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INFORMATICS OR ORACLES IN REGIONAL PLANNING

Peter Nijkamp

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Peter Nijkamp

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1. Introduction

The industrial revolution has meant a landmark in the history of mankind. The current 'informatization' of our society, also denoted as the 'informatics revolution', may mean another milestone in the development of modern societies (see Nora and Minc, 1978).

There are however significant differences between the industrial and the informatics revolution. The industrial revolution meant a large-scale geographical concentration of economic-technological activities and people at favourable places (due to natural resources, physical conditions and so forth). The commodities produced in such industrial centres had to be shipped to regional, national and even international market places. Consequently, large-scale physical transport (commodities, people) is one of the main features of the industrial society. This will be called locomotion.

The costs of the locomotive society are extremely high, not only in terms of direct transport costs, but also in terms of risks, traffic safety, congestion, environmental deterioration and other externalities. Therefore, it is no surprise that our post-war quaternary society has paved the road toward a blend of knowledge orientation and information transmission (see Moto-oka, 1983). The resulting 'informatics revolution' will no doubt have a profound impact on the functioning of our societies. It is increasingly realized that - in addition to traditional production factors (such as capital, land, labour and resources) - also information is a production factor of major importance. Information appears to become the most appropriate tool to increase the efficiency of production, and hence to improve the competitive position of industrial sectors, regions and countries.

Consequently, accessibility to information systems and fast data transmission are nowadays often more important than efficiency in physical transport. The logistics revolution and flexible automation in many large-scale multi-plant firms are a good illustration of this point. Instead of locomotion we observe an increasing trend toward infomotion.

Infomotion has a deep impact on the economic development potential of cities, regions and countries. In the locomotive society the highest growth potential could be achieved by those areas which had the most favourable physical locational profile, as is clearly illustrated by the evolution of western economies after the industrial revolution. In the infomotive society however a new spatial pattern may emerge, in which the competitive position of areas is mainly determined by their accessibility to information and telecommunication systems. This also implies that even peripheral areas (the Greek islands, the Mezzogiorno) may have unexpected growth promises in the next decades.

Infomotion is not only relevant in the context of entrepreneurial decision-making, but it is equally relevant in the fields of public decision-making (at both a national and a regional or local level). In these cases, information is not only power, but often even ammunition. Therefore, effective and efficient public policy-making needs badly an advanced planning environment oriented toward the use of modern communication and information technology.

Public decision agencies sometimes fear that the information technology is only a modern variant of the old Delphi oracle. This is unfortunately a misguided perception of the potential offered by the informatics revolution. Accessibility to and efficient use of information makes also public decisions more competitive. Clearly, the current terminology (artificial intelligence, learning machines, expert systems, fifth generation of computers, acoustic sensor systems, symbolic query languages) may make potential users somewhat suspicious and may even evoke a feeling of distrust. It should be realized however that all these developments in informatics, nowadays often denoted as Knowledge Information Processing Systems (KIPS), may - in case of a 'smart software' and an intelligent user - enhance the quality of public decision-making in terms of management, strategy and also effectiveness (see also Feigenbaum and McCorduck, 1983). In conclusion, infomotion is nowadays an indispensable component of private and public decision-making.

2. Regional Potential of the Information Sector

In contrast to the successive phases of the industrial revolution (mechanization, energy transmission, electronics), the informatics revolution has a highly regulating and controlling potential which makes information and telecommunication extremely appropriate instruments in a policy-making context. This new development has three major features, viz. (a) high speed and reliability, (b) flexibility and adaptive potential, and (c) organizational and communicative power. Consequently, informatics will not become a substitute for private or public decision-making, but it will enhance its quality by providing complementary tools (cf. Wegener, 1985). In this respect one may assume that the 'wealth of nations' (Adam Smith) will be determined by the 'wealth of information'. This holds of course also true at a subnational level for the 'wealth of regions'. Thus the distribution and use of modern information and telecommunication technology will exert a decisive impact on the distribution of welfare among regions (see also Fritsch and Ewers, 1985). Free access to information and knowledge networks is therefore of paramount importance for a balanced development of a country or a global economy. Monopoly tendencies on the other hand will no doubt aggravate distributional inequalities.

This statement does not only hold for the information sector as such, but also for the telecommunication sector. It is sometimes argued that a monopoly provision of telecommunication services can be defended on the following grounds: (a) telecommunications are a natural monopoly, (b) telecommunications services should be provided on the basis of equity and 'public service' considerations, rather than of market criteria, and (c) telecommunications make a vital contribution to industrial and technological development, and thus to national security. It has however been suggested by Ergas and Okoyama (1984), that a competitive system, supplemented by adequate public regulations, is not necessarily inferior.

