

ESSAY IN INDUSTRIAL TYPOLOGY OF THE BELGIAN COMMUNES

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RESUME. Essai de typologie industrielle des communes belges

La typologie industrielle proposée dans cet article est sans conteste le premier essai de classification des communes belges intégrant à la fois l'importance du fait industriel dans la commune et le type d'industries présentes.

Au départ des 36 données sélectionnées dans les statistiques du Cadastre et de l'O.N.S.S., 11 variables ont été construites. L'analyse en composantes principales a permis d'individualiser quatre facteurs rendant compte de près de 80% de la variation totale; ces quatre composantes sont représentatives de la grande industrie, de l'industrie légère, du poids industriel (part relative de l'industrie dans la commune) et des fabrications métalliques.

Sur base des scores obtenus sur ces quatre composantes, il a été ensuite possible d'établir une typologie des communes en huit classes ayant chacune un profil précis, profil qui, par ailleurs, oppose souvent Flandre et Wallonie, communes rurales et centres urbains.

It is not easy to characterize industrial activity present in an area. One comes up against the problem of the choice of criteria and the even more decisive problem of the data available.

Generally, the degree of difficulty is inversely proportional to the spatial level : the smaller the spatial level (commune, district) the greater the difficulty.

In this survey we have set out to measure the load and the kind of industrial activity in the different Belgian communes by comparing the data available in 1980.

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1. SOURCES USED AND SELECTION OF THE VARIABLES

1.1. Sources

In the absence of an industrial and commercial census on 1st March 1981 (not organised, contrary to 31st December 1947, 1961 and 1970 when it was carried out at the same time as the census of the population) and in the absence of the results of the census of the working population on 1st March 1981, only two sources were used : the Cadastral survey and O.N.S.S. (National Office of Social Security). The Cadastral data (1982) is about land use on 1st January 1980. One of the 25 categories groups together workshops and industrial buildings. According to the Cadastre all buildings used for industrial purposes are included. The list is relatively complete (Mérenne-Schoumaker 1975) : it includes small buildings (joiner's workshops, mechanical workshops, etc.) where often only one or two people work. The few omissions are due to industry existing in a building initially not intended for industrial purposes (e.g. a residential building occupied by a clothing workshop). However, although it is classified in built-up parcel this category often includes a certain amount of non built-up land, most frequently less than three ares. On the other hand, in the statistics of 1st January 1980, no distinction is made between industrial sites and other sites (e.g. car parks, air-fields, military land, cemeteries, etc.). In fact, a precise survey of this kind of land would not have helped much as many are not listed as such at the Cadastre for tax purposes.

The O.N.S.S. statistics deal with the number of establishments and the working population at their place of work. In the listings by commune (1) one can individualise, at the level of the 3 figure activities code (code N.A.C.E. : general Nomenclature of economic Activities in the European Communities) the number of manual and intellectual workers according to sex for three different sizes of establishments : those employing 0-20 people, 20 to 50, 50 or more. The information obtained from these statistics makes it possible to analyse the personnel employed by status, sex and size of the establishment. Given on the 30th June each year, this data is precious. One reservation, however, : not all the working population is listed. Self-employed persons as well as the permanent staff of the S.N.C.B. (National Belgian Railways) and S.N.C.V. (Local Railways) are not included which as a result causes a problem at the level of the primary and tertiary sectors. However, the secondary sector is hardly affected as most of the manpower is listed at the O.N.S.S.

1.2. The variables selected

Initially 36 variables were retained for each commune. In addition to the classification code of the commune there were three values

TABLE 1. List of the 11 chosen variables.

Abbreviation	Meaning
	"Industrial load"
%SI/SB	% of surface of workshops and industrial buildings in relation to the surface of the built-up areas
%ET.IND	% of industrial establishments in relation to the total number of establishments in the commune
%EMPL 1	% of industrial jobs in relation to the total number of jobs in the commune
	Type of industrial activity
	Size of establishments :
%EM>50	% of industrial jobs in the industrial establishments employing more than 50 persons, in relation to the total number of industrial jobs
%ET>50	% of industrial establishments employing more than 50 persons, in relation to all the industrial establishments
	Type of activity (*) :
%EMPL 2	% of industrial jobs of branch 2 (extraction and processing of non-energy minerals and by-products; chemical industry)
%EMPL 3	% of industrial jobs of branch 3 (metalwork industry, precision engineering)
%EMPL 4	% of industrial jobs of branch 4 (other manufacturing industries)
%EMPL 5	% of industrial jobs of branch 5 (building trade and civil engineering)
	Personnel : sex
%F.IND	% of women workers in industry
	Personnel : status
%E.IND	% of intellectual workers in industry

(*) The percentage of the jobs of branch 1 (energy and water) was not used as it is the complement of the other four ones.

of the Cadastre (total area of the commune, area of built-up parcels and area of workshops and industrial buildings) and the 32 O.N.S.S. variables. These deal with the number of establishments and the personnel employed according to five branches of activity and four groups of workers (based on status and sex). In addition we have listed the number of industrial establishments that employ at least 50 persons and the staff attached to them. Finally we have used the total number of establishments in the commune and the corresponding personnel (which is also divided into both status and

sex). Table 1 gives the nomenclature of the variables and their meaning.

The 36 initial variables have been organised (addition by status and by sex, relativisation, etc.) in such a way as to construct 11 relative variables that are, a priori, liable to evaluate either the industrial load or the type of industrial activity present in the Belgian communes. These 11 variables will be the subject of a multivariate statistical analysis in the continuation of the survey.

1.3. The limits of the data retained

The data used is far from being entirely satisfactory. Several criticisms can be made.

1) The area recognised as industrial area is without doubt smaller than in actual fact because, as already pointed out, it is not possible to take into account industrial land listed as such and that certain buildings used for an industrial activity are not listed under that heading : the percentages of industrial areas are, in general, underestimated.

2) As regards industrial employment the O.N.S.S. total is also less than in actual fact because the self-employed workers of the secondary sector are missing. However, the percentages of industrial jobs are higher than their actual value as the total of the jobs of the commune is even more underestimated (lack of self-employed workers and the permanent staff of the S.N.C.B. and S.N.C.V.).

3) The classification by branch is deliberately brief due to the synthetic character of the data analysis and to avoid this aspect of the information becoming over-important. In fact we have kept the code to one figure which generates more than one third of the total variation affecting the data matrix.

4) Area, number of establishments and jobs are perhaps not the most suitable indicators of industrial activity. The choice of added value would probably be more suitable. Unfortunately this data is not available at the commune level and without a breakdown on the basis of the provincial added values (as done by C. Vandermotten in 1983 for example) this data could not be used.

5) The distribution of communes resulting from the merger of the communes on 1st January 1977 is far from satisfactory especially in an analysis of industrial function which is essentially a spatially punctual activity.

To conclude, the data used is by no means perfect but it was the only information available at the communal level. The problem was therefore how to put the data to the best use in order to express industrial reality on a communal level.

2. DATA ANALYSIS

The aim of this survey is to establish an industrial typology of Belgian communes. It is therefore concerned with classifying spatial individuals - 596 to be exact - on the basis of 11 variables which are supposed to express both the industrial load in the commune and the type of industrial activities present.

