The use of computers in urban and regional planning in West Germany: a review

Michael Wegener

Institute of Urban and Regional Planning
University of Dortmund
West Germany

The development of planning information systems for urban and regional planning in West Germany is much less advanced than it could be considering the high degree of computerization in other fields of the public administration. This failure is due partly to the inability of the present information systems to respond to actual information needs of the planning practice, partly to the growing sensitiveness of the public against "technocratic" reasoning. There exists in this field publicly funded R&D capability on a high technical level, but the research policy currently followed tends to increase the technical bias of the planning information systems. Private and university research offer more problem-oriented methodology, but fail to communicate it effectively to the planning practice.

The paper first looks at the "consumers" of computer application in urban and regional planning, mainly the cities. Then the "producer" side is reviewed, passing through the different types of suppliers of computer application methodology: from public to private and to university research. The paper ends with some reflections on the future role of computers in planning.

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INTRODUCTION /1/

West Germany is one of the most computerized countries in the world. There are some 160.000 computer systems, worth about 36 billion marks, installed in this country, and that number may continue to rise by almost ten percent each year.

One might expect that urban and regional planning /2/ might benefit from this abundance of storage and computing capacity in both, theory and practice, resulting in a rich body of theoretical background, empirical evidence, and practical methodology for analysis and forecast.

However, such an assumption would be greatly misleading. In reality, the use of computers in urban and regional planning in West Germany is minimal, and it plays practically no role at all in the actual decision-making process. In this paper I will attempt to identify some of the reasons why this is so. Some of the reasons are quite general and apply probably to many countries, some of them, however, are rooted in the social and cultural development of this country.

The paper proceeds as follows: First it looks at the "comsumers" of computer application in urban and regional planning, mainly the cities. Then the "producer" side is reviewed, passing through the different types of suppliers of computer application methodology: from public to private and to university research. The paper ends with some reflections on the future role of computers in planning.

1. THE CONSUMERS

In West Germany there are some 8.500 communities responsible for local planning. Of course, not all of them have a planning department. Small communities are assisted by their county administration through planning services. Altogether, there are 235 independent cities and counties engaged in local planning. Regional planning is, in general, in the responsibility of the states. There are ten states plus West Berlin. In most states some regional planning functions are performed by regional planning associations.

All these planning authorities are potential users of computer-assisted planning methodology. However, as a recent survey revealed (Kooperationsausschuß ADV, 1978) only about 60 of the largest cities and 8 of the 11 states can be said to have implemented rudimentary first components of planning information systems /3/.

The dissemination of information technology in local government in the Federal Republic of Germany startet relatively late, but developed rapidly in the early seventies. Today most of the major administrative functions of the municipalities, e.g. the population register, the city budget, local taxes, welfare services, accounting, and personnel, have been or are in the process of being computerized. Moreover, this computerization was not confined to large cities, but has been made available to small communities by some 70 computing centers distributed across the country.

With the exception of a few early experiments, the planning departments hardly took notice of this rapid development. Still in 1973, only five cities (Cologne, Bonn, Munich, Bochum, and Düsseldorf) could report any activity at all in the field of planning information systems (Kooperationsausschuß ADV, 1974). And even today the utilization of the systems installed is not too frequent. The city of Cologne, which operates one of the most advanced systems in the country, reports 68 inquiries completed in 1977, a typical one being, for instance, the tabulation of children of kindergarten age by kindergarten districts (Lehmann-Grube, 1978). Consequently, only a minimal share of the capacity of municipal computers is used for planning purposes.

What are the reasons for the little use of computers for urban and regional planning? In a paper published by the KGSt, the influential advisory institute on automation in local government, blame is given to the insufficient command of the instruments of public planning by the planning departments (Ostermann, 1977). Certainly, lack of qualification of the planners is such a reason, and I will return to it later, but there are others.

Consider the typical procedure a planner has to follow if he wants to use the planning information system. Again Cologne is taken as an example, because its system has been better documented than others: The planner addresses his inquiry to the working group in charge of the information system. A member of the group checks the inquiry for feasibility, selects the programs required for it, writes the necessary control statements on coding sheets and sends them to the computer center. There the inquiry passes through at least four steps: registration, punching, checking, and execution. Each step is liable to errors and may have to be repeated. Including all coordination and checking-back meetings, a single inquiry may take several weeks to be completed (Erkens, 1978).