In view of the increasing importance of information for management and decision-making, it is no surprise that the information sector has grown dramatically. For instance, Naisbitt (1982) claims that approximately 60 percent of total employment in the USA is information-oriented. Despite this growth, it is interesting to report on some disenchanting observations, made by Jonscher (1983), who claims that the contribution of the information sector to final (consumer) expenditures is relatively low (approx. 7 percent), and that it is more the turnover and substitution rate within the quaternary sector which is high, than the absolute total growth. On the other hand, the indirect productivity increases caused by the information sector may be very significant. In general, the employment generating effects of the information sector are still fairly modest, while the assessment of these effects is fraught with difficulties and uncertainties. For instance, the information technology market is highly segmented and mainly composed of 3 different segments (see Hills, 1984), viz. computers (mainframes, micros, software, etc.), telecommunications (transmission via satellites, microwaves, fibre optic, cable, videotex, etc.), and microelectronics (chips, microprocessors, etc.).

Despite many uncertainties regarding measurement, it is clear that the information sector has grown in importance over the past decades. For instance, the telecommunications industry being only a small part of the informatics sector absorbs already one per cent of the GNP in the OECD countries annually (see Ergas and Okayama, 1984). This importance is also illustrated by Figure 1, based on Business Week (June 30, 1980, p. 104). The same journal also states:

> "The old industrial society that generated wealth in the form of capital goods and manufactured products is giving way to a new society valued in terms of intangible assets, such as knowledge and information processing. In fact, for 15 years more people have been working at processing information than any other type of job." (June 30, 1980, p. 102)

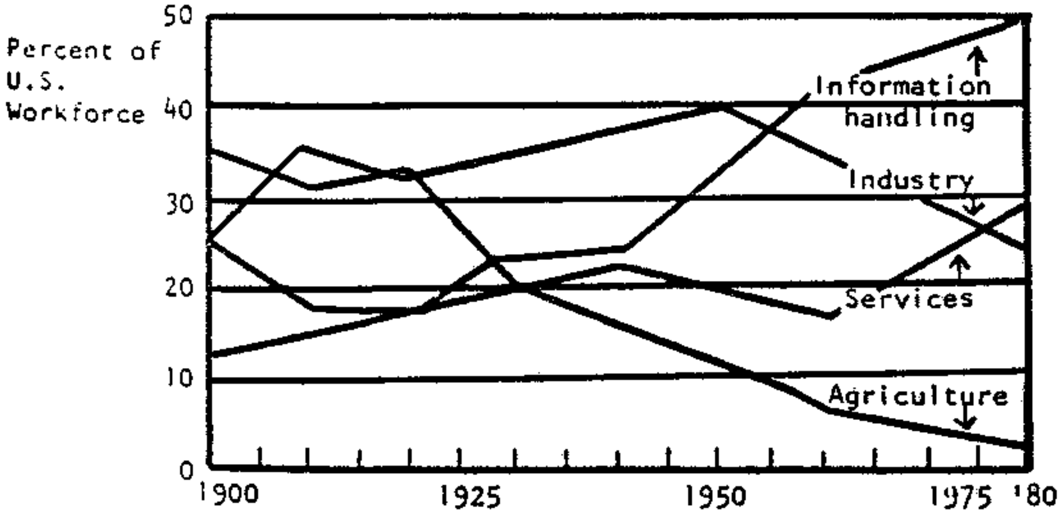


Fig. 1: Employment Trends in Four US Sectors (1900-1980)

An interesting contribution to the discussion on the importance of the information technology for corporate strategy has been made by Goldhar and Jelinek (1983), who emphasize the economies of scope - in contrast with the economies of scale - offered by this technology. This means that the information technology allows an integration of all economic, organizational and technological functions (such as engineering and marketing) in one organization, so that the process predictability, timely delivery, quality and efficiency can be improved without losing. flexibility and variety. The capabilities of such information-based systems for manufacturing processes are:

Extreme flexibility in product design and product mix, which allows for an almost unlimited variety of specific designs within a reasonable family of options, including alternative materials.

Rapid response to changes in market demand, product design and mix, output rates, and equipment scheduling.

Greater control, accuracy, and repeatability of processes, all of which lead to better quality products and more reliable manufacturing operations.

Reduced waste, lower training and changeover costs, and more predictable maintenance costs.

Greater predictability in all phases of manufacturing operations and more information, both of which make possible more intensive management and control of the system.