Numerical taxonomy comes from a series of much discussed methods. The reduction of data to a few principal components followed by cluster analysis is perhaps a traditional approach but the researcher has a great deal of liberty as to the aim of the cluster and the processing options. It is common in industrial geography to use the relative share of employment in the various branches of industry for the initial variables but on that basis alone the aims of the analysis can vary greatly. From the functional analysis of space (Ferrier and Racine 1974) to the control of industrial location policy (Kemper, 1977) the field of application is vast and the techniques of classification often used. Our work is in keeping with this methodological line and is essentially descriptive even though, as will be seen, it does raise questions and it does establish functional and geographical relationships which go beyond a solely industrial context.

2.1. Analysis of principal components

The application of principal component analysis on the data matrix enables a more exact interpretation of the information the variables contain. Whereas the industrial load is easy to individualise, several components are needed to define the notion of type of activity. The initial variables are standardised in order that the variation table from which factors are issued is none other than the matrix of linear correlations between variables.

The number of factors retained for the rest of the analysis is four. Not only is it the number fixed by the minimum unit threshold of an eigen-value but above all it satisfies, in this survey, the concern about interpretation of factors. The share of the total variance held by the fifth factor (6%) (table 2) made us retain it initially but it was associated with one single variable and slightly reduced the importance of the identification of the first factor. Insofar as the communalities of the variables did not suffer (table 3) we preferred to use four for the final number of components. Together they account for nearly 80% of the total variation.

The interpretation of the components was done after a rotation of axis in the variables space (Varimax). The factor loadings are shown in table 3. It should be remembered that values less than 0.25 are ignored and that the variables are shown in a decreasing order for

TABLE 2. Variance explained.

Factor	Eigenvalue	Cumulative proportion
1	4.145835	0.376894
2	2.076635	0.565679
3	1.482814	0.700480
4	1.030567	0.794168
5	0.643603	0.852678

TABLE 3. Rotated factor loadings and communalities.

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Communa- lities
%EM>50	0.880	0.0	0.0	0.0	0.8288
%ET>50	0.811	0.0	0.0	0.0	0.6645
%SI/SB	0.787	0.0	0.0	0.0	0.7162
%EMPL 5	-0.770	-0.406	0.0	0.0	0.8006
%EMPL 2	0.622	-0.439	0.0	-0.492	0.6971
%E.IND	0.610	0.0	-0.536	0.0	0.8218
%EMPL 4	0.0	0.919	0.0	0.0	0.8801
%F.IND	0.0	0.802	0.0	0.0	0.6863
%ET.IND	0.0	0.0	0.902	0.0	0.8352
%EMPL 1	0.538	0.0	0.749	0.0	0.8621
%EMPL 3	0.320	0.0	0.0	0.909	0.9432
Variance expl. after rotation	3.837	1.970	1.729	1.200	

each successive factor (standard presentation of the programme used : BMDP4M).

There are many variables that are strongly correlated with the first component and they all testify to "big industry". The maximum factor loadings are reached by variables relating to the size of establishments (bigger than 50 jobs) and to the built-up area used for industrial purposes. The activities most closely linked with this factor belong to branch 2 (extraction and processing of non-energy minerals and by-products; chemical industry) and to a lesser extent to branch 3 (transformation of metals, precision engineering). The activities of branch 5 (building trade and civil engineering) form the only variable that is correlated negatively with this component and confirm the proposed interpretation. Finally an important proportion of industrial jobs, and among these, a big share of intellectual workers, are the last characteristics of the communes with a high factor score. The second main component is, on the other hand, representative of

"light industry". The activities of branch 4 (other manufacturing industries) and the percentage of women workers in the firm are the variables which permit a clear interpretation of the factor considered. Furthermore, the negative and not inconsiderable correlations of the variables representing branches 2 (extraction and processing of minerals and chemical) and 5 (building trade and civil engineering) back up this meaning.

We gave the third component the title of "industrial load" suggested, a priori, to designate three initial variables (see table 1). One of these, the surface variable, does not intervene in this component, but the two others (% of industrial establishments in relation to the total number of establishments and % of industrial jobs in relation to the total number of jobs) show very high factor loadings. These two variables almost make the third factor an index of industrial specialisation. The only other variable showing a correlation of any importance is the share of intellectual workers. The connection is negative and therefore testifies to a high proportion of manual workers in the jobs in communes with high positive scores.

The last component retained for this analysis is expressed on the basis of one single variable, i.e. the share of industrial jobs in branch 3 (metal processing, precision engineering). This variable was already linked to the first component but the correlation was far weaker. It can be noticed on the other hand that branch 2 (extraction and processing of minerals and chemical) shows a negative loading with the last factor. Consequently a simultaneous examination of the scores shown by commune for the first and last factors makes it possible to distinguish the type of industrial activity which characterizes the commune concerned : big firm of the steel industry type, for example (factor 1 positive, factor 4 negative) or big firm in the processing industry (factors 1 and 4 positive). The projection of the individuals (communes) in the plan created on these two factors enables a clear visual distinction of this phenomenon (figure 1 shows some typical cases).

The result of the exclusive use of relative variables is that the extremes in the factor scores are often found in the smaller communes. Engis is one such case : maximum score for the first component. The presence of "big industry" in this commune (chemical) is such that it simultaneously and by exclusion gets a minimum score for the last factor. The other minimums are generally reached, whatever the factors may be, by rural communes whereas traditional and new strongholds of industry obtain high scores (La Louvière, Seraing or Vilvoorde for the first factor; Herstal, Genk or Kuerne for the fourth, etc.). As to the big urban centres they can present a more complex situation. A high score for the first factor shows the presence of big industry, but the industrial load is often lost in the job

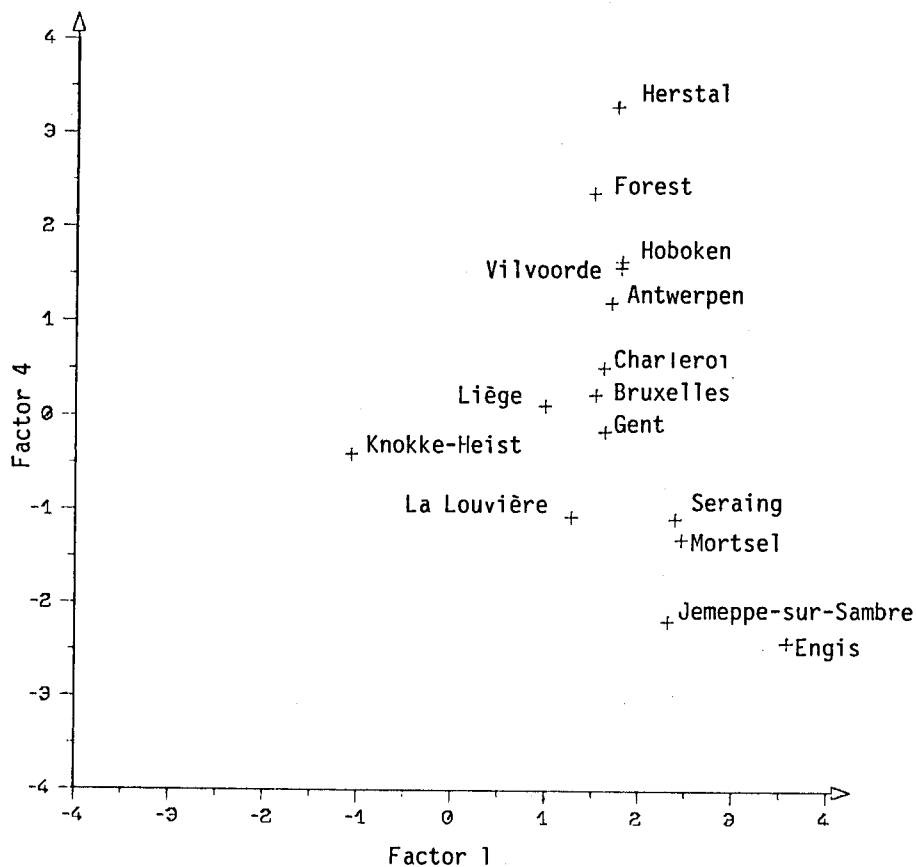


Fig. 1. Projection of a few communes in the plan formed by factor 1 (big industry) and factor 4 (processing industry). The scores are standardised.

and establishment total of the commune, thus resulting in a definitely negative score for the third component. Such is the case of the communes of Brussels, Antwerpen and Liège but it is less so for Gent and Charleroi for instance.