The typical output of the procedure: tabulations by blocks or districts, cross-tabulations, or maps. That is exactly the kind of information planners had always collected for problem analysis, but rarely used for problem-solving. Take for instance the example of the kindergarten children. It is no question that it is desirable for a kindergarten planner to have this information. But age group information has been available from the statistical offices all the time. And without consideration of intra-urban migration such information is almost useless except for shortest-term projections. If information which is not new and not very useful is offered through a frustratingly unwieldy and time-consuming procedure, nobody should be surprised that planners quickly loose their interest in information systems and return to their traditional ways of information-gathering.

The failure of urban information systems in this country is not a mere repetition of the American experience of the late sixties, which has been well reported (Fehl, 1971). The main causes of this failure lie in the professional attitude and training of planners in this country. In contrast to elder generations of planners, many younger planners see their profession not as a technical, but as a political one, and quite a few of them are strongly motivated to contribute by their work to more

social justice. They have a strong sense for political categories like power, conflict, and coalitions, and they take great care to avoid the image of being narrow-minded experts or "technocrats" and try to express themselves in political terms, i.e. in response to current political issues. The facts and figures afforded by today's planning information systems are of little use for them, what they look for is "soft" or "informal" information (Fehl, 1971) concerned with goals, motivations, issues, future trends and problems.

Only little of this kind of information can be found in the present systems. Indeed, they contain only the "hardest" kind of statistical data and the most trivial and routine techniques for their manipulation. The majority of application programs is concerned with data retrieval, sorting, selection, and aggregation tasks. Heavy emphasis is placed on programs for tabular reports, diagrammatic presentations, and line printer or plotter maps. Data analysis techniques are largely confined to basic statistics. In a few cities programs are available for network analyses yielding accessibility indices or allocating population to public facilities on the basis of travel times. Except population projections, no forecasting techniques are applied. Typical small-area population projection programs predict population by age and sex with migration rates exogenously determined. More sophisticated programs confront biometric projections with the expected housing stock of a target year and thus determine net migrations (Glöckner, 1977). The demographic models are in general developed and operated by the statistical offices. In the planning departments are, with few exceptions, no models in use or development.

One exception is a modeling project conducted at the planning department of Stuttgart in which relationships found between accessibility measures and population and employment densities were used to project future densities (Hartel, 1977). Another notable exception is the Stadtentwicklungsreferat (Department of Urban Development) of Munich. Founded during the preparation for the 1972 Olympic Games, its staff of about 40 professionals has since won reputation for high-level and yet pragmatic development and application of computer-assisted planning tools. As the only planning department in this country, it operates its own computer, a PDP 11/70, with a custom-tailored interactive data management and analysis system called KOMPAS (Franke, 1978). Among the planning tools developed are a model of intra-urban migration, a housing market model, and an employment projection model, as well as a set of location-allocation programs for the planning of public facilities (Schußmann, 1978). However, almost none of these programs has so far been transferred to other cities.

The non-existence of sophisticated computer applications in the planning practice of cities is not simple backwardness, but was deliberately brought about. Under the influence of the critical reports on American planning information systems the KGSt recommended to its member cities extreme caution with respect to the use of computers in planning. In fact, in most phases of the planning process, such as goal formulation, problem synthesis, or evaluation, it saw hardly any room for the computer (KGSt, 1975). After publication of this verdict, it was only

logical for the KGSt to dismiss its advisory committee on automation in urban planning. The cities gratefully accepted the verdict for a number of reasons. Firstly, it seemed that they could save money, a matter of no small weight in a period of economic stagnation. All statements by city administrators on this matter advocate small-scale, incremental approaches (e.g., Prinz, 1975; Lehmann-Grube, 1978). Secondly, it fitted into their view of the computer as the efficient printing machine as which it served them in the administration. Thirdly, with the growing importance of citizen participation in local planning (which had just found its way into the West German planning legislation) the value of "hard" information in the planning process was further reduced in favor of rhetoric and other techniques to produce consensus. And finally, computers generally became very unpopular.

This was only partly due to the growing awareness that a tightening network of public data banks might threaten the individual privacy of citizens and might lead to a concentration of power in the hands of those who operate them. Such tendencies are present also in this country, as the growing system of information banks on the national and state level (although original plans have been greatly reduced) has already created a general feeling of surveillance. But despite an early discussion of the problem by Fehl (1972), most planners seem not even to have realized that data protection will be a growing problem for them in the near future.