Faster throughput due to better use of all machines, less in-process inventory, fewer stopping for missing parts or materials, or machine breakdowns. Higher speeds are now made possible and economically feasible by the sensory and control capabilities of the "smart" machines and the information management abilities of the CAM (Computer Aided Manufacture) software.

Distributed processing capability make possible and economical the encoding of process information in easily replicable software.

The same authors also claim that the differences between traditional technology and Computer-Integrated Manufacturing in factories and organizations can be indicated as follows (see Goldhar and Jelinek, 1985):

Traditional technology	Computer-Integrated Manufacturing
Centralization	Decentralization
Large plants	Disaggregated capacity
Balanced lines	Flexibility
Smooth flows	Inexpensive surge and turnaround ability
Standard product design	Many custom products
Low rate of change and high stability	Innovation and responsiveness
Inventory used as a buffer	Production tied to demand
"Focused factory" as an organizing concept	Functional range of repeated reorganization
Job enrichment and enlargement	Responsibility tied to reward
Batch systems	Flow systems

Such new technologies, especially in the field of the information and telecommunication sector, will have a far reaching impact on the locational pattern of firms and hence on regional development. The modern technology offers also a large growth potential for traditional rural areas, provided these areas are connected with an information and knowledge network. Thus, the infomotive capability of a region will be decisive for its future economic position.

Clearly, the new information technology (NIT) may also exert impacts on mobility behaviour of people (tele-shopping, tele-conferencing, e.g.). However, so far the significance of the effects of such technologies on spatial behaviour is still doubtful (see for a review also Kellerman, 1984). The use of modern telecommunication facilities technically enables the substitution of physical commuting by telecommuting, so that more jobs cease to require physical travel. However, Salomon (1984) indicates that the social costs born by the individual telecommuters are likely to discourage wide-scale transitions to this type of work. He arrives at the following conclusion:

> "Telecommuting is presented in most of the literature as a new remedy to the ills associated with vehicular commuting. On the other hand, work at home imposes a radical change of life style on most individuals. At present there are numerous indications that the change is not positive, as initially perceived by some writers. Unlike other technologies which may be implemented by employers and which employees are required to use (e.g. teleconferencing), the intrusion of the work role into the home environment must be a cooperative effort if the welfare of the individual is to be considered. It is therefore contended that there is only a small probability that the stated promises will be achieved. The options of neighbourhood or satellite work centres seem more viable. The option of working at home should be evaluated only for a limited number of segments of the labour force. In the future, the monitoring of values may indicate changes toward greater acceptance of such intertwined patterns of work and home roles." (Transport Reviews,1984,vol.4,no.1, p. 111)

Altogether, the new spatial (urban and regional) picture that is likely to emerge due to the use of NIT is one of a moderate deconcentration, both from large metropolitan areas to medium-size cities and from central regions to more intermediate regions. Also in a regional and urban policy context new horizons are emerging. Regional and urban policy is increasingly moving toward a spatially-oriented telematics and informatics policy (cf. De Jong and Lambooy, 1985) in order to fully benefit from the growth potential offered by modern information technology.

3. Informatics and Regional Planning

Although modern societies are increasingly exhibiting the features of an information society, this does not necessarily imply that regional and local authorities are fully using the potential offered by modern information technology. Despite available possibilities, it has to be realized that the existing systems of information (statistics and specialized operative systems) are often incomplete, inconsistent, and insufficiently oriented toward the needs of the analysis of geographical aspects of regional and local socioeconomic planning. This situation leads to a lack of data for models, gaps in adequate use of information for the decision making process, and difficulties faced by users in making consistent decisions and in implementing models and techniques. Hence, the obvious problem is: How to fulfill the needs of information for planning integrated regional-national developments (see also Van Est et al., 1985).

In general, information serves to assess impacts of policy decisions and to maximize the success of policies. In contrast to the past, we are now observing a tendency toward systematic comprehensive future-oriented information systems. A major problem however is caused by conflicting aims regarding such information systems, for instance, the desire of complete versus manageable information systems, the desire of centralized versus decentralized information systems, or the desire of a timely release versus reliability of information systems. In principle, it should be recognized that redundant information is equally unsatisfactory as lacking information: both cases are less efficient and hence increase costs, risks and abuses of information (see Nijkamp and Rietveld, 1984).

Useful judgement criteria for the quality of urban and regional information systems (and hence for the choice of information to be included) are:

- availability
- actuality
- accessibility
- consistency
- completeness
- relevance
- pluriformity
- comparability
- flexibility
- measurability
- comprehensiveness
- effectiveness
- versatility
- validity

Despite the available information technology, it should be noticed that the actual use of this technology and of advanced information systems for local and regional planning is still very modest. An illustration of this statement can be found in a cross-national comparison of regional information systems in various countries (see Nijkamp and Rietveld, 1984).

