almost one quarter of total waste generated. Non-metallic wastes were the third most relevant category, representing almost 8% of total waste generated. Within the category of non-metallic wastes, paper and cardboard wastes amounted to 2,644 thousand tonnes in 2010, that is, 3.45% of total waste. If we look at the distribution by waste category in the paper industry we can see how, as was expected, paper and cardboard wastes are the most important category, followed by mixed wastes and other chemical wastes. These three categories accounted for more than three quarters of total waste generated in the paper industry.

Once examined the evolution of the waste generated by the Spanish economy in general and by the paper industry in particular, we describe the results of applying our EIO-LCA model. Table 5 reports the evolution of the total amount of waste generated by the top-ten waste generating suppliers of the paper industry in the years 2005 and 2010. In the last row we also show the amount of waste generated by the total of supplier industries.

Table 5. Waste generated by suppliers of the paper industry, 2005-2010.

| 2005 | | | 2010 | | |
|---|---|---|---|---|---|
| Industry | Thousand tonnes | Share | Industry | Thousand tonnes | Share |
| Agriculture, Hunting, Forestry and Fishing | 243 | 14.78 | Agriculture, Hunting, Forestry and Fishing | 186 | 14.88 |
| Mining and Quarrying | 359 | 21.84 | Mining and Quarrying | 395 | 31.6 |
| Wood and Products of Wood and Cork | 25 | 1.52 | Wood and Products of Wood and Cork | 15 | 1.2 |
| Pulp, Paper | 280 | 17.03 | Pulp, Paper | 255 | 20.4 |
| Chemicals and Chemical Products | 43 | 2.62 | Chemicals and Chemical Products | 19 | 1.52 |
| Other Non-Metallic Mineral | 15 | 0.91 | Other Non-Metallic Mineral | 16 | 1.28 |
| Basic Metals and Fabricated Metal | 130 | 7.91 | Basic Metals and Fabricated Metal | 78 | 6.24 |
| Electricity, Gas and Water Supply | 327 | 19.89 | Electricity, Gas and Water Supply | 93 | 7.44 |
| Wholesale Trade | 80 | 4.87 | Wholesale Trade | 70 | 5.6 |
| Retail Trade | 35 | 2.13 | Retail Trade | 35 | 2.8 |
| Renting of M&Eq and Other Business Activities | 1 | 0.06 | Renting of M&Eq and Other Business Activities | 32 | 2.56 |
| Other Supporting and Auxiliary Transport Activities | 25 | 1.52 | Other Supporting and Auxiliary Transport Activities | 0 | 0 |
| Total | 1,644 | | Total | 1,250 | |

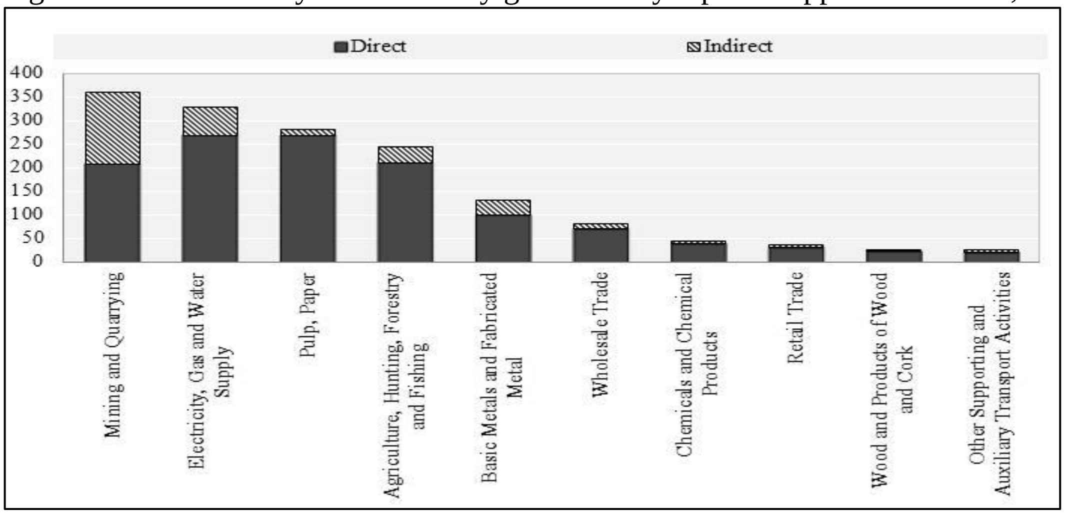
Source: INE.

The first point to note is that, as the total waste generated in the economy diminished, the waste generated by the suppliers of the paper industry dropped from 1,644 thousand tonnes to 1,250 thousand tonnes in 2010. Given the relevance in waste generation of mineral wastes, the industry of mining quarrying was the supplier industry that generated a highest amount of waste both in 2005 and 2010. Because of the close linkages among firms within the own paper industry, an important share of waste was generated by firms belonging to the paper industry. The industry of agriculture, hunting, forestry and fishing also played a very relevant role mainly explained, as in the case of mining and quarrying, by its importance in the generation of animal and vegetal wastes. Together, these three industries accounted for 53.63% in 2005 and 66.90% in 2010 of the total waste generated by the suppliers of the paper industry.

Some changes deserve special mention, in particular the decrease experienced by the industry of electricity, gas and water supply and by other supplier industries like basic metals and fabricated metal, chemicals and chemicals products, wood and products of wood and cork or other supporting and auxiliary transport activities. In contrast, the contribution of the industries of renting of machinery and equipment and other business activities and other non-metallic mineral substantially increased over the period.

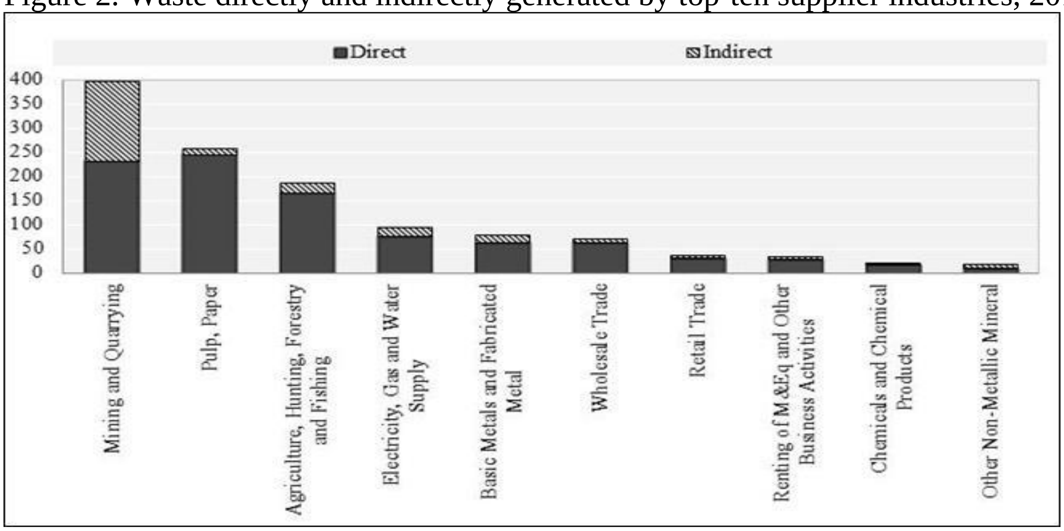
In order to differentiate between direct and indirect suppliers, in Figures 1 and 2 we divide the total waste generated reported in Table 5 into the waste generated by direct suppliers and by indirect suppliers within the same industry.

Figure 1. Waste directly and indirectly generated by top-ten supplier industries, 2005.




Source: INE.

Figure 2. Waste directly and indirectly generated by top-ten supplier industries, 2010




Source: INE.