However, the more important reasons for the unpopularity of the computer are connected with the nostalgic, backward-looking spirit growing out of the general dissatisfaction with our technical civilization. The people blamed the computer when unimaginative and bureaucratic use of computers had hurt them, and by and by blamed the computer also for other things they did not understand and were afraid of. The computer became the epitome for all that which is inhuman, bureaucratic, and threatening in modern society. Certainly, this feeling can be found in many countries, but in Germany with her long anti-rational cultural tradition, public opinion was only too liable to follow it. The period of the late sixties, when societal reform and modern planning methodology seemed to merge (and which was later denounced as the time of "planning euphoria"), was too brief to establish a tradition. Today, the myth of the computer has almost been turned into a negative myth: The best way to ruin an issue in local politics is to rest it on arguments taken from a computer. The planners quickly learned that lesson, and because it fitted so well into their image of themselves, they started to like it.

2. THE PRODUCERS

I will now turn to the supply or producer side of the market and ask: Who is producing computer methodology for urban and regional planning, what kind of methodology is produced, and how does it find its way to potential consumers? Three types of producers can be distinguished, differing by their institutional setup and their principal source of funding: public, private, and university research. The contributions of these three types will be reviewed.

2.1 PUBLIC RESEARCH ORGANIZATIONS

There are several public organizations working in the field of research and development for urban and regional planning. They are public in the sense that they are controlled by local, state or federal government and that their funding, institutional or project-oriented, comes from government sources. A few of them are KGSt (Cologne), DIFU (Berlin, Cologne), ILS (Dortmund), BfLR (Bonn), GMD (Bonn), and DATUM (Bonn). Of these, DATUM, which calls itself "Institute for Computer-Assisted Development Planning", is exclusively doing R&D in the field of information technology for local, regional and national planning authorities. Therefore, this review will focus on DATUM's work.

DATUM was founded in 1964 as a clearing house for urban planning methodology with special emphasis on the new data-processing techniques. The latter soon became its main field of activity. Since 1972 DATUM also works for state and federal agencies. On its staff of about 60 there are some 35 professionals, about one half of them being computer scientists, the other half being economists, social scientists, and planners (DATUM, 1977).

About 20 percent of DATUM's income is institutional funding from membership subscriptions (federal, state, and local). About 30 percent come from contracts with public agencies on software development and other services. The remaining 50 percent come from long-range research grants by the Federal Ministry of Research and Technology and its three EDP promotion programs (Hartenstein, Schäfer, 1978).

Such grants provided the funding for three major projects the results of which today form the nucleus of DATUM's set of tools for urban and regional planning:

- Between 1968 and 1974 DATUM collaborated with the City of Cologne and Siemens, the German computer manufacturer, on the design and development of a local planning information system named KODAS. KODAS is a flexible set of programs centered around a standard-format workfile extracted from administrative or statistical files. KODAS programs contain modules for data manipulation, aggregation, statistical analysis, diagrammatic presentation, and mapping, as well as the PYRAM/PROGNO package for population analysis and projection (DATUM et al., 1974; Menge, Staack, 1978).
- In the ROLAND project (1972-1977) a set of tools for planning and monitoring in regional and national planning was developed, with the Federal Housing Ministry and the Planning Ministry of Bavaria as pilot users. The project focused on four areas: a data-base/workfile interface (MARS); line printer and plotter mapping programs (INKAS); network analysis programs for public transport (PIC) and road transport coupled with location-allocation modules (EVA); and population and migration projection programs (DIPAS, KURS). In addition, a standard reporting format for monitoring selected social and economic indicators on various geographical levels was designed (Hartenstein, Schäfer, 1978).

- Project GEOCODE (1972-1978), conducted in cooperation with the Cities of Dortmund and Wiesbaden and the data processing organization of the State of Hessen, served to establish standards and procedures for generating and maintaining spatial reference or geocoding files. The system developed is segment-oriented like the DIME system of the US Bureau of the Census and thus integrates other approaches, such as point-, grid-, or block-oriented concepts (Hansen, v. Klitzing, 1976). In the project also a map encoding technique (ANCER) and a supporting program package (SEDAN) were developed (v. Klitzing, 1978).

Besides the software produced in these three projects, DATUM has developed or adapted from other sources various programs, such as (for references cf. DATUM, 1977):

- DISTRIKT: a program to define districts in spatial reference networks;
- DAMAST: a data management system for processing census data;
- UNIMATCH: a file matching program by the US Bureau of the Census;
- PUSTA: the SITE PLANNER location-allocation program by P.S. Loubal;
- LIMES: a program for grid-oriented allocation of users to public facilities;
- GRIDS/GRIDSAGG: a modified version of the grid-oriented mapping program by the US Bureau of the Census.