Regional and urban planning and information systems exhibit a wide variety across various countries, depending on historical, institutional and political factors. In the framework of a study carried out under the auspices of the International Institute for Applied Systems Analysis (IIASA), a cross-national in-depth comparison of elements and contents of spatial information systems in 6 different countries has been undertaken, viz. Sweden, France, the USA, the Netherlands, Czechoslovakia (CSSR), and Finland.

Clearly, such cross-comparisons are fraught with difficulties due to the abovementioned differences among countries. The present cross-comparisons have been based on national reports on spatial information systems for the country at hand, written by an expert in this field (see for more details Nijkamp and Rietveld, 1984).

All these national reports have been written according to a common standard framework, so that at least a common scope and structure of the cross-national comparisons is guaranteed. Each expert from the country concerned had to provide detailed information on various planning components, linkages between these components, degree of centralization, specific information systems for each planning component, and so forth. The following components were included in the national reports: housing, transportation, commuting, migration, labour market, environment and land use.

The regional information systems in these 6 countries were compared in terms of 5 main attributes. Because of the small number of countries involved and the large number of variables affecting the different features of these systems, the results could only be tentative, and have been expressed as ordinal rankings. Figure 2 shows the results of the comparison of the information systems.

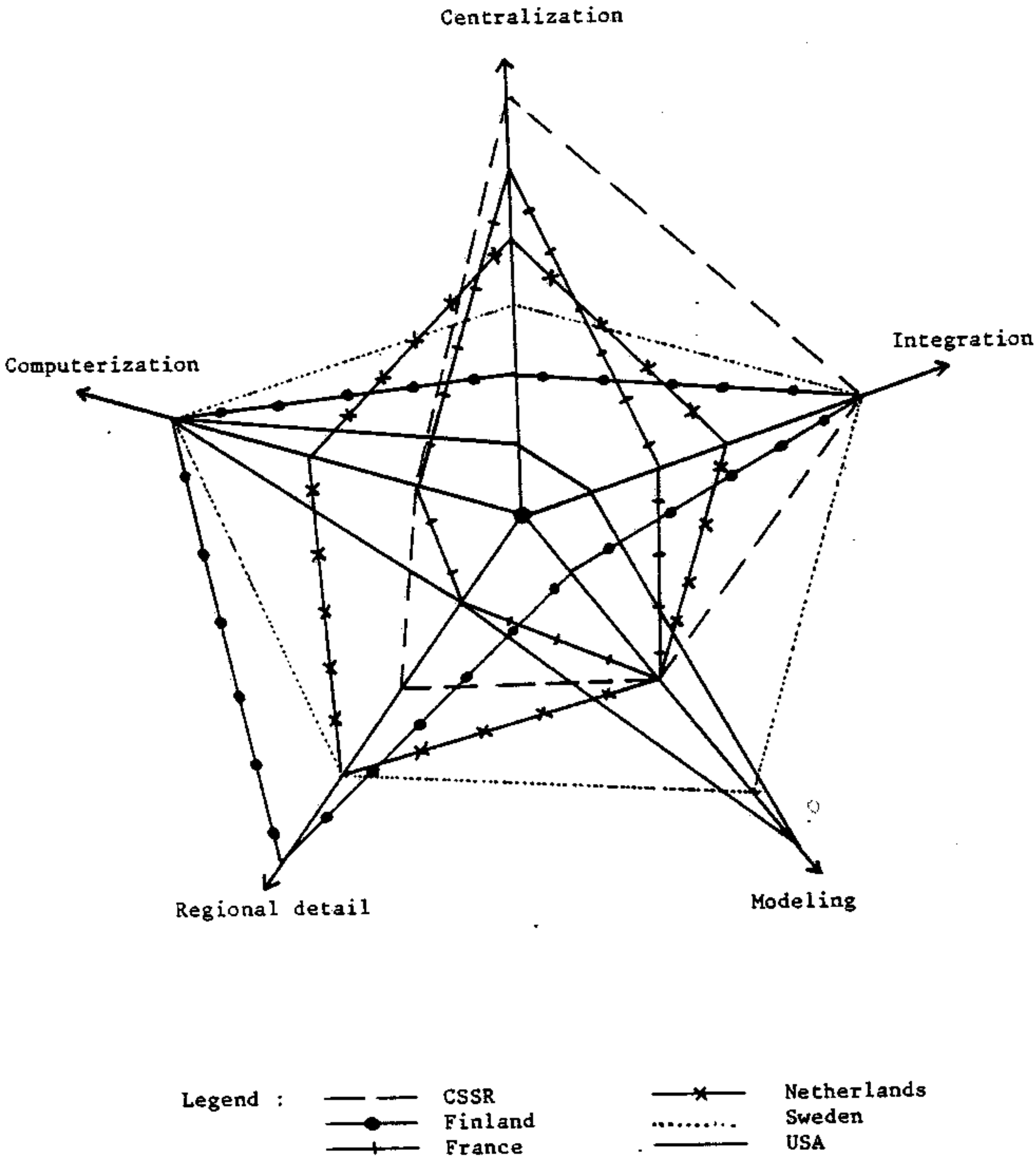
The degree of centralization of information systems seems to be lowest in the USA, where most states have developed their own regional economic models. In contrast, regional initiatives for building information systems appear to be small in France and Czechoslovakia. In the other countries, some steps have been taken toward decentralization. The extent of decentralization in each country certainly seems to reflect the level of decentralization of the planning systems.