The degree of representation of individuals forms, in this analysis, a particularly enriching tool. The reliability of the reconstitution of the places is estimated here by the difference in distance (of Mahalanobis), of each case to the centroid of the set of data, in the space of the initial variables and in the space of the four factors. The outcome of the principal component analysis shows that a dozen communes are badly or very badly represented. By resorting to the basic variables and even the unused additional information of the O.N.S.S. one can apprehend these abnormal situations. Thus it is possible to see that these different spatial individuals often present

a high score (in absolute value) for the third component (industrial load). This is because they are either very industrial communes that are specialised in a field not covered by our analysis - e.g. the communes which in 1980 are still an active coal mining centre (Beringen or Farciennes) - or non industrialised communes (e.g. Faimes in the Hesbaye of the Liège region of Herstappe in southern Limbourg).

2.2. Typological analysis

The second stage of the research is devoted to the classification of the communes based on the scores they have in the four components simultaneously. It was deemed necessary that the four sets of factor scores be present in order to enable sufficient discrimination of the underlying classes - for instance, the interest in crossing the first and fourth components should not be forgotten. Furthermore, no special weighting of the factors is brought in and the scores are standardised before carrying out the classification procedure. Finally it should be remembered that the aim of the work is not to establish a regionalisation but simply a typology. The analysis does not take any spatial criteria into account (such as contiguity constraints, etc.).

Several classification methods and choices of application were compared but in all cases the "measurement of similarity" used is based on the Euclidean distance. Hereunder we explain the processes which would seem to lead to a result not only satisfactory from a thematic point of view but also stable if the methodological comparisons carried out are reliable.

First of all, a hierarchical procedure, using the centroid algorithm (weighted distance between centroids), is applied to the data matrix (4×596). It should be remembered that initially each case is in itself a class and that at each step the classes with the smallest distance between them are combined and dealt with in one single class. This "amalgamation process" is continued until all the cases are combined into one single class. As one gets nearer to the root of the tree which is thus formed, it can be seen that the distances increase very rapidly. The first sudden jump that appeared in this grouping sequence was chosen and as a result the procedure has eight distinct clusters of individuals.

This first heuristic is only applied for exploratory purposes. Indeed the expected typology does not justify the use of a hierarchical classification. Its part in this analysis is limited to supplying some information about the number of classes to be envisaged and about their statistical characteristics i.e. a given partition of all the places.

We therefore calculated the values of the centroids of the eight classes seen at the chosen step of the hierarchical procedure and the individuals closest to these mean values served as initiators to a transfer classification procedure. This method established a classification of the communes based on the Euclidean distance between the observations and the class centres. The individuals are iteratively re-allotted in the class, the centre of which is closest to them. The centres of the classes are made up by the means of the observations that form them. The programme enables the use of an initial membership variable or the definition of initiators case as has been done in this analysis. Furthermore, a stepwise procedure can be requested which increases the number of classes by one unit at each step by subdividing one of the clusters. In this case one chooses, a priori, the final cluster number and the transfers are made at the desired steps by the user. This operation "by default" was also tried in order to obtain classification comparisons. The interpretation of the eight classes, centered in the beginning on the eight initiator individuals, is based on the mean values and the variation of the scores shown for the four principal components (table 4). Furthermore, to make it easier to understand the classification, we have set out the communes of each category according to the region to which they belong (Flanders, Wallonia, Brussels) and we have individualised the 135 urban centres such as they are

TABLE 4. Cluster means and standard deviations.

Cluster Mean St. Dev.	Factor 1	Factor 2	Factor 3	Factor 4	Size
1	-0.8447 0.4411	-0.3938 0.5367	-0.7781 0.3890	-0.2571 0.4650	97
2	0.5410 0.5169	0.0942 0.5631	-0.8949 0.5169	1.1581 0.6044	51
3	0.3113 0.4954	1.5054 0.5679	0.4218 0.7118	-0.2693 0.4212	91
4	0.5768 0.6522	-0.5044 0.5004	0.4804 0.6700	2.2093 0.7393	50
5	1.6339 0.8039	-1.0375 0.5957	0.2765 0.6690	-1.1379 0.8024	68
6	-0.3183 0.5242	0.5808 0.4493	0.7811 0.5672	-0.1058 0.4251	89
7	0.3449 0.6761	0.6104 0.6844	-1.8374 0.8463	0.3531 0.4886	47
8	-0.9884 0.4689	-0.8564 0.3708	0.5509 0.5275	-0.1621 0.4153	103

TABLE 5. Distribution of Belgian communes according to the 8 typology classes, the region to which they belong and the kind of urban centre they are.

Typology Classes	Number of communes based on the region they belong to				Proportion of urban centres											
	Flanders nbr (1)	% (1)	Wallonia nbr (2)	% (2)	Brussels nbr (3)	% (3)	Country nbr (4)	% (4)	Flanders nbr (5)	%in(1) (5)	Wallonia nbr (6)	%in(2) (6)	Brussels nbr (7)	%in(3) (7)	Country nbr (8)	%in(4) (8)
1. Not-industrialised communes	31	9.9	66	25.2	-	-	97	16.3	4	12.9	23	34.8	-	-	27	27.8
2. Industrialised towns and centres	25	7.9	21	8.0	5	26.3	51	8.5	15	60.0	12	57.1	5	100.0	32	62.7
3. Urban centres specialised in light industry	74	23.5	17	6.5	-	-	91	15.3	22	29.7	5	29.4	-	-	27	29.7
4. Centres specialised in metalwork	26	8.3	22	8.4	2	10.5	50	8.4	8	30.8	5	22.7	2	100.0	15	30.0
5. Centres of big industry	25	7.9	43	16.4	-	-	68	11.4	3	12.0	12	27.9	-	-	15	22.1
6. Communes slightly specialised in light industry	79	25.1	10	3.8	-	-	89	14.9	10	12.7	-	-	-	-	10	11.2
7. Towns and centres with minority industrial function	14	4.4	21	8.0	12	63.2	47	7.9	3	21.4	10	47.6	12	100.0	25	53.2
8. Small communes with presence of industry	41	13.0	62	23.7	-	-	103	17.3	-	-	2	3.2	-	-	2	1.9
Total	315	100.0	262	100.0	19	100.0	596	100.0	65	20.6	69	26.3	19	100.0	135	22.7

TABLE 6. Denomination and classification of the 135 urban centres in Belgium according to their classification in the industrial typology.

