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New Information Systems:
The use of Retail Information Systems in the Netherlands

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Abstract

This article describes the use of Distributional Information Systems (DIS) in the Netherlands as an important tool in retail planning. The development of DIS as a nation-wide coverage of the whole retail sector is pictured. Due attention is given to the performance and success of DIS, followed by a more elaborate discussion of the linkage between DIS and Geographical Information Systems (GIS). Various empirical examples are presented as well.

1. Toward an Information Society

Effective and accessible information systems are vital to economic performance and strategic decision-making. According to recent estimates, already more than half the jobs are directly or indirectly related to information and services, and this figure is likely to grow in the near future (see also Naisbitt 1984). It is increasingly believed that advanced infrastructures for information exchange and services will be as dominant in the last decade of the 20th century as canal, rail and road transport infrastructures were in previous centuries.

Especially the rapid development of digital and electronic technologies opens a new potential for sophisticated voice, data and image transmission, such as digital recording and transmission of sound and pictures, optical fibres for very fast transmission of information, super-fast computers and satellite broadcasting and video transmission. Especially in the RACE programme of the European Community many attempts are being made to stimulate and enhance R&D in information technology. Clearly, the development of hardware and software has to run parallel in this context.

From a geographical viewpoint the trend towards advanced information systems has led to the design and use of geographical information systems (GIS). A GIS serves to offer a coherent representation of a set of geographical units or objects which - besides from their locational position - can be characterized by one or more attributes (feature, label or thematic component). Such information requires a consistent treatment of basic data, via the stages of collection and storage to manipulation and visualisation.

All such information systems may be highly important for planning of our scarce space, not only at a global scale (e.g., monitoring of rain forest development), but also at a local scale (e.g., physical planning). In this framework, spatial information systems are increasingly combined with pattern recognition, systems theory, topology, statistics and finite element analysis.

Such techniques are not only relevant for scientific research, but may also act as information bases for physical planning. The Netherlands has always been marked by a strict system of physical planning in view of a proper management of scarce space, and it is no doubt that various types of spatial information systems have been developed in recent years which serve to provide a rational basis for policy judgement.

One of such initiatives will be briefly described in the present paper, viz. the so-called distributional information system (DIS), which is essentially a retail information system. In Section 3, some backgrounds of this system will be described, followed by a more in depth description of this system in Section 4. Section 5 will then be focused on possible applications of GIS-DIS in retail planning, whilst this paper will be concluded with some retrospective and prospective remarks.

2. Geographic Information Systems

The past twenty years have witnessed the development of various computer-based applications of information systems which have changed the activity patterns and decision modes of people. The design, manufacturing and quality control of products have been altered significantly with the introduction of Computer Aided Design and Computer Aided Manufacturing (CAD/CAM). To the same extent GIS tools are currently modifying our perception of geography and planning.

In the introduction we already discussed the functions of a GIS: handling geographic data entry, storage, analysis and mapping more rapidly, inexpensively, and accurately than the traditional non-automated methods. While effective record-keeping, analysis and management are important benefits of GIS in the daily operations, the greatest benefits of GIS are those resulting from its application in support of decision making. A GIS can quickly and accurately provide decision makers with information in the most concise form: a picture. A GIS produces maps and supporting tables of information that used to be difficult or time consuming to produce in the past. It generates a multitude of relationships in information from varied sources which are immediately accessible to decision makers, who can then spend their time on strategic policy rather than assembling facts hidden in volumes of written information.

The above text is evidently a very positive description of the possibilities and the potential of GIS; it is however based on the experiences of the first GIS-users, i.e., the city of Tacoma (see Woods 1990), one of the first cities in the United States that were using GIS in their planning practise. Of course this kind of laudary comments can also be found in the descriptions of the major software vendors. On the other hand, it has to be recognised that GIS is just in its development phase. Therefore it is interesting to know what the experiences are concerning the application of GIS in the Netherlands.

It is only a few years back that the first application of GIS in the Netherlands has materialized.

The introduction of a complete GIS started in the Netherlands in 1985. In that year both the National Physical Planning Agency (RPD) and the Geographical Institute of Utrecht bought hardware and software for the development of GIS (see also Scholten 1987, Ottens and Harts 1985). Of course, at that moment there were already various kinds of smaller software packages and information systems in use (e.g. Van Est and De Vroege 1981). But especially the case of the RPD showed the necessary conditions for building up a real GIS; hardware, software, but - most of all - data and an organisation. After four years of hard work one may conclude that a GIS for spatial planning on a national level (scale 1:25000) has reached the state of maturity, so that application of GIS for decision support is nowadays not any longer a vendor story (Scholten and Padding 1990, De Jong 1990).

After the RPD we have seen many more organisations in the Netherlands which have started with the installation of a GIS (e.g. STIBOKA, the National Agency for Soil Research, the Ministry of Agriculture, RIVM, the National Institute of Public Health and Environmental Protection, and some Planning Agencies of Dutch provinces). They all have the same problem: how to gather information regarding both the geographical and the attribute part, and how to build up an organisation for on one hand the record keeping and on the other hand the application of the information system for decision support by using the appropriate methods and techniques for spatial analysis.