The degree of integration refers to the production of synchronized and standardized information on the various planning components (such as housing and transportation) at each planning level. Of special interest are Finland and Sweden, whose information systems are based to a large extent on administrative register systems, which can be linked by means of codes that identify all statistical units, such as persons.

The role of modeling in helping regional forecasts or production of impact statements is strongest in the USA and Sweden, but very modest in Finland. The majority of operational (multi)regional models have not been subjected to rigorous validation tests. In addition, there appears to be a serious lack of models for ex post evaluation of policy performance. This would indicate that regional planners are generally not paying enough attention to lessons that can be learned from the past.

The degree of regional detail that is appropriate depends on the particular planning component as well as the spatial level. For instance, high detail is necessary for local economic and industrial planning. In Finland, regional detail is generally very high, and data are available at the local or country level. In Sweden and the Netherlands county or provincial data are available, and in France and the USA the average size (by population) of the corresponding region is even greater. It appears that the larger the population, the lower the degree of regional detail. All six countries have problems with confidentiality of information.

Figure 2: A 'spider web' with attributes for spatial information systems.



The extent of computerization of regional information systems has increased rapidly in the last two decades. This is most evident in data storage and processing, and less so for data input and output, though Finland, Sweden and the USA have online connections to their administrative databases for the major users. The ranking of the countries is the same as that for the role of modeling, with the exception of Finland, which indicates that progress in one does not necessarily imply advances in the other. In view of the high demands imposed by regional planning systems in some countries, computerization and modeling appear to be underdeveloped in information systems at the regional level.

In the light of the previous results, an obvious question is of course: what could be done in order to improve the current situation and to enhance the efficiency and efficacy of informatics in local and regional planning. First of all, it has to be recognized that the future of planning will involve more rather than less data, information and intelligence. Consequently, the skilled practitioner, with a commitment to implementation, should be able to weave information and intelligence into local and regional decision-making and policy-making processes by clear and operational devices, with a particular emphasis on both the limitations inherent in the methods employed and the (hidden) values incorporated in assumptions and manipulations.

Consequently, three mutually interrelated fields are of great importance here, viz. hardware, software, and orgware.

Hardware concerns the information technology and is focusing attention on technological devices and equipment (computers, composers) that facilitate the handling of large data sets in order to transform them into structured information. The major advantage of current technology is that it allows a decentralization of hardware (e.g., micros linked to a mainframe), so that also local and regional authorities (even in peripheral areas) may have, in principle, access to an information and knowledge network.

Software concerns the handling, retrieval and transformation of data in order to make them suitable for decision and policy purposes. The enormous progress made in recent years leads to a situation where too many software packages obfuscate the insight into the real potential of a specific software. User-supplier interaction, appropriate training facilities, and a clear view on information needs are necessary conditions here for a satisfactory use of software.

Finally, orgware is perhaps the most important issue in this field. The organization structure for using knowledge, information, opinions in a coherent way has often been a stumbling-block. This requires a clear division and coordination of tasks among operation staff, heads of data processing departments, administrative personnel, and decision-makers. Clearly, permanent evaluation and monitoring is of paramount importance here (see also Masser and Wilson, 1984). Furthermore, various hierarchical policy levels and various planning sectors have to be taken into account. A good illustration of the spatial, hierarchical and sectoral linkages can be found in Figure 3, derived from Dias (1985). He distinguishes 3 planning levels, viz.:

- national: aggregate planning for the national economy as a whole, as well as sector planning, (multi- and inter-) regional planning, and large-scale facet planning.
- regional: intraregional planning (including regional sector planning, county planning and intermediate scale project planning.)
- local : town planning, countryside planning, and small-scale sector and project planning.