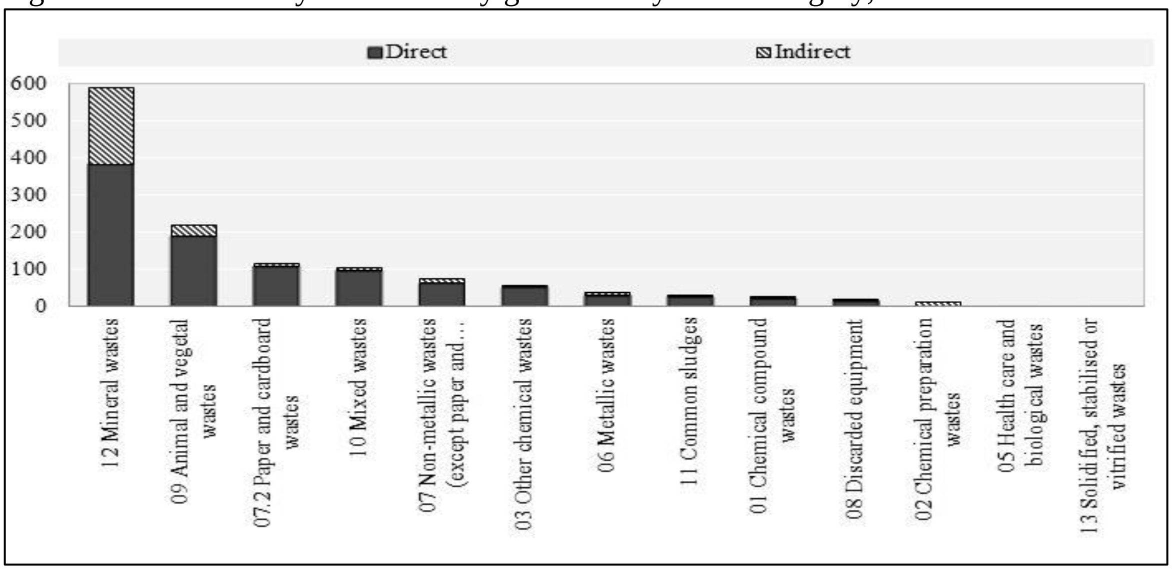
The first fact to mention is that the contribution of direct and indirect suppliers remained almost unaltered over the period: direct suppliers generated between 77-78% of waste and indirect suppliers between 21-22%. Moreover, in all the top-ten supplier industries with the sole exception of electricity, gas and water supply the contribution of direct suppliers increased over the period.

In 2005 the industry where indirect suppliers played a greater role was mining and quarrying (43% of the total waste). However, although the contribution of indirect suppliers continued to be the same in 2010, the first position in terms of importance of indirect

suppliers in 2010 was held by the industry of other non-metallic mineral products, where surpassing 53% of waste was generated by indirect suppliers.
At the opposite end of the scale we find the suppliers belonging to the industry of pulp and paper, where the contribution of direct suppliers amounted to more than 95% of total waste generated.

After analysing the waste generated by direct and indirect suppliers by industry we differentiate among waste categories. Figure 3 distributes the waste generated by direct and indirect suppliers by waste category.

Figure 3. Waste directly and indirectly generated by waste category, 2010




Source: INE

Most of waste generated was mineral wastes (47%), followed by animal and vegetal wastes (17.3%). The third waste category in importance was paper and cardboard wastes which accounted for 104.71 thousand tonnes, that is, 9% of the total waste generated by the suppliers of the paper industry. Mixed wastes presented a similar share: 8.17%. Again, most of waste categories were mainly generated by direct suppliers, the contribution being especially remarkable in the case of paper and cardboard wastes and mixed wastes where more than 92% of waste was generated by direct suppliers. In line with the results obtained in the analysis of the waste generated by supplier industry, the highest contribution of indirect suppliers was found in the generation of mineral wastes where indirect suppliers represented more than 35% of waste generation.

**4. Conclusions**

This paper used input-output tables and different survey data on waste generation to examine the evolution of the total waste generated by the suppliers of the Spanish paper industry to validate if they have decoupled growth and waste generation, over the period 2005-2010.
The analysis of the evolution of waste generation in the Spanish economy revealed that there is a high degree of concentration, both in terms of sectors and in terms of waste

categories. In sectoral terms the mining sector was the leading sector and in terms of waste categories mineral wastes and animal and vegetal wastes were the main categories.

Despite the volume of waste generated by many manufacturing activities decreased over the period 2005-2010, the amount of waste generated by the Spanish paper industry increased very slightly (0.12%), although its production raised incredibly (32.77%). In difference with the structure by waste category in the total economy, paper and cardboard wastes are the main type of waste generated by the paper industry, followed by mixed wastes and other chemical wastes. These three categories represent the highest amount of total waste generated by the paper industry.

The estimation of the volume of waste generated by the suppliers of the paper industry show that, although the impact on some suppliers (especially indirect suppliers) can be small, taken as a whole they are significant. Thus, although the amount of waste generated by the suppliers of the paper industry diminished over the period 2005-2010 due to the general decrease experienced by the volume of waste generated in the economy, the waste generated by suppliers amounted to 1,250 thousand tonnes in 2010, an important volume if we take into account that the waste generated by the own paper industry in 2010 amounted to 1,739 thousand tonnes.

As was expected, most of waste was generated by direct suppliers. However, there are some industries where indirect suppliers play a very relevant role like mining and quarrying or other non-metallic mineral products. The high concentration noted above also reflects in the ranking of waste generating industries: mining and quarrying was the leading supplier industry in terms of waste generation. Mineral wastes were also the main category in terms of waste generation, followed by animal and vegetal wastes. The strong intra-industry relationships existent within own paper industry also had a reflection in the raking of industries and waste categories: the paper industry was the second waste-generating supplier industry in 2010 and paper and cardboard wastes were the third waste category in importance.

Finally, data have shown that the production associated with the multiplier effect that the Spanish paper industry exerted in 2010 was higher than 2005. Additionally, the waste generated by all its suppliers was amounted to 1,644 tonnes in 2005 and 1,250 tonnes in 2010. Therefore, it can be said that papermaking process (including the Spanish paper industry and its whole supply chain) has decoupled economic growth and waste generation. Thus, papermaking process is an example to follow by other industries to get sustainable development in terms of waste generation.

Obviously, the model employed in this paper suffers from important limitations. The major ones are related to the hypotheses commonly employed in EIO analysis. In addition, a more detailed disaggregation of industries would be desirable. Anyway, as highlighted by Finnveden et al. (2009) in their review of recent developments in LCA, “the combination of IOA and LCA is promising to complement LCA applications for macro-level policy support” (Finnveden et al., 2009, p. 16). In our case we have shown that inter-industry relationships matter when evaluating the evolution of waste generation and they have to be taken into consideration if we really want to have an accurate picture of the environmental impacts that production processes cause.