Typology classes	Big cities	Regional towns	Small towns
1. Not-industrialised communes			<p>Fl : Knokke-Heist, Zelzate, Leopoldsburg, Neerpelt W : Braine-l'Alleud, Beaumont, Enguien, Erquelimmes, Thuin, Esneux, Hannut, Kelmis, Stavelot, Bastogne, Bouillon, Durbuy, Florenville, La Roche-en-Ardenne, Neufchâteau, Saint-Hubert, Vielsalm, Beauraing, Ciney, Florennes, Gedinne, Philippeville, Rochefort</p>
2. Industrialised towns and centres	<p>Fl : Antwerpen W : Charleroi Br : Anderlecht, Evere, Ganshoren, Koekelberg, Uccle</p>	<p>Fl : Leuven, Mechelen, Turnhout, Brugge, Hasselt W : Tournai, Verviers</p>	<p>Fl : Herentals, Aarschot, Asse, Tienen, Ieper, Nieuwpoort, Roeselare, Sint-Truiden, Tongeren W : Nivelles, Wavre, Ath, Quévrain, Aywaille, Huy, Waremmes, Virton, Gembloux</p>
3. Urban centres specialised in light industry		<p>Fl : Kortrijk, Aalst, Sint-Niklaas</p>	<p>Fl : Halle, Aveigem, Izegem, Menen, Poperinge, Tielt, Veurne, Waregem, Brakel, Deinze, Dendermonde, Eeklo, Geraardsbergen, Lokeren, Ninove, Oudenaarde, Ronse, Wetteren, Zottegem W : Binche, Leuze, Mouscron, Péruwelz, Malmédy</p>
4. Centres specialised in metalwork	<p>Br : Berchem-St-Agathe, Forest</p>		<p>Fl : Boom, Geel, Lier, Vilvoorde, Temse, Bree, Genk, Lommel W : Braine-le-Comte, Dour, Pépinster, Aubange, Couvin</p>
5. Centres of big industry	<p>Fl : Gent</p>	<p>W : Mons</p>	<p>Fl : Mol, Willebroek W : Tubize, Comines, Fleurus, La Louvière, Lessines, Saint-Ghislain, Soignies, Herve, Visé, Welkenraedt, Andenne</p>
6. Communes slightly specialised in light industry			<p>Fl : Heist-op-den-Berg, Hoogstraten, Diksmuide, Torhout, Beveren, Maldegem, Beringen, Bilzen, Maaseik, Maasmechelen</p>
7. Towns and centres with minority industrial function	<p>W : Liège Br : Auderghem, Brussels, Etterbeek, Ixelles, Jette, Molenbeek-St-Jean, St-Gilles, St-Josse-ten-Node, Schaerbeek, Watermael-Boitsfort, Woluwe-St-Lambert, Woluwe-St-Pierre</p>	<p>Fl : Oostende W : Arlon, Namur</p>	<p>Fl : Diest, Blankenberge W : Jodoigne, Chimay, Eupen, Spa, Marche-en-Famenne, Libramont-Chevigny, Dinant</p>
8. Small communes with presence of industry			<p>W : Sankt-Vith, Bertrix</p>

N.B. The communes are in alphabetical order under the Provinces the classification of which is in the same order as that of the Institut National de Statistique. Furthermore we have distributed the urban centres into three big regions : Fl = Flanders; W = Wallonia; Br = Brussels.

defined by the Atlas de Belgique (1972). This data is shown on tables 5 and 6.

The first class shows not-industrialisation. The communes listed in this category are often rural. There are : 45% of the communes of the Province of Luxembourg, 24% of those of the Province of Namur, 20% of those of the Province of Liège and 19% of those of the Province of Hainaut.

This class does, however, include many small urban centres mainly in Wallonia and especially in Luxembourg and Namur. Among the Flemish communes are a few seaside towns (Knooke-Heist, De Haan and Middelkerke) as well as three communes of the Antwerpen urban area (Brasschaat, Borgerhout and Ekeren, the last two ones having totally or partially merged with Antwerpen on 1st January 1983).

The towns and centres with strong industrial presence - heavy or processing industry - are grouped in the second-class of the analysis. Antwerpen (before merging) and Charleroi are included as well as five Brussels communes and three communes of the Antwerpen urban area (Deurne and Wilrijk which have merged with Antwerpen and Edegem). Furthermore this category includes 7 of the 14 regional towns in Belgium and 18 urban centres, 9 in Flanders and 9 in Wallonia. This class is therefore essentially urban (62.7% of the communes here are urban centres) and is represented just as well in Flanders as in Wallonia.

The urban centres specialised in light industry are grouped together in the third category. Due to the regional industrial structures this class has 4.3 times more Flemish communes than Walloon ones : 22 out of the 27 urban centres in this category are Flemish. The importance of the textile industry is obvious : many of the communes in the third class are specialised in this activity. However, all the centres here are not in the textile industry. The following are examples of such cases : Malmédy (paper), Alken (brewery), Bornem (dairy products), Lanaken (rubber).

The fourth class groups the centres characterised by an important relative industrial presence connected especially with metal works and which, at the same time, have little light industry. As in the second class there is not much difference between Flanders and Wallonia. Class 4 is, however, far less urban than class 2 even though the proportion of urban centres is a little higher than the average. There are namely two Brussels communes (Berchem-Ste-Agathe and Forest). Communes are often in this category due to the presence of big firms of the metalwork industry, particularly : motor car construction (e.g. Genk), foundry (e.g. Couvin), cable manufacture (e.g. Dour) or construction of electrical appliances (e.g. Oostkamp). Furthermore, this class also includes two secondary centres of Liège (Ans and Herstal), one commune of the Antwerpen urban area (Hobo-

ken which has merged with Antwerpen) as well as Kuurne (secondary centre of Kortrijk) and Dison (secondary centre of Verviers).

In the fifth class, there are centres which score at the same time very high in the first factor (big industry) and very low in the second and fourth factors (light industry and metalwork). Among the big towns are Gent and Mons both of which, due to the merger of communes, now have big industrial zones in their territory. Four communes of the Liège urban area are also in this category : Flémalle, Oupeye, Saint-Nicolas and Seraing. Class 5 has most of the big steel centres, hence, for instance, Tubize (Clabecq) and La Louvière and several big chemical centres such as Tessengerlo, Ham, Mortsel and Engis.

The communes in the sixth group generally have high scores in the third and second factors (industrial load and light industry). The meaning that can be given to this sixth class is therefore basically not different from the interpretation given to the third group. The averages of the classes are very similar, and at the most it should be noted that the scores of the individuals of class six are lower, particularly in the second component. It was possible to begin the classification procedure again on the basis of a division into seven groups with the existing third and sixth classes joined, initially, into one single category. However, after considering the urban level of the communes we felt, we should keep this class. Indeed the communes of the sixth category are just very occasionally small urban centres and when this is the case they are at the lowest level of the hierarchy. Furthermore, it should be noted that this class 6 is typically Flemish, even more so than class 3.