At each planning level and for each planning problem information is needed to support decisions. Information is necessary to reduce the usual uncertainties with which planners and decision makers have to cope regarding the effects of their decisions. Nijkamp (1983) gives eight dimensions of a decision problem that influence the impact of a planning decision and thus the proper choice of a specific planning level:

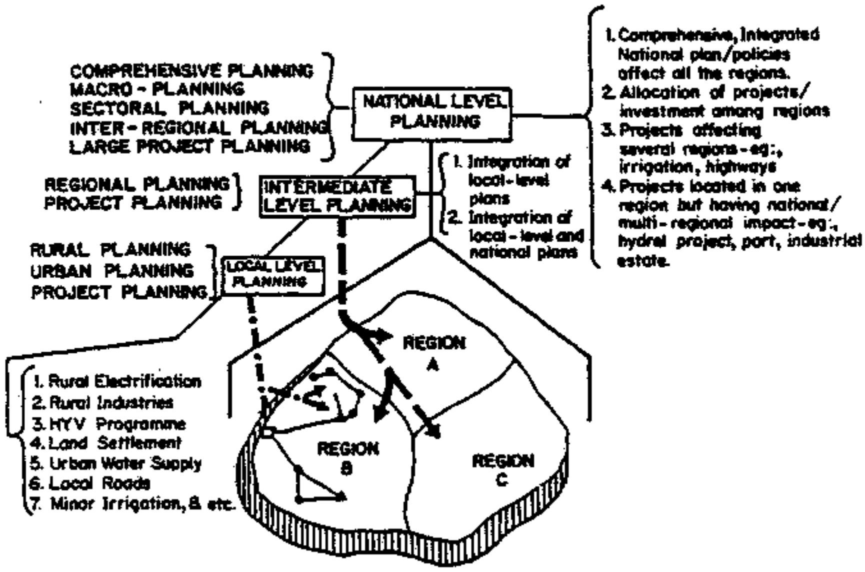
- frequency of the choice situation
- range of impacts from a decision
- number of spillover effects to other systems
- number of conflicts involved in implementing a decision
- financial consequences of a decision
- time horizon of impacts from a decision
- number of actors involved in making the decision, and finally
- the degree of uncertainty regarding the outcome of the decision.

Such rules of thumb may be helpful in designing effective information systems for regional and urban planning, as will be indicated in section 4.

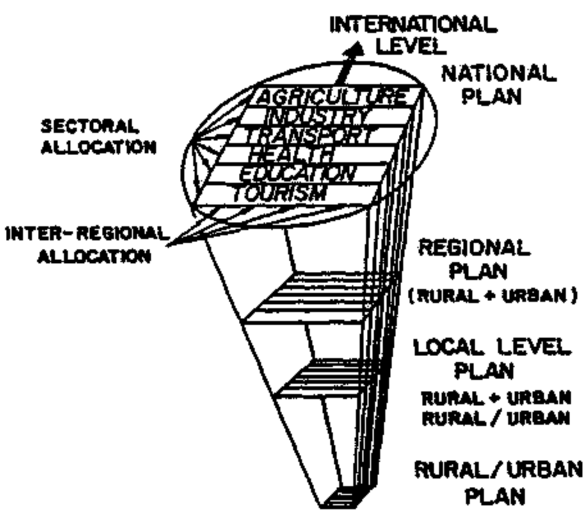
4. A Strategic Information System Design for Long-Term Regional Planning

How can we fulfill the need for an appropriate strategic planning information system? In recent years the design of strategic information systems has not exclusively been left over to engineers and systems analysts, but increasingly also to planners (in both the public and private sector). This transition has called for more attention for the integration of information system design in strategic planning procedures. In the present section the design of such a strategic information system will be discussed at the regional level.

Figure 3: A Comprehensive Planning Framework (source: Dias, 1985)



A Spatial View



A Hierarchical View

The aim is to propose an accessible and flexible information system in order to provide an operational basis for an effective, offensive and future-oriented regional socio-economic policy. Socio-economic policy-making at the regional level has increasingly become a problematic activity, due to the open nature of regional economies, the diffuse demarcation of various sectors, the impact of international developments, and the frictions emerging at the local level. Furthermore, the regional level is increasingly becoming a battle field between conflicting interests; for instance, national, regional and local interests meet each other at the regional level. Consequently, regional authorities feel an increasing need for a reliable, effective and prospective socio-economic information system.