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Appendix 1. Matrix A, year 2005.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0,04 | 0,00 | 0,16 | 0,02 | 0,01 | 0,05 | 0,01 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 2 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,05 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,02 |
| 3 | 0,10 | 0,00 | 0,16 | 0,01 | 0,05 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 4 | 0,00 | 0,00 | 0,00 | 0,16 | 0,02 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,01 | 0,00 |
| 5 | 0,00 | 0,00 | 0,00 | 0,00 | 0,11 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 6 | 0,00 | 0,01 | 0,00 | 0,00 | 0,01 | 0,23 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,07 | 0,00 |
| 7 | 0,00 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,13 | 0,00 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 | 0,01 | 0,00 | 0,03 | 0,01 |
| 8 | 0,01 | 0,03 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,09 | 0,03 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,03 |
| 9 | 0,01 | 0,02 | 0,01 | 0,02 | 0,01 | 0,01 | 0,01 | 0,00 | 0,08 | 0,05 | 0,01 | 0,01 | 0,00 | 0,01 | 0,01 | 0,01 | 0,00 |
| 10 | 0,00 | 0,01 | 0,01 | 0,01 | 0,05 | 0,01 | 0,01 | 0,00 | 0,01 | 0,13 | 0,01 | 0,01 | 0,01 | 0,03 | 0,04 | 0,02 | 0,00 |
| 11 | 0,00 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,09 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 |
| 12 | 0,02 | 0,04 | 0,02 | 0,01 | 0,01 | 0,02 | 0,02 | 0,00 | 0,01 | 0,02 | 0,03 | 0,19 | 0,17 | 0,12 | 0,09 | 0,17 | 0,01 |
| 13 | 0,01 | 0,03 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,01 | 0,01 | 0,03 | 0,02 | 0,06 | 0,01 | 0,01 | 0,01 | 0,01 |
| 14 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,03 | 0,09 | 0,02 | 0,01 | 0,01 |
| 15 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,13 | 0,00 | 0,00 |
| 16 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,07 | 0,00 | 0,00 | 0,00 | 0,03 | 0,00 |
| 17 | 0,02 | 0,06 | 0,02 | 0,02 | 0,01 | 0,02 | 0,03 | 0,00 | 0,03 | 0,03 | 0,05 | 0,03 | 0,01 | 0,02 | 0,01 | 0,01 | 0,18 |
| 18 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 | 0,01 | 0,01 | 0,00 | 0,01 | 0,00 | 0,01 | 0,00 | 0,01 | 0,00 | 0,00 | 0,01 | 0,01 |
| 19 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,02 | 0,01 | 0,01 |
| 20 | 0,03 | 0,02 | 0,06 | 0,06 | 0,06 | 0,05 | 0,04 | 0,01 | 0,04 | 0,04 | 0,04 | 0,03 | 0,03 | 0,04 | 0,03 | 0,04 | 0,01 |
| 21 | 0,03 | 0,02 | 0,05 | 0,06 | 0,06 | 0,03 | 0,02 | 0,01 | 0,04 | 0,03 | 0,03 | 0,02 | 0,02 | 0,03 | 0,03 | 0,03 | 0,01 |
| 22 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 23 | 0,00 | 0,05 | 0,04 | 0,03 | 0,02 | 0,03 | 0,04 | 0,01 | 0,03 | 0,03 | 0,05 | 0,02 | 0,02 | 0,01 | 0,01 | 0,02 | 0,00 |
| 24 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 25 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 26 | 0,01 | 0,04 | 0,01 | 0,01 | 0,00 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,02 | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 |
| 27 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,01 | 0,00 | 0,01 | 0,00 | 0,01 | 0,01 | 0,00 | 0,00 | 0,02 |
| 28 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 |
| 29 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 |
| 30 | 0,00 | 0,05 | 0,05 | 0,04 | 0,05 | 0,02 | 0,05 | 0,01 | 0,05 | 0,04 | 0,04 | 0,03 | 0,04 | 0,04 | 0,03 | 0,03 | 0,04 |
| 31 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 |
| 32 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 33 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 34 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,03 | 0,00 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

| | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0,00 | 0,00 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 |
| 2 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 3 | 0,00 | 0,00 | 0,00 | 0,00 | 0,13 | 0,00 | 0,02 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 |
| 4 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 |
| 5 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 7 | 0,00 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,01 | 0,01 | 0,00 | 0,06 | 0,02 | 0,01 | 0,01 | 0,02 |
| 8 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,07 | 0,07 | 0,08 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 9 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,02 | 0,00 |
| 10 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 11 | 0,07 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 12 | 0,04 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 |
| 13 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 |
| 14 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 |
| 15 | 0,00 | 0,08 | 0,00 | 0,00 | 0,00 | 0,02 | 0,02 | 0,02 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 |
| 16 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 |
| 17 | 0,00 | 0,02 | 0,02 | 0,04 | 0,01 | 0,01 | 0,02 | 0,00 | 0,01 | 0,02 | 0,01 | 0,00 | 0,01 | 0,03 | 0,01 | 0,01 | 0,01 |
| 18 | 0,34 | 0,01 | 0,01 | 0,02 | 0,01 | 0,00 | 0,01 | 0,01 | 0,03 | 0,02 | 0,01 | 0,11 | 0,01 | 0,01 | 0,02 | 0,01 | 0,02 |
| 19 | 0,01 | 0,02 | 0,01 | 0,00 | 0,01 | 0,04 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 |
| 20 | 0,01 | 0,02 | 0,03 | 0,01 | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 | 0,01 | 0,01 | 0,00 | 0,02 | 0,01 |
| 21 | 0,02 | 0,02 | 0,01 | 0,00 | 0,03 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 | 0,01 | 0,01 | 0,00 | 0,02 | 0,01 |
| 22 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,05 | 0,00 | 0,01 | 0,00 | 0,01 | 0,01 | 0,00 | 0,01 | 0,01 |
| 23 | 0,00 | 0,02 | 0,07 | 0,02 | 0,00 | 0,01 | 0,01 | 0,01 | 0,13 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,01 |
| 24 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 25 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,02 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 26 | 0,00 | 0,01 | 0,04 | 0,01 | 0,00 | 0,15 | 0,21 | 0,10 | 0,15 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 |
| 27 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,02 | 0,01 | 0,15 | 0,02 | 0,01 | 0,04 | 0,03 | 0,01 | 0,01 | 0,01 |
| 28 | 0,01 | 0,02 | 0,02 | 0,02 | 0,01 | 0,02 | 0,01 | 0,02 | 0,01 | 0,01 | 0,17 | 0,06 | 0,01 | 0,01 | 0,00 | 0,01 | 0,01 |
| 29 | 0,01 | 0,03 | 0,05 | 0,09 | 0,04 | 0,01 | 0,00 | 0,00 | 0,02 | 0,02 | 0,02 | 0,01 | 0,02 | 0,01 | 0,01 | 0,02 | 0,02 |
| 30 | 0,02 | 0,06 | 0,06 | 0,05 | 0,01 | 0,04 | 0,06 | 0,11 | 0,02 | 0,07 | 0,05 | 0,03 | 0,06 | 0,05 | 0,01 | 0,03 | 0,04 |
| 31 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 32 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 33 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,05 | 0,00 |
| 34 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,01 | 0,00 | 0,00 | 0,01 | 0,01 | 0,00 | 0,04 | 0,01 | 0,00 | 0,01 | 0,11 |