Category 7 is the category with the fewest individuals. They are likely to show positive scores for all the factors except for the third (industrial load). All these communes have industrial activities, perhaps heavy industry or metalwork and definitely light industry, but on the whole the relative share of industry is small due to the other activities of the commune. These are often highly urbanised communes. It is therefore perfectly normal that there are the 12 communes of the Brussels urban area including the city of Brussels as well as Liège, Oostende, Arlon and Namur and nine small centres including 2 seaside towns (Blankenberg and De Panne). It should be added that this class is more Walloon than Flemish and that out of the 14 Flemish communes 8 are in Brabant and 3 at the seaside. The last and eight class in the analysis has the most individuals. Their scores are generally negative in the first two components (big and light industry) and very positive in the third (industrial load). The main features of these communes are therefore a high proportion of jobs and industrial establishments (initial variables highly correlated with the third factor). Apart from a few excep-

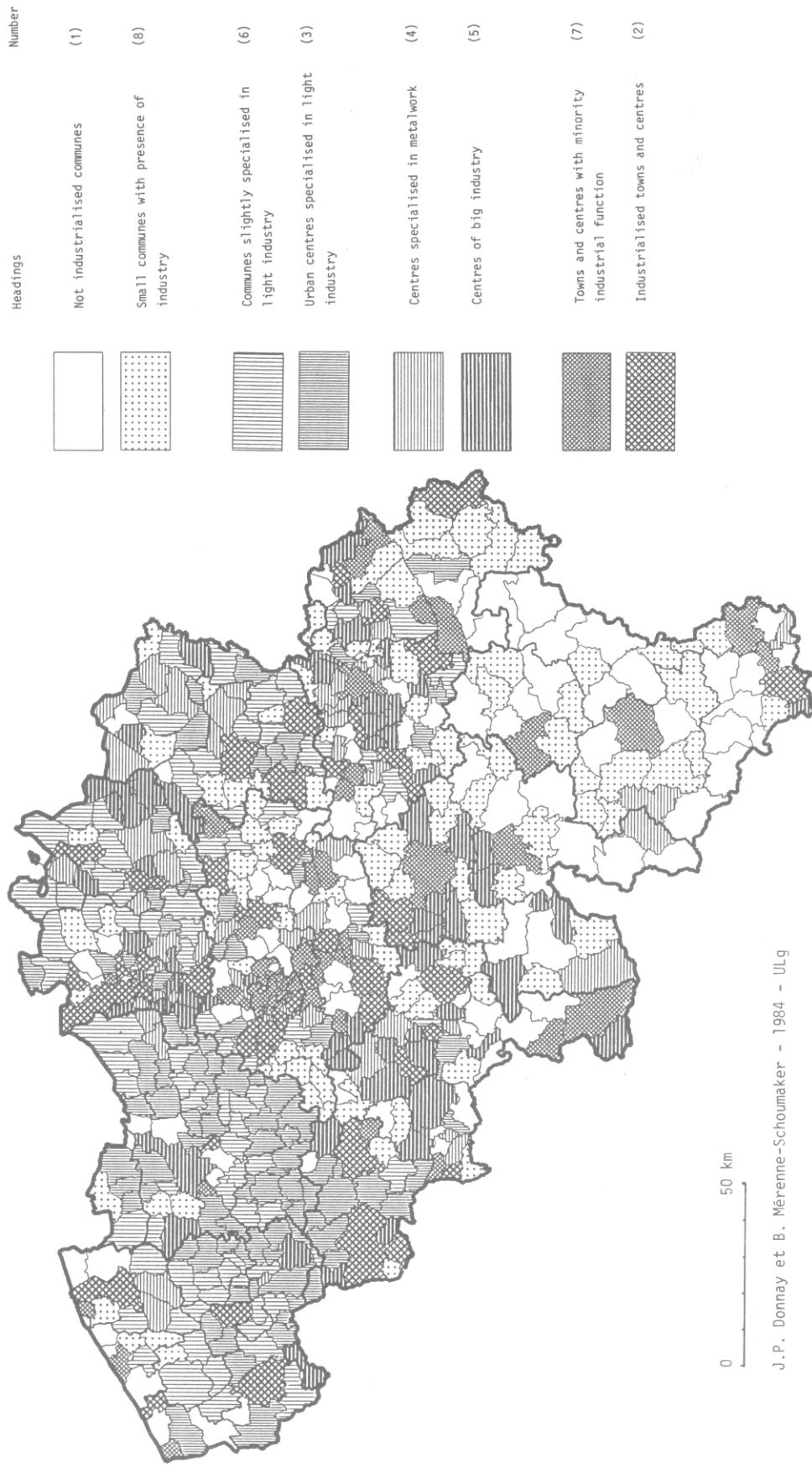
tions these communes are sparsely populated (only two - Châtelet and Courcelles - have more than 15,000 inhabitants) and do not correspond to urban centres (except for two, Sankt-Vith and Bertrix). The eight cluster is interpreted as "small communes with presence of industry". This class is more strongly represented in Wallonia than in Flanders : it includes 37% of the communes in the Province of Luxembourg, 32% of those in the Province of Namur and 20% of those in the Province of Liège.

To sum up, classes 1, 5, 7 and 8 are more Walloon than Flemish whereas the contrary can be said for 3 and 6. In class 4 the regions do not differentiate and most of the Brussels communes are in classes 7 and 2. These last two categories are very strongly urban : in addition to the Brussels communes one also finds Charleroi and Liège as well as 10 out of 14 regional towns. Classes 4, 3 and 1 also have an above average proportion of urban centres. On the other hand there are few towns in class 6 and particularly in class 8 (figure 2).

Finally, as already mentioned, several processing options have been tested during this transfer classification. Apart from the applications of the method with seven and six initiator cases - combinations of classes 3 and 6, and 1 and 8 - we have compared the results of the method using initiators with those obtained by the "pre-assigned" procedure subdividing, at each step, a category into two new clusters. As shown in table 7, the divisions are quite similar in both cases. However, the variance analysis and the distance between class centres seems less favourable to the stepwise method and for that reason the method, we have just described, was chosen.

TABLE 7. Grouping methods comparison.

With initial cluster center		Stepwise splitting		Common cases (100% = lesser size)
Cluster	Size	Cluster	Size	
8	103	4	123	100 %
4	50	2	34	100 %
5	68	3	71	98 %
1	97	6	92	95 %
7	47	5	43	79 %
2	51	8	52	71 %
6	89	1	86	71 %
3	91	7	95	70 %



J.P. Donnay et B. Mérenne-Schoumaker - 1984 - ULg

Fig. 2. Industrial typology of the Belgian communes.

2.3. Typology of communes and big industrial regions

Does industrial typology make it possible to individualise and pick out the characteristic features of the big industrial regions in Belgium? Illustration 2 gives an indisputable answer to this question by spatially visualising the classification used, this classification is shown in the appendix.

In fact, if one takes into account the communes corresponding to the classes with the highest industrial density (i.e. classes 2 to 5) and one also takes into account the classes which are the best represented as well as their spatial distribution, the regional specificities can clearly be picked out.

Both Flanders and Western Hainaut are therefore the first group to be characterised by a high proportion of class 3 communes, i.e. urban centres specialised in light industry. In this region more than 60% of the communes make up this class. The concentration can clearly be seen in the south and east of each of the two Flanders which do, however, present slightly different spatial structures. Western Flanders is less industrialised even when it includes clearly individualised poles which are almost always class 2 (Brugge, Ieper, Roeselare and Nieuwpoort) whereas Eastern Flanders seems more homogenous, the Gent pole is in class 5.

The Antwerpen-Brussels-Charleroi axis is clearly individualised on the map and its structure is typical of an industrial axis : there is a succession of class 2 poles (Antwerpen, Mechelen, certain Brussels communes, Nivelles, Genappes, Charleroi) in between class 4 communes. One can also see a few tentacles spreading out of the axis such as the one going towards Leuven. Furthermore, elaborated typology highlights the heart of the Walloon Brabant residential nucleus (Braine-l'Alleud, Waterloo, Lasne).

Campine and its Hesbaye border on the other hand make up a more heterogeneous group - but is this not a specificity of the industrial feature of this region? Industrial poles often turn out to be the class 2 type (Turnhout, Herentals, Aarschot, Hasselt, Tienen, Sint-Truiden and Tongeren) whereas leaning against them are the Herentals-Lommel-Overpelt and Hammont-Genk-Hasselt axis which often include class 4 and 5 communes. It should also be pointed out that the map also shows an Antwerpen Campine (to which are traditionally attached the 4 Limburg communes Tessenderlo, Ham, Lommel and Overpelt) and a Limburg Campine and that the lower industrial density of the Hesbaye fringe can be seen.