DATUM's current development activities focus on four areas:

- In the PENTA project DATUM cooperates with urban statisticians on the design of decision aids centered around the computerized population register.
- In a joint project with the Statistical Office of West Berlin a generalized monitor (ADAMARS) to serve as an interface between a data bank (ADABAS) and application programs based on the workfile approach is being developed.
- A third project is directed towards the development of basic software for report generation and mapping by graphical display on minicomputers connected with large systems. This is a cooperation with the Gesellschaft für Mathematik und Datenverarbeitung (GMD).
- A fourth area consists of activities to provide planners with better access to data from various sources, especially the 1981 census.

I have listed these DATUM activities in some detail to make it clear that there exists a tremendous amount of know-how and expertise and an impressive array of ready-to-use tools for supporting the work of urban and regional planners. In some application areas, such as computer mapping, where DATUM's programs compete with others like the ubiquitous SYMAP, the REGMAP system of the GMD (1976), the mapping software developed at the BfLR (Rase, 1978), or programs developed elsewhere (Oest, 1974; Loch, Lück, 1976), one can even talk of oversupply. How does this match with the gloomy picture sketched above of the planning practice in cities?

In fact, there is some success: More than 25 state and local computer centers have installed the KODAS system, and some 15 cities use the PYRAM/PROGNO package for population projections. Some of the ROLAND programs have been installed with a few interested users, and the GEOCODE concept has good chances to be widely distributed because of its compatibility with other geocoding approaches (cf. HEPAS, 1975). However, in the whole, the transfer of DATUM's know-how and software to the consumers has been disappointingly low.

DATUM has responded to this problem by devoting more of its efforts to dissemination. It has established a transfer department and takes great care to inform about its products and services. Only recently, DATUM has proposed to the Federal Ministry of Research and Technology a long-range program (TRANSPLAN) to develop and test effective techniques for the transfer of statistical and planning software to public agencies.

These efforts are highly commendable and certainly a step in the right direction. But there remain some doubts as to whether improved marketing alone will solve the problem. If the reasons for the reluctant use of computers by planners are only nearly those as I have described them, the present product line of DATUM is far away from the kind of tools planners really would use. And indeed, quite significantly, DATUM's clients more often than not are the statisticians and computer people, and not the planners. This points to a basic weakness of DATUM's work, which strikingly contrasts with its technical excellence: its lack of planning theory.

I use the term planning theory here in its twofold meaning (Faludi,1973), as theory of planning, i.e. of the planning process, and as theory in planning, i.e. of the process to be influenced by planning. DATUM says little about the planning process in which it sees its activities embedded (cf. Hartenstein, 1977; 1978), but from that little it can be assumed that it shares the incrementalist position en vogue today. Incremental decision-making requires only minimal, i.e. ad hoc and problem-specific information, while comprehensive synopses and long-range projections are considered neither possible nor necessary. If this interpretation is correct, it is only logical for DATUM to advocate primarily the most pragmatic and down-to-earth applications of computers: data manipulation, analysis, and presentation, and the simplest forms of short-term projections. This interpretation could also explain why planning theory in its second meaning, i.e. urban or regional theory, is almost absent in DATUM's work or, at best, dealt with in rather brief and technical terms, and it could explain why DATUM has never built any urban or regional models.

2.2 PRIVATE RESEARCH ORGANIZATIONS

There is only a small number of private research institutions active in the field of software development for public planning. However, some notable contributions were made by private firms, especially in modeling. Private research institutions were the first to introduce model-building into urban and regional planning in West Germany.

Large-scale urban modeling in West Germany did not start before 1969, but from the beginning tried to accomplish more than just to repeat a Lowry model application. The first urban model in West Germany was the POLIS simulation model developed by Battelle-Frankfurt (Wegener, Meise, 1971; Battelle, 1973), which was run with data of Cologne, Vienna, Darmstadt, Karlsruhe, and recently Cologne again (Ruppert, Würdemann, 1978).

POLIS is a dynamic simulation model of major aspects of spatial urban development. Starting from the state of the city in the base year, the model simulates the development of the spatial distribution of population, employment, buildings, and land use, as well as of transportation, as it responds to planning interventions by the city or other public agencies over a number of time intervals, until a time horizon has been reached. The achievements of the model have been that it accomplished a true feedback between the transportation and land use systems; that it employed multidimensional attractivity functions based on utility theory; and that it allowed the control of spatial development by zoning and land use regulations and by a variety of action programs. Later the simulation model was augmented by a computerized evaluation model based on multiattribute utility concepts. The evaluation model served to evaluate the simulation results at each time step as seen by different groups of the community (Bauer, Wegener, 1975a; 1975b).