In order to focus our study more precisely, it is assumed that socio-economic policy is the main point of departure for the design of the information system for the region concerned. Linkages with other policy sectors in the region will only be taken into consideration, if they are related to the socio-economic system. Furthermore, the lower level of the information system to be designed is the supra-local level, so that purely municipal information systems are left out for the time being. In designing such an information system various problems may emerge:

- under-information, i.e., the level of information is too low to be of use for complex policy problems;
- over-information, i.e., the level of information is too high to assure structured decisions;
- mis-information, i.e., qualitative discrepancy between demand and supply of information;
- incoherent information, i.e., lack of coordination between information related to multiple policy sectors or levels;
- non-actual information, i.e., the necessary information is not available on time.

The design of information systems for regional policy is once more difficult due to recent developments in public policy in many countries, viz. decentralization, deregulation and orientation toward the market sector. In spite of these new directions, however, regional policy needs in any case information for the development, implementation and evaluation of policies. In this context, a strategic information system serves to provide regional policy with an effective and future-oriented information system. Elements of such a system will be further discussed later on.

4.1 Supply of Information

A first step in the design of an information system is an inventory of the supply of available information. Three aspects have to be considered in this respect:

- information for regional socio-economic planning is usually multi-dimensional in nature, so that a regional socio-economic information profile is necessary;
- information is usually provided by various institutions and agencies, at the national, regional, supra-local and local level, so that a multi-level information supply is to be considered;
- information may be judged from both a quantitative and a qualitative viewpoint in order to account for a reliability bias.

The regional socio-economic information profile proposed here is composed of 7 main subsets, viz.:

(1) employment (such as jobs, levels of skill, unemployment changes, commuting size, etc.);
(2) economic structure (such as technology, science parks, high-tech, industrial structure, changes in economic sectors, etc.);
(3) production environment (such as locational factors, investment subsidies, venture capital, available industrial areas, job migration, etc.);
(4) housing market (demand and supply of dwellings, occupancy rates, etc.);
(5) demography (population size and growth, migration, etc.);
(6) amenities (physical infrastructure, communication network, etc.);
(7) energy and environment (purification plants, alternative energy supply, etc.);

The multi-level information supply may be distinguished according to 3 levels:

- national (Central Bureau of Statistics, e.g.);
- regional (provincial research institutes, e.g.);
- local (municipal statistical offices, e.g.).

Most of these institutions are (semi-)public, but also private institutes gathering and providing information may play an important role. The structure of information supply can be represented by means of an information supply matrix (see matrix 1).

4.2. Information need

The information needs can also be distinguished according to the relevant spatial levels and the elements of the information profile, although as far as the spatial level is concerned the demanders of information may differ from the suppliers. This leads to an information demand matrix, which has essentially the same structure as matrix 1.

multi-level information supply	socio-economic information profile: 1	2	3	4	5	6	7
national							
regional							
local							

Matrix 1: An information supply matrix.

4.3. Confrontation of Supply and Demand

By confronting the need for regional socio-economic information with the available supply, one may identify the bottlenecks in a regional information system. Such a bottleneck analysis may be based on the following judgement criteria:

- frequency of provision (and mutation) of information;
- spatial level (degree of spatial aggregation);
- static versus dynamic information;
- level of detail;
- completeness (including reliability);
- accessibility (including costs);
- standardization and integration.

The bottleneck analysis can be based on an information input-output matrix (see matrix 2), which gives a structured representation of the information network or regional socio-economic policy. Each entry of this matrix indicates the existence of a linkage between supply and demand (both in a qualitative and a quantitative sense). Clearly, indirect links may also be traced in this matrix. The following general conclusions - based on empirical research in the Netherlands - may be inferred from the bottleneck analysis:

- in general, information in a quantitative sense is sufficiently available in order to analyse the regional labour market, the production structure and the production environment;
- there are however many overlaps in the information supply, so that in many cases incoherences may emerge due to different data sources,

		multi-level information need		
		national	regional	local
multi-level information supply	national			
	regional			
	local			

Matrix 2: An information input-output matrix.

geographical aggregation levels, different time periods, different definitions, etc.;

- in general there is a lack of strategic information on new trends in industries, new locational conditions, strenghts and weaknesses of industrial areas, etc.;
- the timely availability of necessary information is a major bottleneck for an effective use of information in regional socio-economic policies.