The Haine-Sambre-Meuse-Vesdre axis shows a structure that is very similar to the Antwerpen-Charleroi axis although the poles in this case are classes 2 and 5 except for Liège and Namur which, as already pointed out, are in class 7. There are also several tentacles such as Huy-Waremme, Namur-Dinant, Fosses-la-Ville-Gembloux.

Finally, the underindustrialisation of the south can clearly be seen on the illustration where almost all the communes are in class 1 and 8. There are two class 2 communes (Bullange and Virton), two class 3 (Malmédy and Hamoir), four class 4 communes (Couvin, Bièvre, Paliseul and Aubange) and four class 5 (Rouvroy, Doische, Walcourt and Momignies). Furthermore, the new industrial poles of Marche and Libramont are distinctly individualised in class 7. In spite of a relatively brief classification by branch, the rarely homogeneous data available at the commune level and a limited choice of indicators, the typology we established has proved to be very interesting since not only does it ensure the discovery of the big industrial regions but it also helps to characterise them both spatially and structurally.

Furthermore, a quick comparison with Sporck's survey of 1961, proposing the division and classification of industrial regions based on employment, has many similarities with our work. In spite of the economic changes that have taken place since 1960 it seems that there are few fundamental changes, at least on a macro spatial level and as concerns regional typologies.

3. CONCLUSION

The industrial typology proposed in this article is doubtlessly the first attempt at a classification of Belgian communes which integrates both the importance of industrial reality in the commune and the types of industry present.

From 36 facts selected in the Cadastral and O.N.S.S. statistics, 11 variables were built up which were to evaluate either the industrial load or the nature of the industrial activities. The principal components analysis individualised four factors accounting for about 80% of the total variation. These four components are representative of big industry, light industry, industrial load (relative share of industry in the commune) and metalworks. Using the scores obtained in these four components it was then possible to establish a typology of communes in eight classes, each class having a specific profile which, moreover, often contrasts Flanders and Wallonia, rural communes and urban centres.

In addition to the results connected to the industrial reality the analysis clearly brings to light the symbiosis of the phenomenon of urbanisation and industrialisation and, to a certain extent, the historical and political regionalisation of Belgium.

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NOTE

(1) The O.N.S.S. data by commune is not published but the general results are given in the annual rapport (O.N.S.S. 1981)

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APPENDIX. Classification of the Belgian communes on the basis of the industrial typology.

Provincie Antwerpen		RETIE	6	HAACHT	4	
		RIJKEVORSEL	6	HALLE (HAL)	3	
		RUMST	5	HELECINE	8	
AARTSELAAR	4	SHELLE	5	HERENT	7	
ANTWERPEN	2	SCHILDE	1	HERNE	8	
ARENDONK	6	SCHOTEN	3	HOEGAARDEN	3	
BAARLE-HERTOG	3	SINT-AMANDS	3	HOEILAART	2	
BALEN	5	SINT-KATELIJNE-WAVER	6	HOLSBEEK	8	
BEERSE	5	STABROEK	8	HULDENBERG	4	
BERCHEM	7	TURNHOUT	2	INCOURT	8	
BERLAAR	3	VORSELAAR	6	ITTRE	5	
BOECHOUT	2	VOSELAAR	6	IXELLES	7	
BONHEIDEN	4	WESTERLO	4	JETTE	7	
BOOM	4	WIJNEGEM	2	JODOIGNE	7	
BORGERHOUT	1	WILLEBROEK	5	KAMPENHOUT	3	
BORNEM	3	WILRIJK	2	KAPELLE-OP-DEN-BOS	5	
BORSBEEK	6	WOMMELGEM	3	KEERBERGEN	8	
BRASSCHAAT	1	WUUSTWEZEL	6	KOEKELBERG	2	
BRECHT	8	ZANDHOVEN	6	KORTENAKEN	8	
DESSEL	5	ZOERSEL	8	KORTENBERG	1	
DEURNE	2	ZWIJNDRECHT	5	KRAAINEM	7	
DUFFEL	5			LA HULPE	7	
EDEGEM	2	Province/Provincie Brabant			LANDEN	1
EKEREN	1	AARSCHOT	2	LASNE	1	
ESSEN	3	AFFLIGEM	6	LENNIK	8	
GEEL	4	ANDERLECHT	2	LEUVEN	2	
GROBBENDONK	4	ASSE	2	LIEDEKERKE	8	
HEIST-OP-DEN-BERG	6	AUDERGHEM	7	LINKEBEEK	7	
HEMIKSEM	5	BEAUVECHAIN	1	LINTER	8	
HERENTALS	2	BEERSEL	4	LONDERZEEL	6	
HERENTHOUT	3	BEGIJNENDIJK	8	LUBBEEK	1	
HERSELT	6	BEKKEVOORT	6	MACHELEN	5	
HOBOKEN	4	BERCHEM-ST-AGATHE	4	MEISE	1	
HOOGSTRATEN	6	BERTEM	1	MERCHTEM	3	
HOVE	6	BEVER (BIEVENE)	8	MOLENBEEK-ST-JEAN	7	
HULSHOUT	3	BIERBEEK	1	MONT-ST-GUIBERT	3	
KALMTHOUT	6	BOORTMEERBEEK	3	NIVELLES	2	
KAPELLEN	2	BOUTERSEM	1	OPWIJK	6	
KASTERLEE	6	BRAINE-L'ALLEUD	1	ORP-JAUCHE	4	
KONTICH	3	BRAINE-LE-CHATEAU	7	OTTIGNIES-LOUVAIN-LA-NEUVE	7	
LAAKDAL	8	BRUXELLES	7	OD-HEVERLEE	8	
LIER	4	CHASTRE	8	OVERIJSE	7	
LILLE	6	CHAUMONT-GISTOUX	1	PEPINGEN	8	
LINT	4	COURT-ST-ETIENNE	4	PERWEZ	1	
MALLE	6	DIEST	7	RAMILLIES	1	
MECHELEN	2	DILBEEK	2	REBECQ	5	
MEERHOUT	3	DROGENBOS	5	RIXENSART	7	
MERKSEM	7	ETTERBEEK	7	ROOSDAAL	8	
MERKSPLAS	4	EVERE	2	ROTSELAAR	3	
MOL	5	FOREST	4	SCHAERBEEK	7	
MORTSEL	5	GALMAARDEN	8	SCHERPENHEUVEL-ZICHEM	6	
NIEL	5	GANSHOREN	2	ST-GENESIUS-RODE	7	
NIJLEN	6	GEETBETS	8	ST-GILLES	7	
OLEN	5	GENAPPE	2	ST-JOSSE-TEN-NOODE	7	
OUD-TURNHOUT	8	GLABBEEK	8	ST-PIETERS-LEEUV	6	
PUTTE	6	GOOK	8	STEENOKKERZEEL	8	
PUURS	5	GREZ-DOICEAU	4	TERNAT	2	
RANST	5	GRIMBERGEN	7	TERVUREN	1	
RAVELS	6			TIELT-WINGE	8	