Appendix 2. Matrix A, year 2010.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0,04 | 0,00 | 0,15 | 0,02 | 0,01 | 0,05 | 0,01 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 2 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,04 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 |
| 3 | 0,11 | 0,00 | 0,16 | 0,01 | 0,05 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 4 | 0,00 | 0,00 | 0,00 | 0,08 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 5 | 0,00 | 0,00 | 0,00 | 0,00 | 0,07 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 6 | 0,00 | 0,01 | 0,00 | 0,00 | 0,01 | 0,21 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,06 | 0,00 |
| 7 | 0,00 | 0,00 | 0,01 | 0,00 | 0,01 | 0,01 | 0,12 | 0,00 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,03 | 0,01 |
| 8 | 0,01 | 0,03 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,10 | 0,03 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,03 |
| 9 | 0,01 | 0,02 | 0,01 | 0,02 | 0,01 | 0,01 | 0,01 | 0,00 | 0,08 | 0,05 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 |
| 10 | 0,01 | 0,01 | 0,01 | 0,01 | 0,05 | 0,01 | 0,01 | 0,00 | 0,01 | 0,13 | 0,00 | 0,00 | 0,01 | 0,03 | 0,03 | 0,02 | 0,00 |
| 11 | 0,00 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,10 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 |
| 12 | 0,02 | 0,04 | 0,01 | 0,01 | 0,01 | 0,02 | 0,02 | 0,00 | 0,00 | 0,02 | 0,03 | 0,20 | 0,18 | 0,12 | 0,10 | 0,18 | 0,01 |
| 13 | 0,01 | 0,02 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,01 | 0,01 | 0,02 | 0,01 | 0,05 | 0,01 | 0,01 | 0,01 | 0,01 |
| 14 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,03 | 0,08 | 0,01 | 0,00 | 0,00 |
| 15 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,07 | 0,00 | 0,00 |
| 16 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,07 | 0,00 | 0,00 | 0,00 | 0,03 | 0,00 |
| 17 | 0,02 | 0,09 | 0,02 | 0,02 | 0,02 | 0,03 | 0,05 | 0,01 | 0,04 | 0,04 | 0,06 | 0,04 | 0,02 | 0,02 | 0,02 | 0,01 | 0,25 |
| 18 | 0,01 | 0,02 | 0,01 | 0,01 | 0,00 | 0,01 | 0,01 | 0,00 | 0,01 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,01 |
| 19 | 0,01 | 0,01 | 0,01 | 0,02 | 0,01 | 0,01 | 0,01 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,02 | 0,01 | 0,01 |
| 20 | 0,03 | 0,02 | 0,05 | 0,07 | 0,06 | 0,07 | 0,04 | 0,01 | 0,04 | 0,04 | 0,05 | 0,03 | 0,04 | 0,04 | 0,05 | 0,05 | 0,01 |
| 21 | 0,03 | 0,02 | 0,05 | 0,07 | 0,06 | 0,04 | 0,02 | 0,02 | 0,04 | 0,03 | 0,04 | 0,02 | 0,03 | 0,04 | 0,05 | 0,04 | 0,01 |
| 22 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 23 | 0,01 | 0,05 | 0,04 | 0,03 | 0,03 | 0,03 | 0,03 | 0,01 | 0,03 | 0,03 | 0,05 | 0,02 | 0,02 | 0,02 | 0,02 | 0,02 | 0,00 |
| 24 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 25 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 26 | 0,01 | 0,05 | 0,01 | 0,01 | 0,00 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,02 | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 |
| 27 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,01 | 0,00 | 0,01 | 0,00 | 0,01 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,02 |
| 28 | 0,01 | 0,01 | 0,02 | 0,02 | 0,02 | 0,01 | 0,02 | 0,01 | 0,01 | 0,01 | 0,02 | 0,02 | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 |
| 29 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 |
| 30 | 0,01 | 0,06 | 0,05 | 0,05 | 0,05 | 0,02 | 0,05 | 0,02 | 0,07 | 0,05 | 0,05 | 0,03 | 0,04 | 0,04 | 0,04 | 0,03 | 0,05 |
| 31 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,01 | 0,00 | 0,00 |
| 32 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 33 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 34 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,03 | 0,00 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

| | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0,00 | 0,00 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 |
| 2 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 3 | 0,00 | 0,00 | 0,00 | 0,00 | 0,13 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 |
| 4 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 5 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 7 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,04 | 0,01 | 0,01 | 0,00 | 0,02 |
| 8 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,06 | 0,06 | 0,07 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 9 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,02 | 0,00 |
| 10 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 11 | 0,06 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 12 | 0,03 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 13 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 |
| 14 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 15 | 0,00 | 0,03 | 0,00 | 0,00 | 0,00 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 16 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 |
| 17 | 0,00 | 0,02 | 0,03 | 0,04 | 0,01 | 0,02 | 0,03 | 0,00 | 0,01 | 0,03 | 0,01 | 0,00 | 0,01 | 0,03 | 0,02 | 0,01 | 0,02 |
| 18 | 0,33 | 0,01 | 0,01 | 0,03 | 0,02 | 0,00 | 0,01 | 0,01 | 0,04 | 0,02 | 0,01 | 0,06 | 0,02 | 0,01 | 0,02 | 0,01 | 0,02 |
| 19 | 0,01 | 0,03 | 0,01 | 0,00 | 0,01 | 0,04 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 |
| 20 | 0,01 | 0,02 | 0,03 | 0,01 | 0,02 | 0,01 | 0,01 | 0,01 | 0,00 | 0,01 | 0,00 | 0,00 | 0,01 | 0,01 | 0,00 | 0,01 | 0,01 |
| 21 | 0,02 | 0,03 | 0,01 | 0,00 | 0,03 | 0,01 | 0,01 | 0,02 | 0,00 | 0,01 | 0,00 | 0,00 | 0,01 | 0,01 | 0,00 | 0,02 | 0,01 |
| 22 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,05 | 0,00 | 0,01 | 0,00 | 0,01 | 0,01 | 0,00 | 0,01 | 0,01 |
| 23 | 0,00 | 0,02 | 0,06 | 0,01 | 0,00 | 0,02 | 0,01 | 0,01 | 0,14 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,01 |
| 24 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 25 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,02 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 26 | 0,00 | 0,02 | 0,04 | 0,01 | 0,00 | 0,16 | 0,23 | 0,14 | 0,17 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 |
| 27 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 | 0,02 | 0,01 | 0,12 | 0,02 | 0,01 | 0,04 | 0,03 | 0,01 | 0,01 | 0,01 |
| 28 | 0,01 | 0,02 | 0,02 | 0,02 | 0,01 | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 | 0,19 | 0,03 | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 |
| 29 | 0,01 | 0,03 | 0,04 | 0,08 | 0,04 | 0,01 | 0,00 | 0,01 | 0,01 | 0,02 | 0,02 | 0,00 | 0,02 | 0,01 | 0,01 | 0,02 | 0,02 |
| 30 | 0,03 | 0,07 | 0,07 | 0,06 | 0,02 | 0,06 | 0,05 | 0,13 | 0,03 | 0,09 | 0,06 | 0,02 | 0,10 | 0,06 | 0,01 | 0,04 | 0,04 |
| 31 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,01 | 0,01 | 0,00 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 32 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 33 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,05 | 0,00 |
| 34 | 0,00 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,01 | 0,00 | 0,04 | 0,01 | 0,00 | 0,01 | 0,12 |

Appendix 3. Diagonal of the R matrix for the direct suppliers, 2005.