In 1976 Battelle designed a housing market model for the Frankfurt metropolitan region. This model, still unpublished, consists mainly of two submodels: an "aging" model in which households and housing of each zone undergo time-dependent changes in a Markov model with dynamic transition rates between households and housing types, and a market model in which market clearance, i.e. matching of housing supply and housing demand in all zones of the region, is accomplished by way of fictitious rent elasticities.

A series of housing market models has also been developed by PROGNOS AG (a research organization located in Basel, Switzerland, but operating predominantly in West Germany). A first, highly aggregated model, MINIBEPRO, allocates projected migrant population to zones according to their attractivity and housing supply, but assumes instant housing construction where demand exceeds supply (Sättler, 1975). A later model, REWOMA, besides being much more detailed, allows for imbalances between supply and demand in the market clearing process, but for computational reasons it allocates households to housing types first and then to zones, instead of doing both simultaneously (Afheldt et al., 1977). A modified version of this model, under the name of MINIWOPRO, was recently implemented and tested for the Munich metropolitan region.

That it does not require a big firm to apply computers in urban and regional planning has been proven by A. Volwahsen. Volwahsen has assembled a unique kit of programs, not all of them of his own making, for just about every purpose a planner can think of. There are all sorts of printing and plotting techniques, programs for data analyses, small and large models for various forecasting, allocation, simulation, and evaluation purposes. The most remarkable thing, however, is the ingenious way Volwahsen combines these tools, frequently with ad hoc written mod-

els, in a study context and presents the results as the most intriguing collage of illustrations, computer output, printed and handwritten text. Even planners who are sceptical about some of the models used will have to admit that Volwahsen opens up new ways of communicating about planning. Samples for his versatility and immense productivity are his simulation project of the Ruhr area RUHRSIM, (Volwahsen et al., 1975) and the recent development study for a borough of Wuppertal (Volwahsen, Heide, 1978) as well as the PRO-REGIO program package for evaluation and conflict analysis in regional land use planning (Volwahsen et al., 1976).

The model-building and other projects reported in this section have two things in common. Firstly, all of them were conducted without a computerized data base. Obviously, the collection of data from different, partly not computerized files never presented unsurmountable problems. This is not to say that model-building would not greatly benefit from better data availability. Secondly, none of the models has (so far) been successfully taken over by a client and operated without the help of the authors. The reasons for that can only be sketched here. In the first place, the models were too complicated, difficult to use, and insufficiently documented, and demanded skills not generally available in the planning departments. Also, the lack of money typical for contract research usually prevented follow-up cooperation with the client, once the research contract had ended. But more important than such practical obstacles was the fact that the interests of the planners, for the reasons discussed earlier in this paper, have drifted away from "hard" to "soft", and from long-range, comprehensive to short-term, specific information. The American debate about the failure of early urban land use models (Lee, 1973) was carefully observed, but more recent evidence of a new interest in urban models in the US (Pack, 1975; 1978) is still being ignored. Today, in the planning departments there is a general scepticism about models which will make model-building a very unattractive market for contract research in the years to come.

2.3 UNIVERSITY RESEARCH

University institutes as developers of planning software are in an even worse position than private research organizations, as they usually lack direct client contact. Therefore, the transfer of planning software from universities into the planning practice has been practically zero.

There would not have been much to be transferred, anyhow. This country has no center of urban and regional research and modeling as we know it from many UK (Cambridge, Leeds, Reading) and US universities. But even between individual researchers communication is low, as there are no relevant journals or conferences. This situation, of course, also affects the education of planners. Only very few planning schools offer courses in spatial analysis techniques, computer programming, or mathematical modeling. The interest of students in such courses is generally low, which is not surprising if one considers the low esteem of such skills in the planning agencies. Once these students, underqualified in this respect as they are, enter their professional life, it is only natural

that they join the opponents of the new technology they do not master. The danger is that the planning schools surrender to this downward spiral of decreasing expectations.

Still, there are some contributions in the field of computer-assisted planning methodology by universities, as in the case of private research mostly in the field of modeling.