The GIS systems will prove their strength when the complete systems are available. The spatial component makes it possible to add and to integrate a variety of spatial information for a diversity of purposes. This makes GIS an instrument par excellence for spatial planning in a broad context, in particular for retail planning. But apart from hardware and software, retail planning needs data and an organisation to build up such a system aimed at generating significant benefits at all levels of government (cf. Borgers 1989, French et al., 1989, and De Man 1989).

In the next sections we will discuss these aspects in more detail, starting with a general introduction into retail developments in Section 3.

3. Developments in the Retail Sector

Retail planning is an important planning field in the Netherlands. It covers the administrative competence of two ministries, viz. the Ministry of Economics and the Ministry of Physical Planning. Until the mid eighties, each city which wanted to change the structure of the retail sector (e.g., building of a new shopping centre, reconstruction of an existing centre etc.) was forced by law to undertake a retail planning study. These studies might range from small scale to large scale studies, might use simple interviews or sophisticated models, and might be ad hoc or well structured. For many cities this was a very expensive undertaking and during the first wave of deregulation it was decided by the government to relax the obligation to pursue such a study under all circumstances. On the other hand, there was still the need for adequate and up-to-date information for strategic retail planning, and this need becomes once more apparent after all dramatic changes in the structure of the retail sector which were to a large extent associated with the economic stagnation in the beginning of the eighties.

The changes in competitive position in the retail sector were reflected in effective demand, productivity, institutional cooperation, labour intensity, technological change, locational change, hierarchical patterns, etc. As a consequence, we observe in many cities a distortion of equilibriumm between supply and demand, dramatic decays in older shopping streets and older shopping centres, a reduction in the position of district shopping centres, a rise in large scale shopping facilities, a trend toward peripheral shopping centres, and changes in shopping behaviour caused by more mobile (i.e. long distance) forms of shopping (especially for specialized services) on the one hand and by technological innovations (e.g., teleshopping) on the other hand.

In view of these developments it is extremely important to have relevant and up-to-date information on trends in shopping facilities, both from a macro-economic perspective (i.e., sector policy) and local economic perspective (retail planning, investment behaviour etc.). Such an information system is also necessary, as retail planning in the Netherlands is a joint responsibility of local, regional and national governments and the business sector. These considerations have then led to a decision to introduce the above mentioned DIS. Such a system should be able to picture the rapid evolution in the retail supply sector in the Netherlands.

4. A Distributional Information System

Retail information systems aim at systematically collecting, storing, retrieving, monitoring and reproducing essential information on the development of the retail and distribution sector. In this respect it serves as a planning vehicle, a basis for proprietary knowledge, a basis for public knowledge, and a basis for public-private cooperation. The clients of such information systems may be local or regional authorities, the national government, the private sector, research institutes etc. Uniform retail information systems aim at generating significant benefits for planning, management and monitoring functions at all levels of government.

The DIS system which has been designed and implemented in the Netherlands offers a uniform, nation-wide coverage of all retail establishments - ranging from small-scale shops to large-scale department stores. The standard format of DIS includes accurate information on the name and location of a shop, its branch, the range of products, its precise size (in square meters of sales space), the use of its floorspace and its vacancy, and its position in amenities hierarchy of a place. This is thus a unique collection of data, based on time consuming field work. All information can be provided in systematic tables or on diskettes.

The registration takes place on a computerized basis via the regional Chambers of Commerce, which have an on-line connection with the Central Office of the Chambers in Woerden, so that all information can be provided centralized and decentralized on a PC. All DIS-information can be supplied on either computer lists or diskettes.

DIS has the following attributes/features:

- accessibility to the information system
- reliability of relevant data
- up-to-date information (twice a year a check)
- nation-wide coverage at a (de)centralized level
- uniform definition/standards for measuring size
- client-friendly use
- potential for dynamic analysis and monitoring
- aggregation possibility at each spatial and branch level
- flexibility in terms of linkage to other information systems

DIS offers for cities, research institutes, regions, entrepreneurial associations and private firms a wealth of strategically relevant information. These clients will briefly be discussed here.

cities

- planning of new shopping areas and impact analysis on existing retail structure
- general retail planning and monitoring
- judgement of new applications for retail establishments
- quality assessment of shopping centres
- assistance in designing restructuring plans for city centres
- up-to-date information on business activities in a given area
- plan preparation in urban renewal areas
- preparation of structure and land use plans for cities
- judgement of the spatial economic structure of a certain area.

research institutes

- registration of shifts in the retail sector
- assistance in designing local expansion plans in the retail sector
- locational research for individual firms

regions

- evaluation and judgement of local and regional distributional plans
- strategic branch-specific research
- research into shopping facilities in small villages
- research into the effects of new large-scale peripheral shops

entrepreneurial associations/private firms

- plan evaluation (e.g., by project developers)
- design of retail plans (e.g., by branch-specific entrepreneurial associations)
- locational analysis (e.g., by individual firms)
- retail establishment advice (e.g., by banks)
- intermediate consultancy (e.g., by brokers).

This multi-client orientation on a broad nation-wide market incorporates of course many severe problems. For instance, the aim of a nation-wide coverage (i.e., an inventory of 120.000 shops in a time span of four years followed by a bi-annual check and maintenance of all information) is very ambitious. See map 1 for an overview of the current state of affairs.