| Industry | 01 Chemical compound wastes | 02 Chemical preparation wastes | 03 Other chemical wastes | 05 Health care and biological wastes | 06 Metallic wastes | 07.2 Non-metallic wastes (except 07.2) | 07.2 Paper and cardboard wastes |
|---|---|---|---|---|---|---|---|
| 1 | 189,16 | 322,96 | 71,72 | 162,32 | 96,84 | 1856,97 | 139,98 |
| 2 | 23,20 | 1,27 | 971,34 | 0,07 | 86,01 | 33,37 | 3,78 |
| 3 | 58,61 | 30,56 | 266,31 | 71,43 | 109,19 | 481,08 | 241,89 |
| 4 | 43,15 | 5,46 | 270,65 | 0,01 | 20,93 | 529,52 | 126,25 |
| 5 | 0,45 | 0,37 | 15,99 | 0,00 | 5,72 | 13,89 | 6,11 |
| 6 | 44,19 | 255,67 | 159,84 | 6,75 | 150,54 | 18047,33 | 125,38 |
| 7 | 3074,98 | 3957,85 | 11223,69 | 5,38 | 2293,64 | 11043,98 | 128992,91 |
| 8 | 75,48 | 11,88 | 473,01 | 0,01 | 43,31 | 21,83 | 1,43 |
| 9 | 1774,78 | 2917,01 | 7314,60 | 7,12 | 254,82 | 821,91 | 467,48 |
| 10 | 137,32 | 84,79 | 315,84 | 0,15 | 245,67 | 2967,10 | 366,46 |
| 11 | 13,11 | 7,67 | 782,14 | 0,03 | 74,16 | 623,33 | 70,06 |
| 12 | 5969,15 | 515,64 | 13030,46 | 1,63 | 17412,17 | 533,06 | 617,74 |
| 13 | 702,47 | 47,69 | 154,33 | 33,33 | 2774,27 | 345,10 | 311,86 |
| 14 | 41,52 | 13,40 | 26,99 | 0,36 | 164,88 | 90,89 | 64,14 |
| 15 | 49,67 | 19,91 | 76,53 | 0,58 | 1055,70 | 78,56 | 41,39 |
| 16 | 40,81 | 77,95 | 38,15 | 0,22 | 304,95 | 1733,42 | 302,85 |
| 17 | 103,00 | 24,73 | 3426,68 | 0,03 | 264,73 | 41,54 | 13,15 |
| 18 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 19 | 883,20 | 223,14 | 144,20 | 0,16 | 934,03 | 2741,69 | 410,33 |
| 20 | 677,96 | 1045,62 | 448,47 | 150,68 | 3411,14 | 16972,51 | 9883,24 |
| 21 | 248,12 | 42,29 | 2,19 | 1,65 | 349,28 | 3729,01 | 10009,48 |
| 22 | 2,38 | 4,75 | 1,91 | 5,96 | 16,69 | 168,24 | 114,68 |
| 23 | 648,97 | 3562,92 | 3058,86 | 1,10 | 640,13 | 3671,93 | 587,78 |
| 24 | 12,04 | 0,31 | 90,53 | 0,00 | 0,22 | 4,42 | 3,54 |
| 25 | 0,51 | 0,46 | 0,33 | 0,00 | 0,84 | 2,28 | 1,97 |
| 26 | 121,58 | 18,87 | 1185,12 | 1,22 | 1493,23 | 787,28 | 1332,73 |
| 27 | 2,40 | 1,53 | 0,00 | 0,12 | 135,65 | 30,32 | 228,20 |
| 28 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 29 | 2,20 | 3,66 | 0,80 | 0,87 | 8,78 | 11,10 | 53,21 |
| 30 | 8,87 | 14,75 | 3,21 | 3,49 | 35,33 | 44,66 | 214,19 |
| 31 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 32 | 0,77 | 1,67 | 0,05 | 1,50 | 7,18 | 12,60 | 26,87 |
| 33 | 2,70 | 6,74 | 0,07 | 132,46 | 10,22 | 17,80 | 20,73 |
| 34 | 5,86 | 34,61 | 0,17 | 3,08 | 37,85 | 69,61 | 176,22 |

| Industry | 08 Discarded equipment | 09 Animal and vegetal wastes | 10 Mixed wastes | 11 Common sludge | 12 Mineral wastes | 13 Solidified, stabilised or vitrified wastes | Other waste |
|---|---|---|---|---|---|---|---|
| 1 | 152,39 | 205094,15 | 459,20 | 270,65 | 442,05 | 0,00 | 0,00 |
| 2 | 3,68 | 0,27 | 25,67 | 470,43 | 204356,98 | 0,00 | 0,00 |
| 3 | 4,80 | 4709,04 | 388,85 | 1037,12 | 1043,97 | 0,00 | 0,00 |
| 4 | 1,33 | 5,85 | 140,32 | 0,00 | 20,47 | 0,00 | 0,00 |
| 5 | 0,01 | 0,02 | 4,86 | 0,00 | 0,26 | 0,50 | 0,00 |
| 6 | 0,77 | 1049,79 | 278,02 | 94,03 | 642,55 | 0,18 | 0,00 |
| 7 | 79,72 | 1475,75 | 25014,26 | 73657,66 | 5926,18 | 5,38 | 0,00 |
| 8 | 0,27 | 1,37 | 34,87 | 0,00 | 109,79 | 0,91 | 0,00 |
| 9 | 3,63 | 404,77 | 1030,48 | 5,06 | 22526,21 | 158,29 | 0,00 |
| 10 | 8,90 | 7,90 | 946,16 | 97,65 | 72,90 | 8,08 | 0,00 |
| 11 | 1,17 | 0,20 | 137,13 | 1059,22 | 3817,49 | 98,82 | 0,00 |
| 12 | 15,17 | 6,72 | 2178,04 | 0,00 | 56001,47 | 2421,90 | 0,00 |
| 13 | 5,58 | 2,46 | 643,59 | 9,73 | 235,61 | 5,10 | 0,00 |
| 14 | 25,17 | 0,71 | 90,62 | 2,23 | 95,19 | 0,68 | 0,00 |
| 15 | 2,89 | 0,89 | 82,11 | 11,79 | 42,88 | 3,65 | 0,00 |
| 16 | 0,41 | 0,02 | 225,01 | 9,94 | 30,69 | 0,08 | 0,00 |
| 17 | 27,17 | 0,00 | 10705,49 | 0,81 | 252062,91 | 0,00 | 0,00 |
| 18 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 19 | 5515,19 | 16,06 | 474,20 | 0,00 | 16,91 | 0,00 | 1045,11 |
| 20 | 1460,24 | 21085,22 | 4086,17 | 0,00 | 6157,37 | 0,00 | 4970,27 |
| 21 | 1137,81 | 3240,51 | 4203,63 | 0,00 | 6381,93 | 0,00 | 501,90 |
| 22 | 2,50 | 246,05 | 410,44 | 0,00 | 37,77 | 0,00 | 438,74 |
| 23 | 1302,37 | 434,01 | 2071,51 | 0,00 | 2066,79 | 0,00 | 2270,09 |
| 24 | 0,22 | 3,69 | 172,34 | 0,00 | 0,00 | 0,00 | 0,00 |
| 25 | 1,36 | 0,00 | 3,39 | 0,00 | 0,00 | 0,00 | 1,55 |
| 26 | 23,21 | 1385,65 | 3288,63 | 0,00 | 155,20 | 0,00 | 8327,79 |
| 27 | 62,18 | 0,00 | 29,85 | 0,00 | 55,28 | 0,00 | 0,33 |
| 28 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 29 | 4,29 | 2,36 | 24,33 | 0,00 | 83,17 | 0,00 | 13,53 |
| 30 | 17,28 | 9,49 | 97,93 | 0,00 | 334,76 | 0,00 | 54,46 |
| 31 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 32 | 5,52 | 19,42 | 98,01 | 0,00 | 25,00 | 0,00 | 16,00 |
| 33 | 2,45 | 20,74 | 189,87 | 0,00 | 4,54 | 0,00 | 36,22 |
| 34 | 18,88 | 69,02 | 415,29 | 0,00 | 153,51 | 0,00 | 268,54 |

Appendix 4. Diagonal of the R matrix for the indirect suppliers, 2005.