One of the most ambitious urban modeling efforts undertaken in this country was the SIARSSY project, a cooperation of the universities of Mannheim, Erlangen, Munich, Stuttgart, and Kassel (Popp, 1974; Popp, 1977). SIARSSY was originally based on ORL-MOD, a Lowry adaption of the ETH Zurich (Stradal, Sorgo, 1971), but was later made recursive and augmented by transportation, infrastructure, ecology, and budget submodels. Parts of the model were calibrated for several cities in West Germany and Switzerland (Bucher, Konanz, 1976; Popp, 1977), but the whole model concept was never completed.

An important contribution to regional modeling is the work of Thoss and his group at the University of Münster. They have developed a family of multiregional optimization models for land use, solid waste disposal and recycling, sewage, and transportation planning, which can be combined with a multisector, multiregional input-output model of production and final demand to form a comprehensive optimization model for regional planning (Thoss et al., 1975). Another model developed by the group is a recursive optimization model of population and employment, production and final demand, the public sector, and land use for spatial development policy in the State of Hessen (Agnew, 1975).

In 1976, a third major modeling project, which connects urban and regional modeling, was launched at the University of Dortmund. In this project the relationships between inter-regional and intra-regional migration, and between locational choice, mobility, and land use in urban regions are investigated with the help of a multilevel dynamic simulation model (Schindowski, Schönebeck, 1976; Schönebeck, Wegener, 1978). The model consists of three submodels connected by feedback loops: a macroanalytic model of regional development; a microanalytic model of intra-regional location and migration decisions containing a housing market model; and a microanalytic model of land use development in selected parts of the urban region. The housing market model uses the "aging" submodel of the Battelle housing market model, but replaces the market clearing part of that model by a Monte Carlo search process.

If one looks for more work of this kind done at universities, Stuttgart and Dortmund come to the mind. Stuttgart has produced a number of modeling projects (Müller et al., 1973; Morlock-Rahn, 1976; Gee, 1977). Dortmund is unique in that already in 1970 it offered students and faculty a planning "data bank" with about 50 test datasets and some 100 application programs still being maintained today (Schraeder, 1972, Killing, 1979). And there has always been some computer research going on at this planning department (Masser et al., 1970; Ernst, Stein, 1976). From 1974 to 1978 the PROSAB package, a grid-oriented program system for land use evaluation in local planning, was developed and tested in three pilot applications (Schindowski et al., 1976; IRPUD, 1978). At the same time Bach developed a comprehensive system of models and appropriate programs for the location-allocation problem (Bach, 1978).

3. CONCLUSIONS

In brief, the findings of this review can be summarized as follows: The development of planning information systems for urban and regional planning in West Germany is much less advanced than it could be considering the high degree of computerization in other fields of the public administration. This failure is due partly to the inability of the present information systems to respond to actual information needs of the planning practice, partly to the growing sensitiveness of the public against "technocratic" reasoning. There exists in this field publicly funded R&D capability on a high technical level, but the research policy currently followed tends to increase the technical bias of the planning information systems. Private and university research offer more problem-oriented methodology, but fail to communicate it effectively to the planning practice.

Which conclusions can be drawn from these findings? I think that they suggest a reconsideration of the future role of computers in planning. For me there is no doubt that computers will continue to play only a subordinate, if not irrelevant part, if they are used only for routine operations on statistical data. Certainly, efficient data management, analysis, and presentation techniques are fundamental, but they are not the ultimate goal. Planning is concerned with goals, motivations, issues, future trends and problems. Its core activities are goal recognition, problem synthesis (design), evaluation, and communication. Only if computers serve these core elements, they will become truly indispensable.

I admit that there are good reasons to be sceptical about such a proposition. Two questions need to be answered, one technical, one political. The first question is: Are computers capable of dealing with "informal" information in a way that is relevant to the planner in a political context? And the second question: If yes, should we use that capability (cf. Weizenbaum, 1976)? This review paper does not allow to discuss these questions. I have recently tried to do so with respect to urban planning (Wegener, 1978). My answer is that there are visible "anti-technocratic" ways of using computers in planning which permit us to answer yes to the second question.

F o o t n o t e s :

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/2/ Throughout the paper the term "urban and regional planning" is used to denote spatial planning at the local and regional level, excluding national planning. Also excluded, for reasons of space, is the planning of the technical infrastructure, such as transportation, energy, water, waste disposal, and sewage.

/3/ The term "planning information system" is used to denote any computer-assisted system designed to provide basic information for planning and decision processes. As a minimum, a planning information system consists of three components: a data base, data management programs, and application programs. For urban and regional planning a fourth prerequisite has to be added: a spatial reference system by which data items can be associated with geographical units of reference like city blocks or census tracts.

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