# Computerised tools for spatial planning in developing countries

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# COMPUTERISED TOOLS FOR SPATIAL PLANNING RESEARCH IN DEVELOPING COUNTRIES

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## SUMMARY

Computer equipmert is available in a majority of Third World countries, but its adequate use is seldom. Probably these countries want and need that equipment to help them with all kinds of problems. Suitable and relatively cheap software is available at the market also. Yet there is a lag in terms of training, integration and application. This is true in the field of spatial planning too.
Computer and telecommunication based developments now and in the future imply consequences for the way of working in the field of spatial planning as well as the spatial organization of the urbanized world. Some issues are described in a nutshell.

## INTRODUCTION

In western, industrial countries there is available a lot of computer equipment, but what is more important, a lot of (good) software. They have been tested, sold in manyfold and became cheap. Sometimes amazingly cheap.
That software is suitable for applications in a wide field of practices and sciences. Partly it is suitable also for application in the so-called Third World. Be aware that we mean 'partly' with emphasis.
Designers and producers of hardware and software try to send or/and to sell as much software as possible to clients; this is true for the scientific world also. Probably the result of these actions may be an irrelevant export to the Third World.
Otherwise, it seems obvious that Third World countries want and need hardware and (dedicated) software to help them with their hugh problems in a range of socio-spatial fields.
In the next I will try to explain why (we think) they 'obviously' want and need them; and for which problems. Also we describe which system(s) and software will be relevant.
Further some attention will be given to a number of social and economic consequences.
Because I am writing this from a viewpoint ofspatial planning I focus at some issues about consequences for urban and regional planning at one hand, and urbanization at the other hand.

## DO THEY WANT AND NEED IT?

Looking to general interests for new and more advanced technology in Third World countries, and more in particular interests for (micro-)computerisation within several fields of science, we may conclude that a number of persons and social institutions want the (further) introduction of new and 'more' advanced technology.
I think that this conclusion is valid also if the frequercy of computer oriented training courses is taken into consideration; these coursee happen with governmental organizations, firms and industries, scientific faculties and departments.
Another sign for wanting new and advanced technology, obviously, is the presence of all kinds of computer equipment and related machinery in several of such countries, mainly unused. Often they have been offered by western, industrialized, and high tech(nology) working countries, without any costs, but with training facilities for a number of local officials, that is chiefs and heads of departments. They attend those courses because they are chief or head, and because it is social status related; probably they never intended to use and to effectuate the knowledge and training they experienced. In other cases they will be raised in function because of their better general orientation.
Anyway, the result will be the availability of advanced

technology, generally unused because of lack of skilled personnel. Yet, we may conclude they wanted it, otherwise fund raisings would have resulted in other deliveries on request.

The other part of the question however, concerned if such countries need it. This one is difficult to be answered. Even in the industrialized world the discussion about the need, or perhaps the necessity, has not been closed.
Of course, for several activities the implementation of high tech is unavoidable, but if that must be the case in other fields obviously it is a matter of politics and political decisions.
Also we have to consider that certain new high tech approaches are insufficiently tested and maybe still a danger for the well-being of people (Bhopal?), because of a too high chance for calamities, or because of inadequate control guarantees which partly will remain a humanly related activity.
In case we speak about the use of computer equipment on behalf of spatial planning, normally, the chance for calamities is out of question. In stead of calamities, other problems and negative consequences may result, which have to be considered. Among others, we mention: loss of employment, centralization of information power, adaptation of methodology, skill of personnel, training, financial demands.

It is defendable that spatial planning needs advanced methodology and equipment because of the content of this field of science, but above all, because the way spatial planners have to work in problem-solving and preparations for decision making. At one hand they have to handle with hugh amounts of data and information; at the other hand (political) decision makers want to get the opportunity to select and to make a choice out of several alternatives.
Evaluations and recalculations under conditions of changed parameters must be possible without serious time-delays.

Implementation of computer equipment and special software close to that condition. Perhaps by doing so we get better decisions; but we have to be aware that more research, even at a more advanced, and sophisticated level, f.i. by using a computer with allied apparatus, does not guarantee better decisions in any causal relation. Yet, the intention will be as such.

If we look at the circumstances under which spatial planners have to work in developing countries as well as the character and site of the problems they have to handle there, we ought to speak about 'necessity' in stead of need.
The explanation why spatial planners in general, need advanced methodology and high tech equipment, is valid in a manyfold for those ones under developing country circumstances.
They are confronted with lack of necessary information, and the way to get that is even more difficult. This is caused partly by socio-cultural factors (like religion, tradition), and partly by bureaucracy (like lack of vertical relations, manpower, functional power, autonomy and undependencies).
It means, spatial planners need strong tools to reach a more

adequate position from where they can do better inquiries, analysis, and proposals c.q. alternatives on behalf of spatial decision making.