| Industry | 01 Chemical compound wastes | 02 Chemical preparation wastes | 03 Other chemical wastes | 05 Health care and biological wastes | 06 Metallic wastes | 07.2 Non-metallic wastes (except 07.2) | 07.2 Paper and cardboard wastes |
|---|---|---|---|---|---|---|---|
| 1 | 30,22 | 51,60 | 11,46 | 25,93 | 15,47 | 296,68 | 22,36 |
| 2 | 17,26 | 0,95 | 722,47 | 0,05 | 63,97 | 24,82 | 2,81 |
| 3 | 28,59 | 14,90 | 129,88 | 34,84 | 53,25 | 234,63 | 117,97 |
| 4 | 11,43 | 1,45 | 71,70 | 0,00 | 5,55 | 140,28 | 33,45 |
| 5 | 0,17 | 0,14 | 6,22 | 0,00 | 2,22 | 5,41 | 2,38 |
| 6 | 9,82 | 56,84 | 35,53 | 1,50 | 33,47 | 4012,15 | 27,87 |
| 7 | 152,93 | 196,84 | 558,20 | 0,27 | 114,07 | 549,26 | 6415,30 |
| 8 | 44,77 | 7,05 | 280,59 | 0,00 | 25,69 | 12,95 | 0,85 |
| 9 | 263,67 | 433,36 | 1086,69 | 1,06 | 37,86 | 122,11 | 69,45 |
| 10 | 33,22 | 20,51 | 76,40 | 0,04 | 59,43 | 717,78 | 88,65 |
| 11 | 16,08 | 9,40 | 959,13 | 0,04 | 90,94 | 764,39 | 85,92 |
| 12 | 1881,22 | 162,51 | 4106,65 | 0,51 | 5487,58 | 168,00 | 194,68 |
| 13 | 144,06 | 9,78 | 31,65 | 6,83 | 568,95 | 70,77 | 63,96 |
| 14 | 25,23 | 8,14 | 16,40 | 0,22 | 100,20 | 55,23 | 38,98 |
| 15 | 37,75 | 15,13 | 58,16 | 0,44 | 802,37 | 59,71 | 31,46 |
| 16 | 13,16 | 25,14 | 12,30 | 0,07 | 98,35 | 559,04 | 97,67 |
| 17 | 23,26 | 5,59 | 773,97 | 0,01 | 59,79 | 9,38 | 2,97 |
| 18 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 19 | 240,28 | 60,71 | 39,23 | 0,04 | 254,11 | 745,88 | 111,63 |
| 20 | 91,87 | 141,69 | 60,77 | 20,42 | 462,22 | 2299,85 | 1339,22 |
| 21 | 46,87 | 7,99 | 0,41 | 0,31 | 65,97 | 704,35 | 1890,64 |
| 22 | 1,16 | 2,30 | 0,93 | 2,89 | 8,11 | 81,69 | 55,68 |
| 23 | 104,40 | 573,19 | 492,10 | 0,18 | 102,98 | 590,72 | 94,56 |
| 24 | 4,01 | 0,10 | 30,17 | 0,00 | 0,07 | 1,47 | 1,18 |
| 25 | 0,26 | 0,23 | 0,17 | 0,00 | 0,42 | 1,15 | 0,99 |
| 26 | 46,41 | 7,20 | 452,37 | 0,46 | 569,97 | 300,51 | 508,71 |
| 27 | 0,91 | 0,58 | 0,00 | 0,05 | 51,58 | 11,53 | 86,77 |
| 28 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 29 | 0,81 | 1,35 | 0,29 | 0,32 | 3,23 | 4,08 | 19,58 |
| 30 | 1,87 | 3,12 | 0,68 | 0,74 | 7,47 | 9,45 | 45,30 |
| 31 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 32 | 0,13 | 0,27 | 0,01 | 0,24 | 1,17 | 2,05 | 4,37 |
| 33 | 0,85 | 2,12 | 0,02 | 41,63 | 3,21 | 5,60 | 6,52 |
| 34 | 0,81 | 4,77 | 0,02 | 0,42 | 5,21 | 9,59 | 24,28 |

| Industry | 08 Discarded equipment | 09 Animal and vegetal wastes | 10 Mixed wastes | 11 Common sludge | 12 Mineral wastes | 13 Solidified, stabilised or vitrified wastes | Other waste |
|---|---|---|---|---|---|---|---|
| 1 | 24,35 | 32766,54 | 73,36 | 43,24 | 70,62 | 0,00 | 0,00 |
| 2 | 2,74 | 0,20 | 19,09 | 349,90 | 151998,79 | 0,00 | 0,00 |
| 3 | 2,34 | 2296,68 | 189,65 | 505,82 | 509,16 | 0,00 | 0,00 |
| 4 | 0,35 | 1,55 | 37,17 | 0,00 | 5,42 | 0,00 | 0,00 |
| 5 | 0,00 | 0,01 | 1,89 | 0,00 | 0,10 | 0,19 | 0,00 |
| 6 | 0,17 | 233,38 | 61,81 | 20,90 | 142,85 | 0,04 | 0,00 |
| 7 | 3,96 | 73,39 | 1244,05 | 3663,27 | 294,73 | 0,27 | 0,00 |
| 8 | 0,16 | 0,81 | 20,69 | 0,00 | 65,13 | 0,54 | 0,00 |
| 9 | 0,54 | 60,13 | 153,09 | 0,75 | 3346,59 | 23,52 | 0,00 |
| 10 | 2,15 | 1,91 | 228,89 | 23,62 | 17,64 | 1,96 | 0,00 |
| 11 | 1,44 | 0,25 | 168,16 | 1298,92 | 4681,36 | 121,18 | 0,00 |
| 12 | 4,78 | 2,12 | 686,43 | 0,00 | 17649,29 | 763,28 | 0,00 |
| 13 | 1,14 | 0,50 | 131,99 | 2,00 | 48,32 | 1,05 | 0,00 |
| 14 | 15,30 | 0,43 | 55,07 | 1,35 | 57,85 | 0,41 | 0,00 |
| 15 | 2,20 | 0,68 | 62,40 | 8,96 | 32,59 | 2,77 | 0,00 |
| 16 | 0,13 | 0,01 | 72,57 | 3,21 | 9,90 | 0,03 | 0,00 |
| 17 | 6,14 | 0,00 | 2418,02 | 0,18 | 56932,81 | 0,00 | 0,00 |
| 18 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 19 | 1500,43 | 4,37 | 129,01 | 0,00 | 4,60 | 0,00 | 284,32 |
| 20 | 197,87 | 2857,14 | 553,69 | 0,00 | 834,35 | 0,00 | 673,49 |
| 21 | 214,91 | 612,08 | 794,00 | 0,00 | 1205,45 | 0,00 | 94,80 |
| 22 | 1,21 | 119,47 | 199,28 | 0,00 | 18,34 | 0,00 | 213,03 |
| 23 | 209,52 | 69,82 | 333,25 | 0,00 | 332,50 | 0,00 | 365,20 |
| 24 | 0,07 | 1,23 | 57,44 | 0,00 | 0,00 | 0,00 | 0,00 |
| 25 | 0,68 | 0,00 | 1,71 | 0,00 | 0,00 | 0,00 | 0,78 |
| 26 | 8,86 | 528,91 | 1255,29 | 0,00 | 59,24 | 0,00 | 3178,77 |
| 27 | 23,64 | 0,00 | 11,35 | 0,00 | 21,02 | 0,00 | 0,13 |
| 28 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 29 | 1,58 | 0,87 | 8,95 | 0,00 | 30,60 | 0,00 | 4,98 |
| 30 | 3,66 | 2,01 | 20,71 | 0,00 | 70,80 | 0,00 | 11,52 |
| 31 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 32 | 0,90 | 3,16 | 15,95 | 0,00 | 4,07 | 0,00 | 2,60 |
| 33 | 0,77 | 6,52 | 59,67 | 0,00 | 1,43 | 0,00 | 11,38 |
| 34 | 2,60 | 9,51 | 57,21 | 0,00 | 21,15 | 0,00 | 37,00 |

Appendix 5. Diagonal of the R matrix for the direct suppliers, 2010.