Furthermore, it is interesting to observe that all new information evokes the need for additional information. Once a satisfactory coverage

of the retail supply side in various regions was reached, new claims emerged, such as:

- the need for a more detailed inventory of all space use by shops
- the need for more insight into employment and revenues of the retail sector
- the need to have also a demand information system, based on information from the household sector
- the need to link the DIS system to other types of spatial information systems (e.g., GIS in general)
- the need to represent the DIS information in user-friendly visual form (e.g., computer carthographic display).

The latter issue, i.e., a link between DIS and computer graphic mapping, has recently been tackled. In a 'shopping atlas' for the province of North-Holland a wide range of experiments has been undertaken, showing the potential of computer graphics for retail planning and research. Some results and further reflections on it will be discussed in the next section.

5. Applications of GIS-DIS in Retail Planning

In general, for spatial planning (including retail planning) with regard to the economic development of inner-cities, urban centres, neighbourhood centers and retail development outside the city the availability of a geographical information system which contains information of both the supply and demand side is an almost necessary condition. A first research project (BRO 1989) has shown the possibilities of the integration based on the locational component of demand information based on survey research and the supply information from the above mentioned DIS.

Some examples of recent computerized GIS-DIS applications in retail planning can be found in maps 2 through 6, taken from the Winkelatlas Noord-Holland. These maps also show that relevant retail information can be provided at various geographical levels. The basic georeference code in the DIS-system is the streetname and number and the six digit postal code.

DIS has in recent years been used in various fields and by various actors. Examples are: the identification of 'white spots' in the retail market by new investors, the judgement of the need by local authorities

to expand the existing retail area in a city, the planning of an integrated supply-demand equilibrium at a regional scale for the retail sector, the preparation of an urban structure plan including both business services and retail services (by using GIS tools), etc.

It is also interesting to investigate the possibilities of DIS and GIS for private retail companies. Their basic questions are usually related to the 'who, what and where' of their focal activities like: who are the customers (or who should the customers be), who are the competitors, what products should be developed, and where are the customers, where should new activities be developed, where are the competitors and where should the distribution process take place? In the current increasingly competitive markets, the successful retailer is likely the one who can gather information relevant to these issues, and integrate it effectively into the decision making process. In Canada, the United States and also in England there are good examples of research projects in which the applications of GIS show the possibilities of the integration of different data sources and the improvement of already existing spatial models within this framework. An overview of research on retail projects in this field is given in a special edition of Environment and Planning A (1989). In general, these research projects appeared to have the following structure:

Data Integration

GIS information from separate sources can well be integrated to perform powerful statistical analyses. The usual information employed was:

- data at the census tract level (e.g., population, average income, number of income earners per household);
- customer spotting survey data (e.g., consumer demographics, expenditures and opinions about competing stores) which is geo-referenced for instance by using the postal code;
- competitive data (e.g., estimated sales and size of stores);
- geographical information about the research area (e.g., census tracts, postal code boundaries, topographic information, e.g., roads, parking spaces, station, residential areas, etc.).

In the above mentioned countries census tracted information was obtained and integrated into the data base. Also the census tract boundaries were digitized and stored. The Netherlands does not have census information, but has more or less the same kind of information at its disposal at the level of CBS neighbourhood districts.

A second data source used in the above analyses was the result of surveys. Respondents are asked a number of questions about e.g., income, shopping behaviour and geo-reference data using their postal codes. Also in the Netherlands the large retailers use 'family credit cards' in order to get this kind of information in an easy way. Furthermore there are various kinds of private firms which are collecting information at the level of the postal code areas in the Netherlands, especially aimed at marketing research (e.g., GeoMarktprofiel, Mosaïc).

Competitive information (e.g., from different sources) appeared to be necessary to ensure a reliable analysis, notably information related to stores, but also to the location of other stores, number of parking places, etc.

Methodology

Trade area analyses appeared to comprise of three parts:

a. calculating the actual market share;
b. analyzing the impact of competitors;
c. determining the characteristics of the trade area population using the survey responses.

The actual market shares can then be based on empirical market share models. For instance, the following data can be employed in such model:

a. results from the in-store customer spotting survey;
b. census tract population and income data;
c. per capita weekly food expenditures provided by retail trade;
d. sales of the store under consideration.

The empirical model can calculate market shares by census tract or postal code area. First, a model calculates census tract income as a ratio of city average. Then the per capita weekly expenditure for each census tract can be determined using a weighting scheme which assumes for instance that consumers from lower income tracts will spend less than the consumers from higher income census tracts. The results can then be multiplied by the average per capita weekly expenditure to arrive at the per capita weekly expenditure for each census tract. By taking this result and multiplying it by the census tract population, the value of the market for each census tract is obtained. The amount of money being spent by the in-store survey respondents in each census tract is then calculated by multiplying the proportion of total respondents in each census tract by the weekly sales at the store under consideration.

Finally, the market share by census tract can be calculated by taking the the respondents' expenditures and dividing these by the value of the market in dollars or in pounds. The graphic result is the census tract map classified to reflect the market share expressed as a percentage of the total markt. Potential mapping functions can be used to generate maps based on information about the competitor's store. Assumptions have to be made about the attractiveness of the competitor such as the square footage of retail floor space, the distance to residential areas, the distance to other shops, the amount of parking space, etc.