## WHICH SYSTEMS AND SOFTWARE ARE RELEVANT

The kind of systems to use, depends of the number of users simultaneously and the number and kinds of connected allied apparatus at one hand; at the other hand it depends of the character of tasks to be worked and the size of included databases, in memory as well as stored in auxillary devices. On behalf of spatial planning we know one has to do with large databases, in particular externally stored. But also during program running, generally, working programs elaborate hugh amounts of data, partly simultaneously. That is, a lot of memory space of the computer is wanted during program execution, which means the necessity of mainframes or minis. In particular, the combination of numeric and graphical (or cartographical) use of computer equipment enlarges the need for that kind of computers.
Contrary to such 'final' kind of workings in the whole of activities of spatial planning, there is an enormous quantity of tasks which do not need the availability of such 'complete' and extended system architecture. That kind of workings concern input, storage and retrieval of data and information. They may be handled fully satisfactory by using cheap and stand alone or in a netwerk connected microcomputers. The advances of such an approach are great, in particular in the long run. By using microcomputers for 'daily' workings, personnel will be able to use their working time more efficiently and more effectively, with certain time freed for other, maybe more qualitative activities. At the same time their jobs, particularly those with a certain degree of routine, will be done better and even with lesser mistakes. In any case tasks using simultaneously a lot of stored data, may be executed in extremely short time because the computer links those data to its program during running; it does not require labour time from personnel.

Because of the character of spatial planning field, two kinds of allied apparatus demand extra nomination and attention, namely graphical tablet or digitizer, and plotter or graphical drawing screen/terminal.

On behalf of an adequate running of the computer equipment, one needs general as well as dedicated software; the last category is called application software also.
There are several kinds of software required:
1. system's software
2. disk operating software
3. system's utility software
4. general software packages
5. application software packages (non-graphical)
6. graphical software packages (CAD)
7. compiler and execution software
8. library managing software
9. user/self-made software.

ad. 1. system's software
Software the computer needs on behalf of starting and control of the central processor, (sometimes) including a simple computer language like Basis. Also it consists of certain utilities needed for ordinary use of a computer system like screen printing, file listing and file copying.

ad. 2. disk operating software
In case a computer system contains disk drives for using floppys and/or hard disks, special software has to be available to handle with those drives, including formatting of disks. Also possibilities for copying, deleting, and printing of files from disks are relevant.
Further it may contain a more extended computer language dealing with display-graphics for the micro, like Basica, including utility software for drawing characters and images by copying from the screen directly to the printer.

ad. 3. system's utility software
To use the computer equipment suitable and efficient, several pieces of software are needed. Already mentioned are screen printing, and formatting of disks, deleting and copying of files.
But also software for cleaning the screen, backup, directory, disk copy and display of files content. Further, there is diagnostic software for testing and searching why certain system running errors appear.

ad. 4. general software packages
In principe, there are a lot of them, but to mention just a limited number of wide reaching ones:
a. word processing for text editing goals, like making papers;
b. spreadsheets for calculating objectives with several optional and/or to formulate ways of calculating, tabulating and creation of dedicated lay-outs, sometimes including management statistical graphs;
c. database management for creating, updating, listing, retrieval, output and restructuring of databases; and,
d. a combination of a, b and c.

ad. 5. non-graphical application software packages
We may start by mentioning statistical software, however they are not exclusively made for and in use by spatial planning, but still relevant for spatial planning research.

Next we have to state that real application packages are rare in spatial planning until now. If we think of computerised tools in this field of science and practice to be used in a higher frequency and by a manyfold of planners, in fact it concerns limited models. 'Limited' in two ways, namely limited in optional possibilities and comprehensiveness, and limited in user-friendliness and protection against bad use. Including helps and instructions during running and (iterative) communication, like menu and optional steering such application software will be in reach of a broader group of users, in particular users unaware of structure and working of the computer system, programming and other hardware/software related issues (in detail).

ad. 6. graphical application software packages
In this case application software is meant by which the user can draw pictures or images, in a two or three dimensional way.
Generally, this kind of packages contains a menu of options, extended by keyboard input of numbers and text strings as well as input from a graphical tablet, and (sometimes) by output facilities including a plotter.
We have to distinguish (at least) two types of graphical application software. The first type concerns CAD packages, like AUTOCAD.