| Industry | 01 Chemical compound wastes | 02 Chemical preparation wastes | 03 Other chemical wastes | 05 Health care and biological wastes | 06 Metallic wastes | 07.2 Non-metallic wastes (except 07.2) | 07.2 Paper and cardboard wastes |
|---|---|---|---|---|---|---|---|
| 1 | 184,09 | 115,27 | 37,18 | 137,68 | 53,86 | 971,64 | 207,96 |
| 2 | 28,13 | 0,00 | 13,64 | 0,01 | 73,06 | 19,89 | 3,37 |
| 3 | 4,94 | 0,00 | 49,82 | 2,58 | 66,24 | 279,58 | 233,53 |
| 4 | 1,63 | 0,00 | 38,02 | 0,04 | 5,31 | 159,70 | 43,39 |
| 5 | 0,05 | 0,00 | 1,17 | 0,00 | 0,16 | 4,92 | 1,34 |
| 6 | 43,09 | 0,00 | 273,69 | 0,00 | 240,61 | 10217,16 | 231,35 |
| 7 | 11684,79 | 0,00 | 37527,77 | 1,96 | 2174,74 | 10469,53 | 80915,17 |
| 8 | 13,33 | 0,00 | 317,16 | 0,01 | 29,06 | 8,17 | 2,15 |
| 9 | 1275,42 | 0,00 | 2770,31 | 5,54 | 333,77 | 1355,68 | 462,72 |
| 10 | 638,16 | 0,00 | 1386,13 | 2,77 | 167,00 | 678,31 | 231,52 |
| 11 | 7,80 | 0,00 | 47,86 | 0,01 | 93,37 | 237,50 | 34,09 |
| 12 | 4589,74 | 0,00 | 3763,94 | 2,27 | 14039,08 | 496,22 | 266,75 |
| 13 | 112,70 | 0,00 | 168,94 | 0,10 | 2482,29 | 331,01 | 193,16 |
| 14 | 23,11 | 0,00 | 34,64 | 0,02 | 508,93 | 67,87 | 39,60 |
| 15 | 15,54 | 0,00 | 23,30 | 0,01 | 342,36 | 45,65 | 26,64 |
| 16 | 63,03 | 0,00 | 119,42 | 7,70 | 312,56 | 1205,60 | 151,55 |
| 17 | 172,49 | 0,00 | 442,91 | 0,25 | 1144,87 | 498,65 | 36,53 |
| 18 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 19 | 1409,26 | 897,94 | 191,73 | 0,00 | 1002,42 | 2923,29 | 206,20 |
| 20 | 230,81 | 2583,61 | 410,47 | 56,04 | 2808,19 | 16419,33 | 10869,64 |
| 21 | 63,57 | 47,40 | 754,45 | 12,62 | 843,41 | 13262,41 | 8064,18 |
| 22 | 1,80 | 3,23 | 3,02 | 63,06 | 14,18 | 258,91 | 568,35 |
| 23 | 10,57 | 15,53 | 12,80 | 0,38 | 9,85 | 33,04 | 452,25 |
| 24 | 0,16 | 0,24 | 0,20 | 0,01 | 0,15 | 0,51 | 7,03 |
| 25 | 0,23 | 0,34 | 0,28 | 0,01 | 0,22 | 0,73 | 9,94 |
| 26 | 5,45 | 8,00 | 6,60 | 0,20 | 5,08 | 17,02 | 232,99 |
| 27 | 12,82 | 4,27 | 0,05 | 0,13 | 120,16 | 92,88 | 642,44 |
| 28 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 29 | 86,14 | 53,28 | 59,92 | 4,55 | 132,84 | 187,00 | 64,49 |
| 30 | 481,78 | 298,00 | 335,13 | 25,44 | 742,95 | 1045,85 | 360,68 |
| 31 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 32 | 30,40 | 2,42 | 0,49 | 0,73 | 11,65 | 12,27 | 13,19 |
| 33 | 43,94 | 16,73 | 0,80 | 299,81 | 4,37 | 64,08 | 39,60 |
| 34 | 9,12 | 8,63 | 2,23 | 9,67 | 15,91 | 141,71 | 93,58 |

| Industry | 08 Discarded equipment | 09 Animal and vegetal wastes | 10 Mixed wastes | 11 Common sludge | 12 Mineral wastes | 13 Solidified, stabilised or vitrified wastes | Otros Residuos |
|---|---|---|---|---|---|---|---|
| 1 | 168,64 | 160660,60 | 121,78 | 50,52 | 201,93 | 0,03 | 168,64 |
| 2 | 4,17 | 0,05 | 14,65 | 3,18 | 229583,06 | 0,00 | 4,17 |
| 3 | 1,46 | 3562,26 | 481,35 | 217,81 | 934,15 | 0,26 | 1,46 |
| 4 | 0,19 | 2,27 | 52,05 | 0,10 | 2,50 | 0,00 | 0,19 |
| 5 | 0,01 | 0,07 | 1,60 | 0,00 | 0,08 | 0,00 | 0,01 |
| 6 | 2,47 | 0,09 | 392,65 | 16,41 | 1001,92 | 11,56 | 2,47 |
| 7 | 20,88 | 10,79 | 68558,64 | 23096,56 | 9193,86 | 23,13 | 20,88 |
| 8 | 0,17 | 1,88 | 46,01 | 2,90 | 198,12 | 4,07 | 0,17 |
| 9 | 5,00 | 315,59 | 1426,47 | 160,60 | 8472,39 | 12,72 | 5,00 |
| 10 | 2,50 | 157,91 | 713,73 | 80,36 | 4239,17 | 6,36 | 2,50 |
| 11 | 1,55 | 0,81 | 87,74 | 6,00 | 6895,87 | 65,88 | 1,55 |
| 12 | 9,25 | 35,53 | 1094,66 | 44,09 | 36258,41 | 160,97 | 9,25 |
| 13 | 32,90 | 4,42 | 272,75 | 1,97 | 334,32 | 21,72 | 32,90 |
| 14 | 6,74 | 0,91 | 55,92 | 0,40 | 68,54 | 4,45 | 6,74 |
| 15 | 4,54 | 0,61 | 37,62 | 0,27 | 46,11 | 3,00 | 4,54 |
| 16 | 44,71 | 0,09 | 254,94 | 1,43 | 111,86 | 1,19 | 44,71 |
| 17 | 90,43 | 41,93 | 191,45 | 93,53 | 71197,05 | 0,00 | 90,43 |
| 18 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 19 | 2242,19 | 4,11 | 79,91 | 2,57 | 20,55 | 0,22 | 2242,19 |
| 20 | 5555,59 | 9434,96 | 13467,72 | 132,94 | 89,15 | 0,00 | 5555,59 |
| 21 | 564,73 | 1204,62 | 4747,24 | 0,00 | 0,00 | 0,00 | 564,73 |
| 22 | 35,06 | 371,27 | 279,09 | 1,71 | 0,16 | 0,00 | 35,06 |
| 23 | 30,05 | 2,12 | 9,95 | 8,38 | 0,47 | 0,02 | 30,05 |
| 24 | 0,47 | 0,03 | 0,15 | 0,13 | 0,01 | 0,00 | 0,47 |
| 25 | 0,66 | 0,05 | 0,22 | 0,18 | 0,01 | 0,00 | 0,66 |
| 26 | 15,48 | 1,09 | 5,13 | 4,32 | 0,24 | 0,01 | 15,48 |
| 27 | 73,53 | 191,95 | 120,39 | 0,32 | 0,69 | 0,00 | 73,53 |
| 28 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 29 | 633,77 | 1656,17 | 112,56 | 0,38 | 1643,11 | 0,00 | 633,77 |
| 30 | 3544,57 | 9262,65 | 629,52 | 2,13 | 9189,59 | 0,00 | 3544,57 |
| 31 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 32 | 3,41 | 11,24 | 19,24 | 0,01 | 0,29 | 0,00 | 3,41 |
| 33 | 38,19 | 51,23 | 346,47 | 0,18 | 0,68 | 0,00 | 38,19 |
| 34 | 111,57 | 89,14 | 724,31 | 0,26 | 0,11 | 0,00 | 111,57 |

Appendix 6. Diagonal of the R matrix for the indirect suppliers, 2010.