The theoretical market share (i.e., the share of the market which the retail store should capture) may be calculated by using interaction models. The results can be presented in maps showing the attractiveness of the store under consideration and the competitors' stores. By means of an overlay analysis of these two maps in GIS, one can produce a map showing how attractive the store under consideration is relative to the competition.

The market share analysis can be elaborated upon by comparing the potential maps based on the census tract statistics.

The above overview of the use of GIS in retail planning is just a very general description. The important point to make is, that GIS gives the following advantages:

- data on different levels and from different sources can be stored and combined;
- analyses which make use of spatial variables can be used (distance decay functions);
- results can be presented in the form of maps in a very easy way.

All these possibilities did already exist, but they are now available in an integrated environment (see for a good example of such an integration Clark 1990).

The combination of DIS-GIS provides a high potential for a more coherent view on the supply side of the retail sector.

6. **Epilogue**

DIS has been supplemented as a tool for retail planning for both the private and public sector, for both economic and physical planning purposes. In addition, it is a rich source of information for a multiplicity of clients.

DIS has to be judged against the background of a strict planning culture in the Netherlands. Its socio-economic significance is potentially very high, although the judgement of its performance may be complicated, as the zero-option (no DIS at all) is difficult to imagine (though the zero option would nevertheless incur high ad hoc costs).

Whether DIS - as a public information system - has to be structurally subsidized (in view of its relevance for public policy-making) or whether it has to cover - through revenues from users - its own costs, is an open question. However, it is foreseeable that the survival chances of a new information system are higher as it is able to generate more financial support from both public and private users. In other words, at the end the price elasticity of demand is of critical importance for the continuity of such information systems. The result will of course be more viable, as DIS would also generate more product diversification (e.g., a shopping atlas, computer graphics and mapping software, a retail information handbook, links to GIS etc.). Consequently, market penetration and market diversification are critical success factors and need to be supported by tailor-made marketing strategies.