TIENEN	2
TREMELO	8
TUBIZE	5
UCCLE	2
VILLERS-LA-VILLE	8
VILVOORDE	4
WALHAIN	6
WATERLOO	1
WATERMAEL-BOITSFORT	7
WAVRE	2
WEMMEL	1
WEZEMBEEK-OPPEM	1
WOLUWE-ST-LAMBERT	7
WOLUWE-ST-PIERRE	7
ZAVENTEM	7
ZEMST	1
ZOUTLEEUW	6

Provincie West-Vlaanderen

ALVERINGEM	1
ANZEGEM	3
ARDOOIE	6
AVELGEM	3
BEERNEM	6
BLANKENBERGE	7
BREDENE	1
BRUGGE	2
DAMME	1
DE HAAN	1
DE PANNE	7
DEERLIJK	3
DENTERGEM	3
DIKSMUIDE	6
GISTEL	6
HARELBEKE	6
HEUVELLAND	6
HOOGLEDE	3
HOUTHULST	6
ICHTEGEM	8
IEPER	2
INGELMUNSTER	6
IZEGEM	3
JABBEKE	6
KNOKKE-HEIST	1
KOEKELARE	8
KOKSIJDE	1
KORTEMARK	6
KORTRIJK	3
KUURNE	4
LANGEMARK-POELKAPELLE	3
LEDEGEM	6
LENDELEDE	3
LICHTERVELDE	6
LO-RENINGE	6
MENEN	3
MESEN (MESSINES)	1
MEULEBEKE	6

MIDDELKERKE	1
MOORSLEDE	6
NIEUWPOORT	2
OOSTENDE	7
OOSTKAMP	4
OOSTROZEBEKE	6
OUDENBURG	8
PITTEM	6
POPERINGE	3
ROESELARE	2
RUISELEDE	3
SPIERE-HELKIJN (ESP.-HELCHIN)	6
STADEN	3
TIELT	3
TORHOUT	6
VEURNE	3
VLETEREN	1
WAREGEM	3
WERVIK	3
WEVELGEM	6
WIELSBEKE	3
WINGENE	6
ZEDELGEM	4
ZONNEBEKE	6
ZUIENKERKE	8
ZWEVEGEM	5

Provincie Oost-Vlaanderen

AALST	3
AALTER	5
ASSENEDE	3
BERLARE	6
BEVEREN	6
BRAKEL	3
BUGGENHOUT	3
DE PINTE	1
DEINZE	3
DENDERLEEUEW	3
DENDERMONDE	3
DESTELBERGEN	3
EKKLO	3
ERPE-MERE	6
EVERGEM	3
GAVERE	6
GENT	5
GERAARDBERGEN	3
HAALTERT	6
HAMME	6
HERZELE	3
HOREBEKE	3
KAPRIJKE	3
KLUISBERGEN	3
KNESSELARE	6
KRUIBEKE	4
KRUISSHOUTEM	6
LAARNE	3
LEBBEKE	3

LEDE	6
LIERDE	3
LOCHRISTI	1
LOKEREN	3
LOVENDEGEM	6
MAARKEDAL	3
MALDEGEM	6
MELLE	2
MERELBEKE	1
MOERBEKE	3
NAZARETH	6
NEVELE	8
NINOVE	3
OOSTERZELE	6
OUDENAARDE	3
RONSE (RENAIX)	3
SINT-GILLIS-WAAS	6
SINT-LAUREINS	8
SINT-LIEVENS-HOUTEM	6
SINT-MARTENS-LATEM	7
SINT-NIKLAAS	3
STEKENE	6
TEMSE	4
WAARSCHOOT	3
WAASMUNSTER	3
WACHTEBEKE	1
WETTEREN	3
WICHELEN	3
WORTEGEM-PETEGEM	6
ZELE	6
ZELZATE	1
ZINGEM	3
ZOMERGEM	8
ZOTTEGEM	3
ZULTE	3
ZWALM	6

Province du Hainaut

AISEAU-PRESLES	8
ANDERLUES	4
ANTOING	5
ATH	2
BEAUMONT	1
BELOEIL	6
BERNISSART	3
BINCHE	3
BOUSSU	1
BRAINE-LE-COMTE	4
BRUGELETTE	7
BRUNEHAUT	2
CELLES	3
CHAPELLE-LEZ-HERLAIMONT	6
CHARLEROI	2
CHATELET	8
CHIEVRES	8
CHIMAY	7

COLFONTAINE	4	ANTHISNES	8	SAINT-NICOLAS	5
COMINES (KOMEN)	5	AUBEL	6	SANKT VITH (SAINT-VITH)	8
COURCELLES	8	AWANS	4	SERAING	5
DOUR	4	AYWAILLE	2	SOUMAGNE	8
ECAUSSINNES	5	BAELEN	8	SPA	7
ELLEZELLES	3	BASSENGE	8	SPRIMONT	8
ENGHIEN (EDINGEN)	1	BERLOZ	1	STAVELOT	1
ERQUELINNES	1	BEYNE-HEUSAY	4	STOUMONT	7
ESTAIMPUIS	5	BLEGNUY	3	THEUX	6
ESTINNES	8	BRAIVES	8	THIMISTER-CLERMONT	6
FARCIENNES	5	BULLINGEN (BULLANGE)	2	TINLOT	3
FLEURUS	5	BURDINNE	1	TROIS-PONTS	1
FLOBECQ (VLOESBERG)	1	BURG-REULAND	8	TROOZ	5
FONTAINE-L'ÉVEQUE	5	BUTGENBACH (BUTGENBACH)	8	VERLAINE	6
FRAMERIES	3	CHAUDFONTAINE	4	VERVIERS	2
FRASNES-LEZ-ANVAING	3	CLAVIER	8	VILLERS-LE-BOUILLET	4
FROIDCHAPELLE	1	COMBLAIN-AU-PONT	5	VISE	5
GERPINNES	8	CRISNEE	8	WAIMES	8
HAM-SUR-HEURE-NALINNES	8	DALHEM	8	WANZE	6
HENSIES	7	DISON	4	WAREMME	2
HONNELLES	8	DONCEEL	1	WASSEIGES	1
JURBISE	8	ENGIS	5	WELKENRAEDT	5
LA LOUVIERE	5	ESNEUX	1		
LE ROEULX	2	EUPEN	7	-----	
LENS	1	FAIMES	7	Province Limburg	
LES BONS VILLERS	1	FERRIERES	6	-----	
LESSINES	5	FEXHE-LE-HAUT-CLOCHER	1	ALKEN	3
LEUZE-EN-HAINAUT	3	FLEMALLE	5	AS	8
LOBBES	1	FLERON	1	BERINGEN	6
MANAGE	5	GEER	7	BILZEN	6
MERBES-LE-CHATEAU	5	GRACE-HOLLOGNE	2	BOCHOLT	3
MOMIGNIES	5	HAMOIR	3	BORGLOON	3
MONS	5	HANNUT	1	BREE	4
MONT-DE-L'ENCLUS	3	HERON	1	DIEPENBEEK	6
MONTIGNY-LE-TILLEUL	1	HERSTAL	4	DILSEN	5
MORLANWELZ	2	HERVE	5	GENK	4
MOUSCRON (MOESKROEN)	3	HUY	2	GINGELOM	8
PECO	3	JALHAY	8	HALEN	6
PERUWELZ	3	JUPRELLE	4	HAM	5
PONT-A-CELLES	8	KELMIS (LA CALAMINE)	1	HAMONT-ACHEL	4
QUAREGNON	1	LIEGE	7	HASSELT	2
QUEVY	1	LIERNEUX	1	HECHTEL-EKSEL	8
QUIEVRAIN	2	LIMBOURG	3	HEERS	6
RUMES	8	LINCENT	1	HERK-DE-STAD	8
SAINT-GHISLAIN	5	LONTZEN	2	HERSTAPPE	8
SENEFFE	4	MALMEDY	3	HEUSDEN-ZOLDER	6
SILLY	8	MARCHIN	5	HOESELT	8
SIVRY-RANCE	7	MODAVE	8	HOUTHALEN-HELCHTEREN	3
SOIGNIES	5	NANDRIN	1	KINROOI	8
THUIN	1	NEUPRE	5	KORTESSEM	6
TOURNAI	2	OLNE	8	LANAKEN	3
		OREYE	6	LEOPOLDSBURG	1
-----		OUFFET	1	LOMMEL	4
Province de Liège		OUPEYE	5	LUMMEN	8
		PEPINSTER	4	MAASEIK	6
		PLOMBIERES	1	MAASMECHELEN	6
AMAY	2	RAEREN	5	MEEUWEN-GRUITRODE	4
AMEL (AMBLEVE)	8	REMICOURT	4	NEERPELT	1
ANS	4	SAINT-GEORGES-SUR-MEUSE	5	NIEUWERKERKEN	8
				OPGLABBEK	3