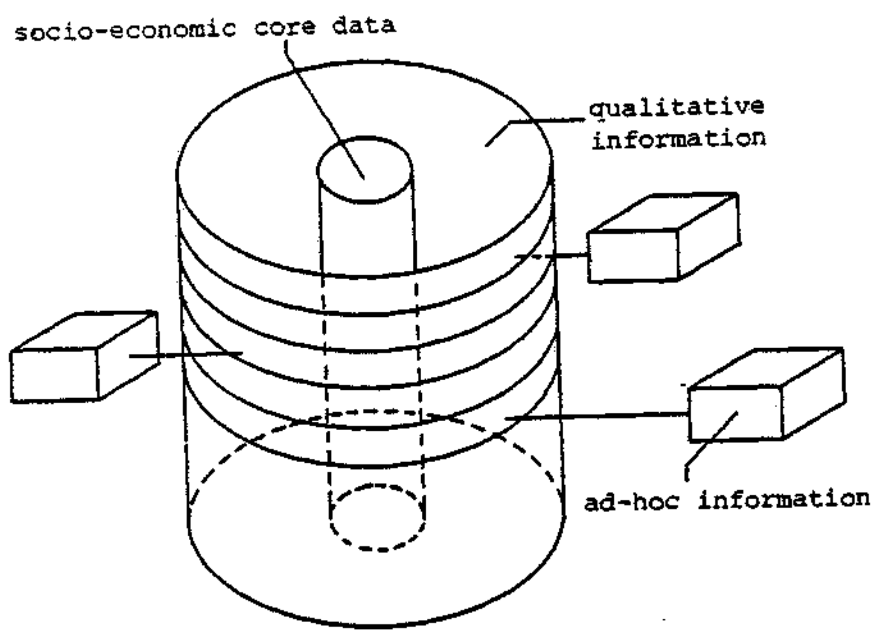
4.4. Framework of a Strategic Regional Information System

Information systems are intermediate tools in regional planning and policy-making. However, in many situations the goals and instruments of regional policies are not explicitly or precisely formulated, so that the design of a strategic information system is fraught with many difficulties. Efficiency goals and equity considerations are often intertwined and also influenced by many constraints and conditions, so that regional policy is - by definition - multidimensional in nature. The integration of multiple levels and of multiple elements of an information network is a matter of utmost importance.

The elements of a regional information profile (see subsection 4.1) may be distinguished into 3 subsets of information content:

- socio-economic core data, i.e., information that is collected on a permanent basis and that provides a reliable statistical representation of the major socio-economic data in the region at hand;

Figure 4: A planning information system



- qualitative information, i.e., information that represents the stronger and weaker aspects of the region concerned in terms of its development potential, the importance of its infrastructure, etc.;
- ad-hoc information, i.e., information which is necessary for acquisition of new entrepreneurs, project design and judgement and plan evaluation.

The foregoing notions can be integrated in a so-called planning information system, based on a satellite structure (see Figure 4). The core of the model is made up of a permanent information flow, while the periphery of this model comprises the qualitative information, which is in turn attached to ad-hoc information blocks.

Technically, the implementation of such a planning information model is feasible, as both the present hardware and software allow us to operationalize this system. The orgware requires however an appropriate institutional arrangement, which comprises all relevant policy agencies in the region at hand. In addition, the implementation of such a system would require a regional coordinating agency which - on the basis of expert views - provides directives regarding the structure and contents of the regional planning information system concerned.

5. Epilogue

Informatics will profoundly alter our ways of living, working and decision-making in the immediate future. Public policy at national, regional and local levels should not neglect these developments, but should give high priority to exploiting the potential of informatics (including telematics and telecommunication) in order to improve the quality of decision-making and hence of life. Therefore, planning information systems should be developed that meet the organizational and institutional requirements of planning and policy agencies in cities, regions and the nation as a whole. Particular attention may be paid here to computer-assisted decision-making, geographical information systems, computerized carthographic methods, use and scope of micro-based computer systems, and systems design. The range of applications of computer-based information systems is wide and diverse, and also in local and regional policy problems we observe an increasing use of computer models, data base systems, and monitoring systems. New developments (decision support systems, expert systems, e.g.) however, have hardly been implemented in the regional planning practice.

In conclusion, modern information technology offers an enormous potential for effective and balanced urban and regional decision-making, as it is both a very efficient way of storing and transforming data into a useful format and a meaningful vehicle for communication between experts, decision-makers and planners. Clearly, the implementation and use of advanced information systems has to be fully embedded in the administrative, institutional and policy setting of a city or region. With this proviso in mind, we may conclude that informatics adds at least five distinct qualities to regional planning in a broader sense (cf. also Meadows and Robinson, 1985), viz. precision, comprehensiveness, logic, explicitness, and flexibility.

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