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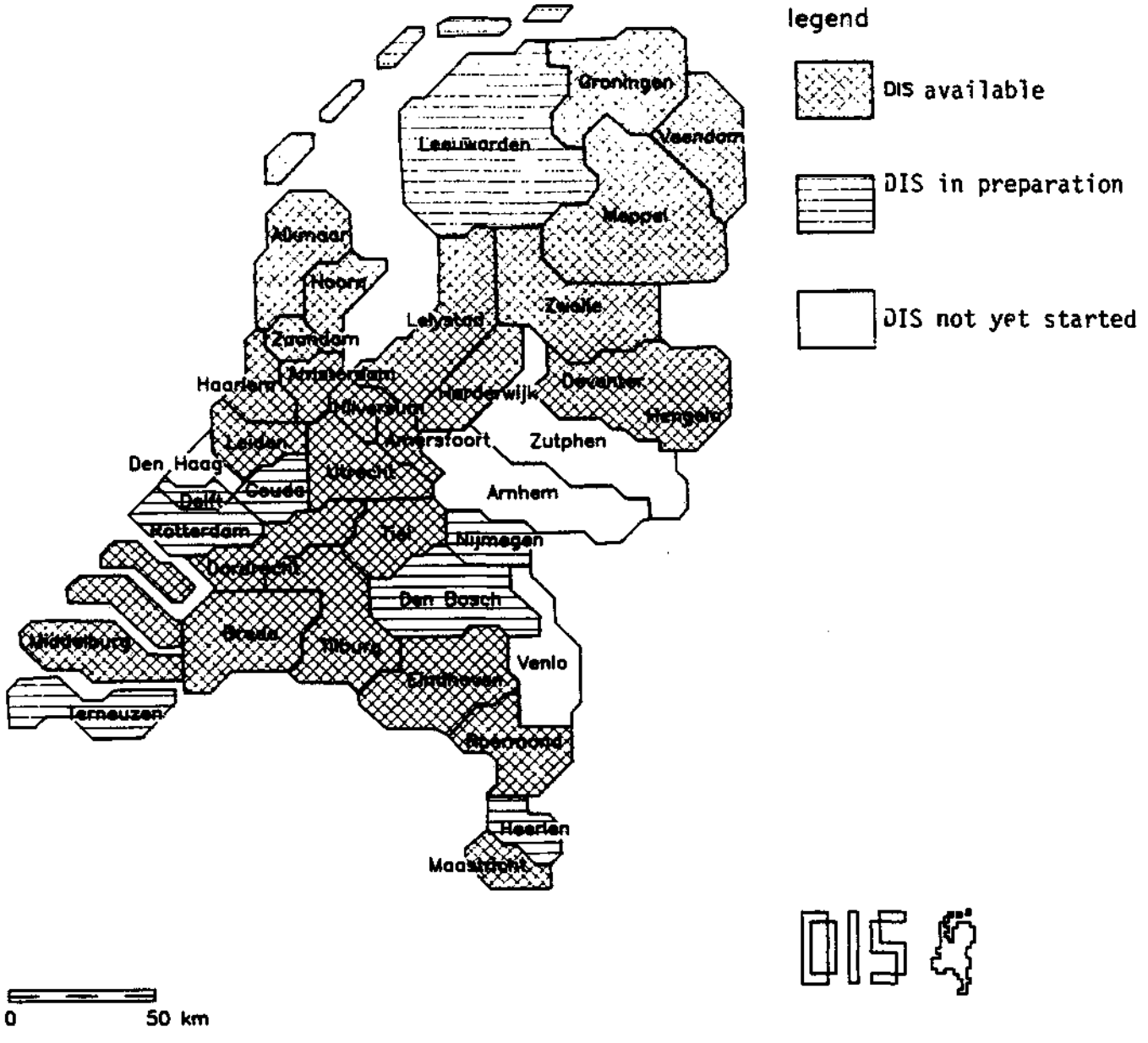
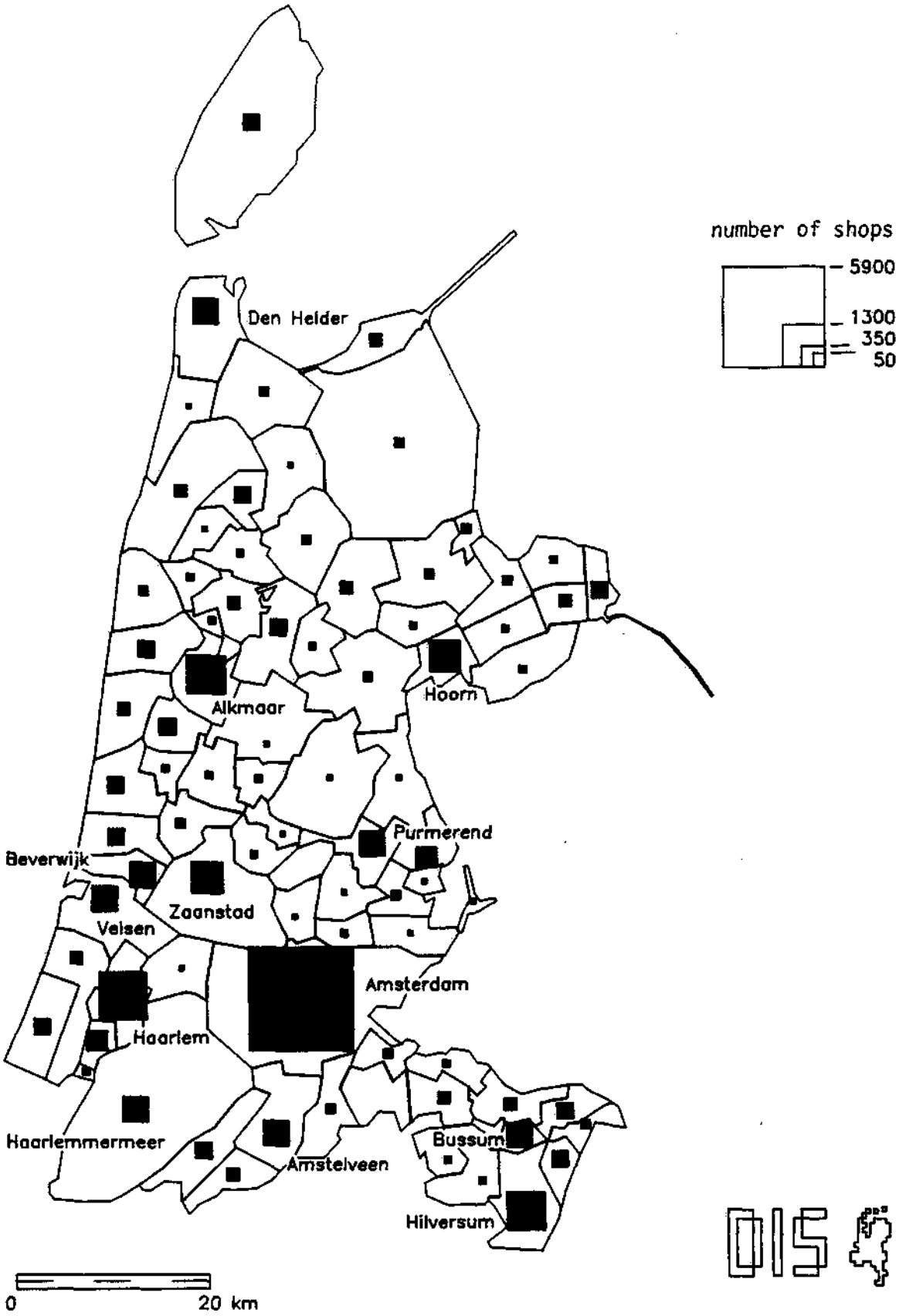
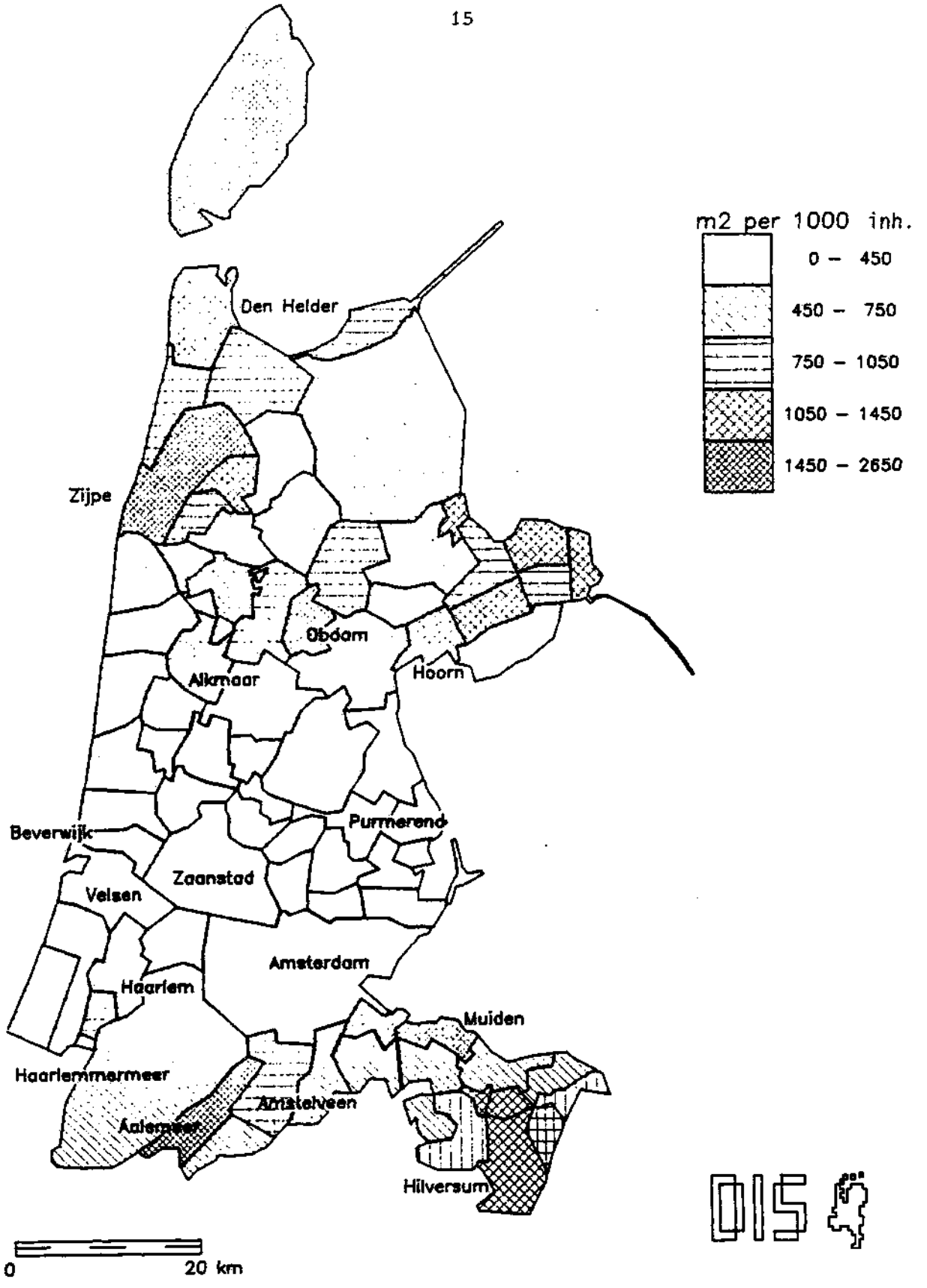
State of affairs of design of DIS (March 1989)