| Industry | 01 Chemical compound wastes | 02 Chemical preparation wastes | 03 Other chemical wastes | 05 Health care and biological wastes | 06 Metallic wastes | 07.2 Non-metallic wastes (except 07.2) | 07.2 Paper and cardboard wastes |
|---|---|---|---|---|---|---|---|
| 1 | 26,09 | 16,34 | 5,27 | 19,51 | 7,63 | 137,70 | 29,47 |
| 2 | 20,24 | 0,00 | 9,82 | 0,01 | 52,58 | 14,31 | 2,43 |
| 3 | 2,27 | 0,00 | 22,93 | 1,19 | 30,49 | 128,67 | 107,47 |
| 4 | 0,24 | 0,00 | 5,61 | 0,01 | 0,78 | 23,57 | 6,40 |
| 5 | 0,01 | 0,00 | 0,35 | 0,00 | 0,05 | 1,46 | 0,40 |
| 6 | 7,87 | 0,00 | 50,00 | 0,00 | 43,96 | 1866,57 | 42,27 |
| 7 | 560,73 | 0,00 | 1800,89 | 0,09 | 104,36 | 502,41 | 3882,98 |
| 8 | 8,79 | 0,00 | 209,10 | 0,00 | 19,16 | 5,39 | 1,42 |
| 9 | 176,89 | 0,00 | 384,23 | 0,77 | 46,29 | 188,03 | 64,18 |
| 10 | 133,29 | 0,00 | 289,51 | 0,58 | 34,88 | 141,68 | 48,36 |
| 11 | 8,93 | 0,00 | 54,83 | 0,01 | 106,96 | 272,05 | 39,05 |
| 12 | 1323,30 | 0,00 | 1085,21 | 0,65 | 4047,71 | 143,07 | 76,91 |
| 13 | 20,94 | 0,00 | 31,39 | 0,02 | 461,18 | 61,50 | 35,89 |
| 14 | 13,18 | 0,00 | 19,76 | 0,01 | 290,33 | 38,72 | 22,59 |
| 15 | 9,58 | 0,00 | 14,37 | 0,01 | 211,07 | 28,15 | 16,42 |
| 16 | 19,56 | 0,00 | 37,06 | 2,39 | 96,99 | 374,09 | 47,02 |
| 17 | 43,79 | 0,00 | 112,45 | 0,06 | 290,67 | 126,60 | 9,27 |
| 18 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 19 | 396,48 | 252,62 | 53,94 | 0,00 | 282,02 | 822,43 | 58,01 |
| 20 | 28,67 | 320,95 | 50,99 | 6,96 | 348,85 | 2039,69 | 1350,28 |
| 21 | 11,69 | 8,72 | 138,75 | 2,32 | 155,12 | 2439,16 | 1483,13 |
| 22 | 1,00 | 1,80 | 1,68 | 35,14 | 7,90 | 144,27 | 316,70 |
| 23 | 1,97 | 2,90 | 2,39 | 0,07 | 1,84 | 6,16 | 84,37 |
| 24 | 0,07 | 0,10 | 0,08 | 0,00 | 0,06 | 0,21 | 2,85 |
| 25 | 0,15 | 0,23 | 0,19 | 0,01 | 0,14 | 0,48 | 6,63 |
| 26 | 2,38 | 3,50 | 2,88 | 0,09 | 2,22 | 7,44 | 101,82 |
| 27 | 5,39 | 1,79 | 0,02 | 0,05 | 50,52 | 39,05 | 270,10 |
| 28 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 29 | 38,36 | 23,72 | 26,68 | 2,03 | 59,15 | 83,26 | 28,72 |
| 30 | 119,92 | 74,17 | 83,42 | 6,33 | 184,92 | 260,32 | 89,77 |
| 31 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 32 | 5,80 | 0,46 | 0,09 | 0,14 | 2,22 | 2,34 | 2,52 |
| 33 | 14,06 | 5,35 | 0,26 | 95,91 | 1,40 | 20,50 | 12,67 |
| 34 | 1,46 | 1,38 | 0,36 | 1,55 | 2,55 | 22,70 | 14,99 |

| Industry | 08 Discarded equipment | 09 Animal and vegetal wastes | 10 Mixed wastes | 11 Common sludge | 12 Mineral wastes | 13 Residuos solidificados, estabilizados o vitrificados | Otros Residuos |
|---|---|---|---|---|---|---|---|
| 1 | 23,90 | 22769,07 | 17,26 | 7,16 | 28,62 | 0,00 | |
| 2 | 3,00 | 0,04 | 10,54 | 2,29 | 165232,70 | 0,00 | |
| 3 | 0,67 | 1639,38 | 221,52 | 100,24 | 429,90 | 0,12 | |
| 4 | 0,03 | 0,34 | 7,68 | 0,01 | 0,37 | 0,00 | |
| 5 | 0,00 | 0,02 | 0,48 | 0,00 | 0,02 | 0,00 | |
| 6 | 0,45 | 0,02 | 71,73 | 3,00 | 183,04 | 2,11 | |
| 7 | 1,00 | 0,52 | 3290,01 | 1108,36 | 441,20 | 1,11 | |
| 8 | 0,11 | 1,24 | 30,33 | 1,91 | 130,62 | 2,68 | |
| 9 | 0,69 | 43,77 | 197,84 | 22,27 | 1175,08 | 1,76 | |
| 10 | 0,52 | 32,98 | 149,07 | 16,78 | 885,41 | 1,33 | |
| 11 | 1,78 | 0,92 | 100,51 | 6,87 | 7899,07 | 75,47 | |
| 12 | 2,67 | 10,24 | 315,61 | 12,71 | 10453,93 | 46,41 | |
| 13 | 6,11 | 0,82 | 50,67 | 0,37 | 62,11 | 4,04 | |
| 14 | 3,85 | 0,52 | 31,90 | 0,23 | 39,10 | 2,54 | |
| 15 | 2,80 | 0,38 | 23,19 | 0,17 | 28,43 | 1,85 | |
| 16 | 13,87 | 0,03 | 79,11 | 0,44 | 34,71 | 0,37 | |
| 17 | 22,96 | 10,65 | 48,61 | 23,75 | 18076,37 | 0,00 | |
| 18 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | |
| 19 | 630,81 | 1,16 | 22,48 | 0,72 | 5,78 | 0,06 | |
| 20 | 690,14 | 1172,06 | 1673,03 | 16,51 | 11,07 | 0,00 | |
| 21 | 103,86 | 221,55 | 873,09 | 0,00 | 0,00 | 0,00 | |
| 22 | 19,54 | 206,88 | 155,51 | 0,95 | 0,09 | 0,00 | |
| 23 | 5,60 | 0,40 | 1,86 | 1,56 | 0,09 | 0,00 | |
| 24 | 0,19 | 0,01 | 0,06 | 0,05 | 0,00 | 0,00 | |
| 25 | 0,44 | 0,03 | 0,15 | 0,12 | 0,01 | 0,00 | |
| 26 | 6,76 | 0,48 | 2,24 | 1,89 | 0,11 | 0,01 | |
| 27 | 30,92 | 80,70 | 50,62 | 0,13 | 0,29 | 0,00 | |
| 28 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | |
| 29 | 282,20 | 737,44 | 50,12 | 0,17 | 731,62 | 0,00 | |
| 30 | 882,25 | 2305,50 | 156,69 | 0,53 | 2287,32 | 0,00 | |
| 31 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | |
| 32 | 0,65 | 2,14 | 3,67 | 0,00 | 0,06 | 0,00 | |
| 33 | 12,22 | 16,39 | 110,83 | 0,06 | 0,22 | 0,00 | |
| 34 | 17,87 | 14,28 | 116,03 | 0,04 | 0,02 | 0,00 | |