The second type concerns cartographical packages like Symap.

To the last mentioned type more limited computer programs like DESIGN (van der Meulen en Kicken 1985), belong also.

ad. 7. compiler and program execution software
For users making their own programs there is a need for software to translate the 'english' written program into machine code.
In case of Basic(a) an interpreter is anough, that is that line by line the program is interpreted and executed. In case of Basic(a) and the other higher computer languages like Fortran and Pascal, the availability of a corresponding compiler c.a. is necessary; otherwise the needed translation into machine code is not possible and the stored program object cannot be linked with the execution preparing software pieces.

ad. 8. library management software
Programming in a modular way may be understood in two ways. The first one is a seriously subdividing of a whole program to get an optimal structuring of that program as a whole. In fact, this means a subdividing into procedures and subroutines as far as possible (and as far as senseful, of course).
The second one follows the same way of working, but now every procedure or subroutine is handled undependently. That is, each of them is compiled into an undependent object (in machine code). Next, the relevant objects are collected into a library, which may be included in a (main) program for calling. To arrange that activity the programmer needs a so-called library manager, a dedicated piece of software which collects objects, and results with a library.

ad. 9. user/self-made software
With the help of several afore mentioned kinds of software the user is capable to write his/her own computer program, to test and to debug it, and to run the program for getting results.
This is not an easy task, it asks for special skilling and experience at one hand; at the other hand it will take a lot of time and energy from the programmer.
An user capable to make his/her own software has more flexibility in using a computer, and is able to work with more dedicated and user/problem oriented programs. This 'user/problem' orientation of software can not be reached in packages under all circumstances, in the contrary, packages have a general orientation to get a wider array of clients. And because, generally, these clients do not have (much)

knowledge about computer systems, programming and program execution, a lot of attention to help its users during running of the package, is necessary, without loosing efficiency of the program. That is, program pieces which will be used relatively little, or which are too specialized. They will be omitted in favour of those helps for the user.

What do spatial planners really need from the afore mentioned range of software kinds?
It will be clear that also the planner needs the different kinds of software related to the system, and those that are used as utilities, making life easier for its user.
But after that software there is a real question which other software is relevant. It depends of the capabilities of that planner to program the computer, or if such capabilities lack the use of packages is compulsory in principe.
Some planners will use own software combined with packages, the other one will only use packages.
Substantially, the choice of what software will be used, depends of the kind of tasks the planners have to face. But, in general, we can say that spatial planners need non-graphical as well as graphical/cartographical software, mainly ready-made packages. However, for certain activities it would be better to have program modules (procedures/subroutines) available, dealing with the CAD/Cartographical tasks within a computer program. That is, by including such modules into the user's program.

Yet, a lot of packages may help the spatial planner to a high degree. I mention:
1. database management software package
2. spreadsheet software package
3. text editing software package; or, a combination of 1, 2 and/or 3 (like the Symphony package)
4. a cartographical package, including data handling from a digitizer and/or to a plotter device
5. a (geographical) spatial information system
6. forecasting package (optional kinds)
7. statistical package, including (management) statistical graphics
8. network linking/transferring software package
9. library with utility software on behalf of the user.

And if the planner is intended to write (some of) his own programs, than he/she needs also:
1. a program text editing software module
2. a compiler in accordance to the computer language is used for writing the program. With compiler is meant a three stage software package (syntax checking, machine coding, and linking for execution)
3. library based software to include in or to link the user's program with procedures/subroutines
4. a library manager software package for creation of and combination of procedures or subroutines into a library
5. some utilities to make programmer's life easier.

## SOCIAL AND ECONOMIC CONSEQUENCES

In general, new technologies cause several positive and negative processes in society. The most well-known is a decrease of labour employment because all kinds of technology replaces labour of human beings by machines and electronics. In particular this is caused by computers and computer related developments, like roboting.
Roboting and flexible industrial approaches are important in the field of manufacturing, resulting in a few final jobs for labourers on behalf of production and process controll, as well as logistic routing designs.
The negative effects of computer use concerning employment is seen (and will be seen in the coming years) in the administrative sector, particularly in those parts working with large databanks, with routine-like, frequently repetitive calculative and administrative elaborations. We may think of several governmental jobs, public desk activities, banking, and other office activities.
Loss of employment implies a lot of seriously social consequences, mainly negative ones, but yet not all negative.
In the long run the use and application of those new and advanced technology means an updating about the way to think about labour; in terms of labour time (40 to 50 hours a week f.e. and free time) and labour quality (dangerous, dirty, heavy, monotonous). Including advanced technologies means also more suitable approaches with economic and social benefits in the long run. New technology is relatively expensive, but because of the high wages for labour, sometimes labour instability too, the final results probably will show a positive account.
But there is an enormous time lag between the implementation and application of computerised tools at one hand, and the moment labour market and employment including insufficient skills at the other hand.
This time lag causes the well-known social and psychological problems of the loss of employment in certain sectors.