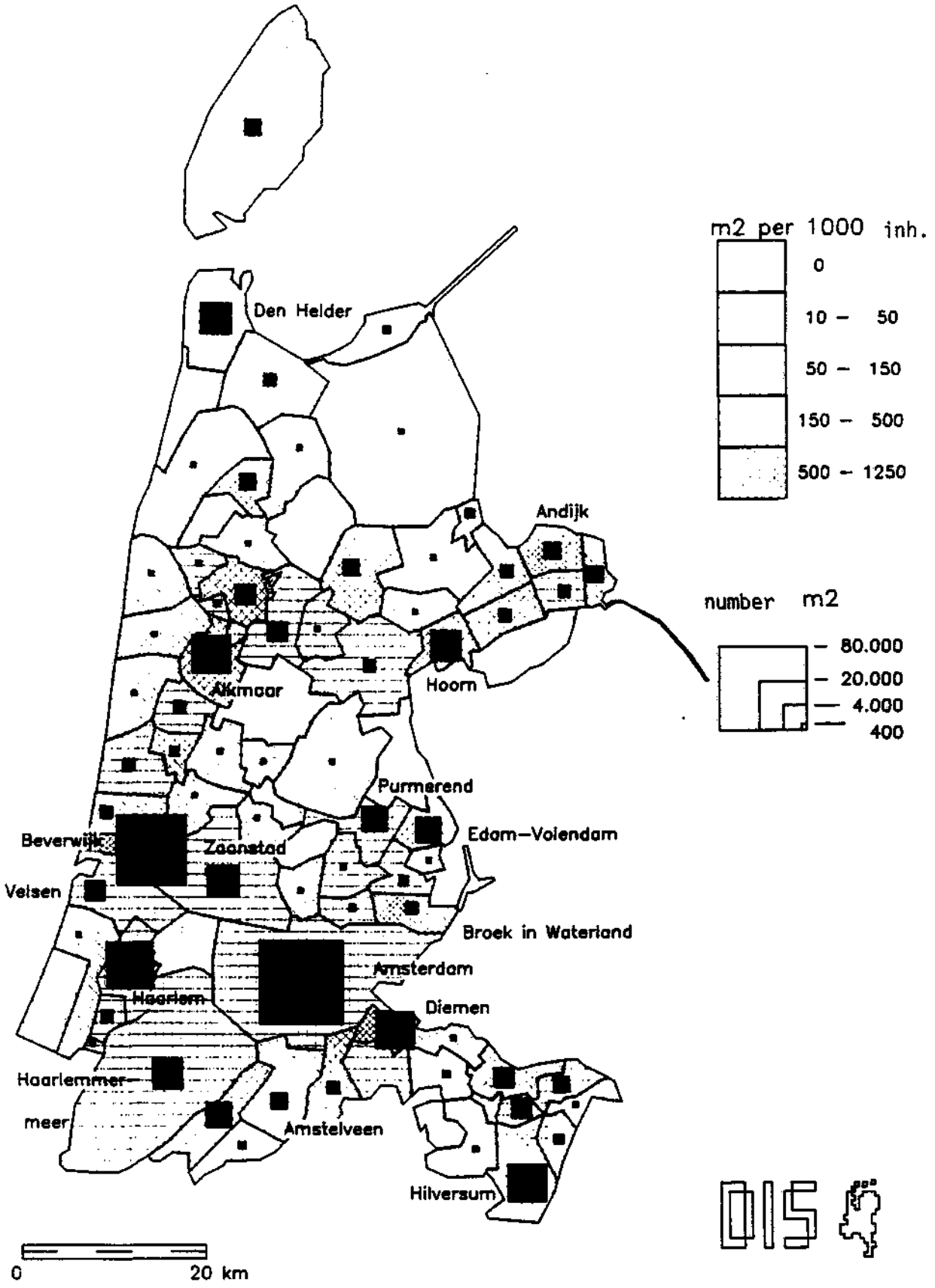
Map 1. Subdivision into Chambers of Commerce