OVERPELT	5
PEER	6
RIEMST	6
SINT-TRUIDEN	2
TESSENDERLO	5
TONGEREN	2
VOEREN (FOURONS)	8
WELLEN	3
ZONHOVEN	4
ZUTENDAAL	4

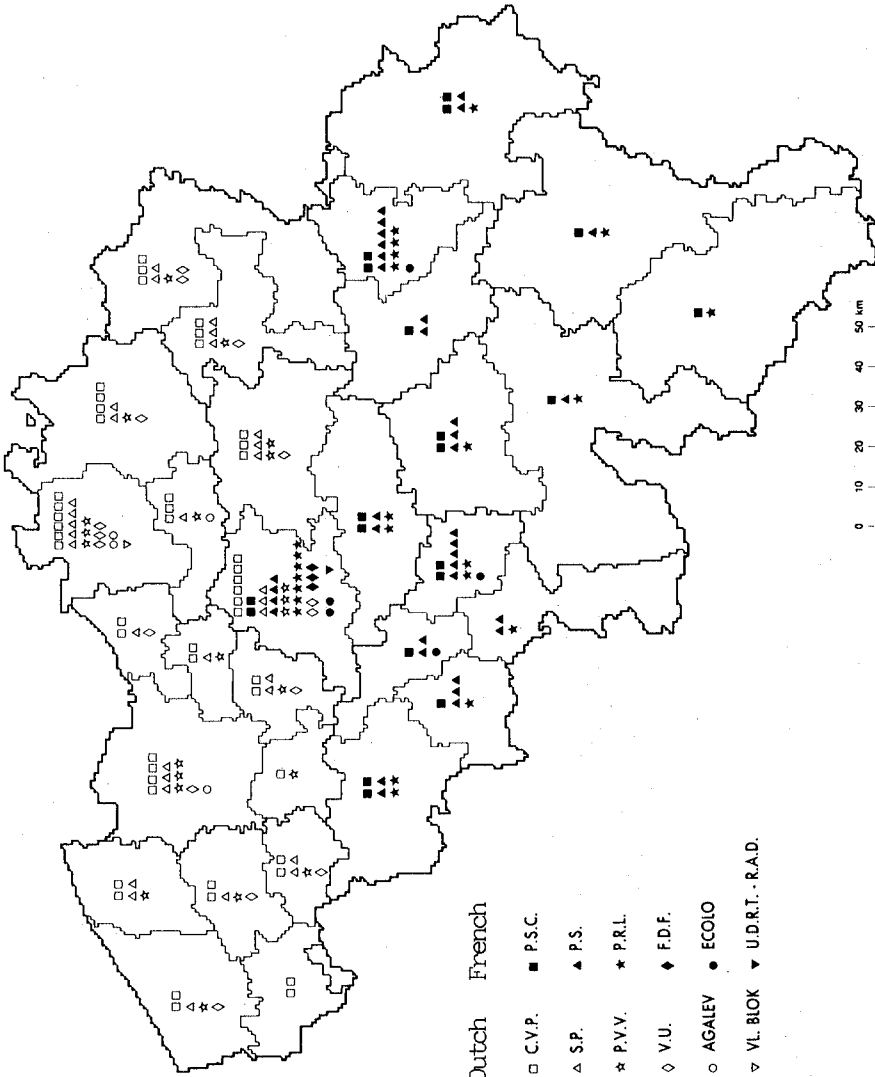
Province de Luxembourg

ARLON	7
ATTERT	8
AUBANGE	4
BASTOGNE	1
BERTOGNE	8
BERTRIX	8
BOUILLON	1
CHINY	1
DAVERDISSE	8
DURBUY	1
EREZEE	8
ETALLE	1
FAUVILLERS	8
FLORENVILLE	1
GOUVY	1
HABAY	1
HERBEUMONT	8
HOTTON	1
HOUFFALIZE	1
LA ROCHE-EN-ARDENNE	1
LEGLISE	8
LIBIN	8
LIBRAMONT-CHEVIGNY	7
MANHAY	8
MARCHE-EN-FAMENNE	7
MARTELANGE	8
MEIX-DEVANT-VIRTON	8
MESSANCY	1
MUSSON	1
NASSOGNE	8
NEUFCHATEAU	1
PALISEUL	4
RENDEUX	1
ROUVROY	5
SAINT-HUBERT	1
SAINT-LEGER	7
SAINTE-ODE	1
TELLIN	8
TENNEVILLE	8
TINTIGNY	1
VAUX-SUR-SURE	1
VIELSALM	1
VIRTON	2
WELLIN	8

Province de Namur

ANDENNE	5
ANHEE	5
ASSESE	5
BEAURAING	1
BIEVRE	4
CERFONTAINE	8
CINEY	1
COUVIN	4
DINANT	7
DOISCHE	5
EGHEZEE	8
FERNELMONT	8
FLOREFFE	5
FLORENNES	1
FOSSÉS-LA-VILLE	5
GEDINNE	1
GEMBLoux	2
GESVES	8
HAMOIS	8
HASTIERE	1
HAVELANGE	1
HOUYET	8
JEMEPPE-SUR-SAMBRE	5
LA BRUYERE	8
METTET	8
NAMUR	7
OHEY	8
ONHAYE	8
PHILIPPEVILLE	1
PROFONDEVILLE	8
ROCHEFORT	1
SAMBREVILLE	5
SOMBREFFE	2
SOMME-LEUZE	8
VIROINVAL	8
VRESSE-SUR-SEMOIS	1
WALCOURT	5
YVOIR	5

BELGIUM IN MAPS XXII Elections 13.10.85 - Chamber of Deputies
 Number of seats by electoral circonscription and party



- | | | | | | | | | |
|--------------------|---|-------|---|---------|---|--------|---|-------------------|
| Christian Democrat | □ | Dutch | □ | C.V.P. | ■ | French | ■ | P.S.C. |
| Socialist | △ | | △ | S.P. | ▲ | | ▲ | P.S. |
| Liberals | * | | * | P.V.V. | * | | * | P.R.L. |
| Nationalist | ◇ | | ◇ | V.U. | ◆ | | ◆ | F.D.F. |
| Green | ○ | | ○ | AGALEV | ● | | ● | ECOLO |
| Others | ▽ | | ▽ | VL BLOK | ▼ | | ▼ | U.D.R.T. - R.A.D. |