Other social and economic consequences are (a.o.):
- other ways of communication (like Viewdata, discussion telephones, networking, facsimile);
- integration of electronics and computer elements (chips) in the homes, 'electronic cottages; also we may think of television telephones, and roboted househelps;
- changes in traffic related equipment and activities (like traffic lights electronically stimulated by traffic flows; board computers in cars and other traffic vehicles to inform their drivers about (among others) which roads to take to reach an input travel destination; weather regulated traffic signs);
- changes in attitudes to a lot of socially and economically related subjects (political acceptance of new technology into society in general);
- by a shift from 'manual' tools upto advanced technological tools and methods based on such high tech. like computer equipment and software, there results a general demand for another kind of skilled labourers; generally, it causes a serious shift in educational and training priorities as well as societal relevance of certain

jobs and activities. As a consequence we will meet all kinds of redistributions concerning economics and financial flows in society, and related chances for (almost) all societal subparts.
Generally, we recognize this topic as CA = Computerised Aided .... and meet it in a fast growing amount of fields and disciplines, with related jobs and professions;
- priority shift from a production steered society to an information society, in which data and information has been got a very important place and influence in making decisions.

## SPATIAL CONSEQUENCES

It is difficult to look into the future, but some imaginations are possible (without guarantees for their realization, or even without probabilities).
Perhaps we have to remind Melvin Webber's issue about the 'urban realm', asking attention for a concept of weaker urbanization and urban concentration, caused by the unimportance of face-to-face contacts and to be 'with body' in the centrally urban area; or more in general the influence of living location and infrastructure will become (relatively) irrelevant.
If we try to estimate the influence of computerisation in the form of telematics on the spatial organization, the urban realm concept may become really important. A lot of consequences may result from that, even a leisure time oriented society, partly because of non-employment, partly because of an increased non-working time for the labourers.

Another strongly effected area concerns locations for employment, in particular offices and industrial settlements. This will be caused by a decreasing demand of human beings for doing the work, by a decreasing need of locating such activities conform the traditional concepts of economics and related living-working areas (even concepts like that of the Charter of Athene, CIAM), an increasing realization of communication and infrastructural links, partly above the ground, partly beneath it.
Because of an increasing need of recreation and leisure time facilities, an increased as such dedicated land use zoning will be required; perhaps this is not contrary to recent concepts of urbanization in which urban concentration is desired to save open and green space, in any case to save existing open and green spaces to be used in another way. Yet, I think, the combining result of leisure influence in the direct environment of the home and that in a recreational view will result in a more space consuming land use at a regional and urban level.

In terms of communicational infrastructure at a regional or national level the so-called beam-pathes will become of great importance; other related elements will be equipment related to satellite communications.

An important range of human activities concern visiting service-offering offices, like community agencies (birth

registre), bank, post office, etc. All these offices need supply elements like desks, waiting and office space for visitors, parking places, etc.
In case of telematics based services a great part of the including space may be reduced because a supposed decreasing visitor's frequency. A connected consequence is a weakening necessity to locate those services in centrally, reachable sites.

The influence of high tech on harbour activities is already known by specialized forms of transport/transfer.
Newer technological developments will lead also to a more machine computer controlled way of working in the harbour. Pipelines, transport band (rolling transport bands), steered and monitored by control panels, but with a few labourers, that is full automatization, computerisation and forms of roboting.

## CONCLUSIONS

Computerisation and telematics will cause several positive as well as negative socio-economic and socio-spatial consequences. Yet it will offer a lot of useful potentialities to help society in doing its activities, and to research and support them in terms of decision making. The development of tools are important in that framework. Among other fields of practice and science they will be integrated in the field of spatial planning. Also they have relevance for Third World countries.
In particular microcomputer equipment as well as software are relatively cheap as far as general application purposes are regarded; availability of package-like software in spatial planning is rather scarce, except packages developed in other fields but useful for planning like cartographical and graphical software as well as statistical packages.
The attention for the consequences of computer and telematics concerning social, economic and spatial processes will grow in the next years because of the serious and overwhelming effects.