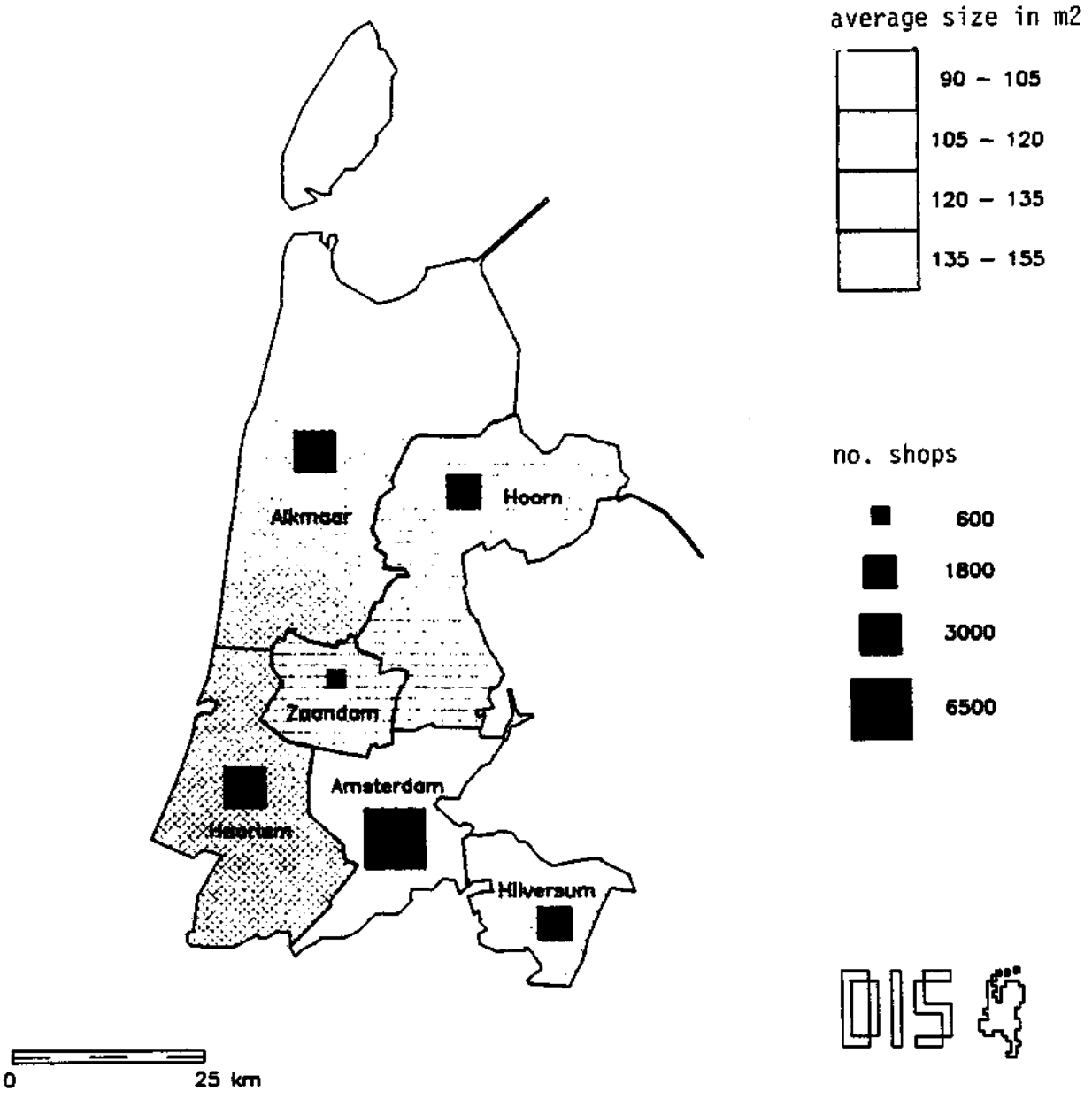
Map 2. Number of shops in communities in North-Holland (1988)



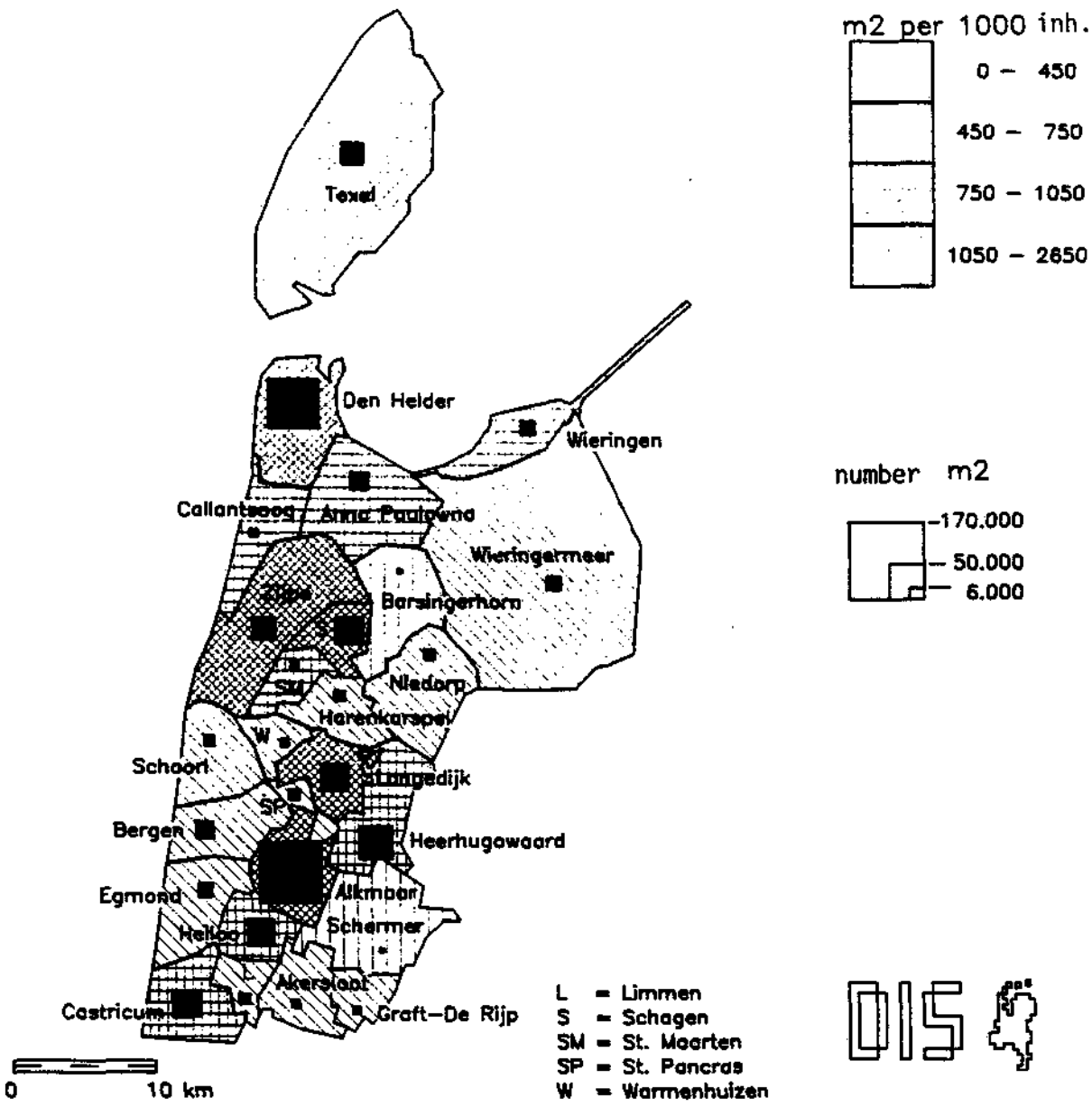
Map 3: Size of shops in communities in North-Holland (1988)



Map 4. Size of shops in the furniture branch in communities in North-Holland (1988)



Map 5. No. and average size of shops in Chamber of Commerce districts in North-Holland (1988)



Map 6. Size of shops in communities in a Chamber of Commerce district (Alkmaar) in North-Holland (1988)