Integrating GIS and electronic networks in urban design and planning

Pia Bille

In 1998 I undertook an inquiry into the use of information technology in Urban Design and Planning in Danish municipalities and among planning consultants. The aim was to find out who was working with the IT and for what purposes it was used. In education there seems to be barriers to a full integration of the new media, and I wanted to find out if that was also the case in the practise of architects and planners. Surprisingly I discovered that there was a computer on almost every desk, - but there were big differences in the use of the technology.
The investigation described here is based on interviews with planners in selected municipalities and with urban planning consultants, and the results have been summarised in a publication.

Introduction

Many of today's architects and planners are uncomfortable with the information technology, not unlike the common attitude among faculty at the School of Architecture, and there still seems to be a gap between architectural practise and computer work. In contrast to this I found that the information technology in several cases has influenced and changed traditional methods and planning procedures. The inquiry indicates that certain planning procedures are redefined in accordance with the IT and it also illustrates how the technology has created new ways of collaboration among professionals.

The paper offers a brief presentation of the findings of the inquiry in the following parts:

- digital maps and data as a condition and a barrier
- computerised automation of work in municipalities
- GIS in physical planning
- IT in planning consultant firms
- The local plan: an example of full IT integration

Finally the paper points out some perspectives in the practise of professional architects and planners and discusses the implications for the education of young architects.

The field of the inquiry: IT and the large scale

The inquiry of the use of IT in large scale architectural planning approached the working area of the planners by dividing it into two main groups: the traditional assignments and special tasks.

Among the traditional assignments are:
- Public management
- Municipal and local plans
- Analyses and investigations that are often background material for plans and projects
- Projects: urban transformation and renewal,

Figure 1 (right). Integrated electronic supported planning
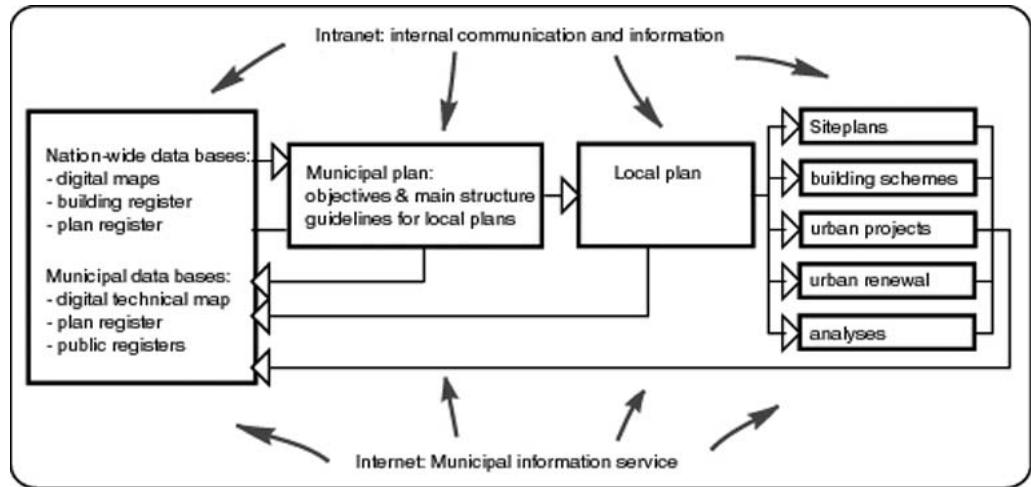
traffic planning, green plans, building schemes etc.

The special tasks include:
- Graphic representation and visualisation
- Information and communication with citizens
- Development assignments - including IT-strategy and IT-implementation
- Aesthetic analysis

I have within these areas attempted to find examples to show the versatility in the use of information technology from the quite ordinary to the most advanced. The intention is to elucidate how well integrated new technology already is in most workplaces.

Briefly you can say that the digital working process will become generally accepted within all areas where you work with data. This means that if you obtain knowledge that can be organised in lists, tables, on maps or any other schematic form, and use and communicate this knowledge in a worked-up form, it will be done electronically - by means of a computer. Some planning consultant firms still consider it a cost. It is seen as a piece of extra work that is done last. But for many planners the time division of the work

process into analogous (traditional) and digital work disappears. This does not mean that the pencil disappears, neither does the computer; but it means that the division of time between using one or the other medium ceases and the work is integrated.

The digital data basis

Digital maps that are the basis of almost all planning work are a result of thinking ahead and at the same time of a closed world. Digital maps are made by cartographers and land surveyors who have their own tradition of how to work with the digital media. Maps are drawn on special computer-systems that have had very little in common with the Window-based PCs and Macs by which the rest of us were seduced. For many years it was considered an impossibility to work seriously with maps on PCs, and not without reason, for it is only in recent years that ordinary PCs have been equipped with capacity and speed that can be compared with the equipment on which the maps are produced. But it has had the consequence that the mapping area has been developed in a closed world, and it is a slow process to make electronic mapping just as simple and straightforward as the office routines.

In practice a collaboration is established between planners and cartographers, so that the planner's work to a certain extent is redrawn by the cartographer before it can be included in the map database. The disadvantage is that the work is in many cases done twice. The advantage is that there is a great deal of security that map-revisions are carried out correctly.

In many cases use of digital maps makes demands on the planners which they are not ready to meet, not even those familiar to cad systems. The maps are organised with a very precise structure, that only cartographers can deal with. Others will have to use manuals and a barrier for the work has been created. Equally, the possibilities of working with the public data collections today are determined by knowledge of the databases, codes and keys, which can deter most people. In addition to this it is often a difficult procedure to get access to the relevant data. In spite of these obstacles its is a fact that the computerisation of the architects' and planners' job is accelerating and infiltrating many areas as the following examples will show.

Computerised automation in municipal administration

The spreading of electronic networks into all municipalities is followed by attempts to automate routines within the municipalities. This is taking place according to an overall strategy in a municipality or is developed in individual departments by particularly interested staff members. It is rarely a task that can be carried out by the municipality on its own, but consulting firms offer concepts that can be tailored to the special needs of the municipality. Treatment of building applications, public hearings and complaints are interesting fields of automation due to the often complex and time demanding procedures.

The local plan

In urban planning a much simpler form of automation is found in the municipalities included in the inquiry. All planning departments use electronic templates for the local plans that are required before an urban area can be developed. A template for a local plan represents a simple and uncomplicated example of automation being a simple text file containing suggestions for most paragraphs in the text document and legends for maps. It only demands ordinary user-qualification in DTP to make the template and each municipality has made its own template which is also offered to planning consultants.

The municipal plan

Municipal comprehensive planning can also in parts be automated. It is hard work and development of a proper application can be required. But it is reasonable in spite of the costs, because the assets that can be gained by - among other things - an automatic updating procedure correspond plentiful with the expenses for the development of the application. Often the development of applications in pilot-projects take place as a collaboration between the municipality describing the procedure and delivering data, a software consultant, and a public authority, who co-finances the project, reports and provides further information about the project for other potential users.

Esbjerg Municipality has in collaboration with a software consulting firm developed an application for maintenance of the municipal plan (masterplan) as a pilot project. A result of the work is that an updating of the plan can be made in a fraction of the time spent before. But prior to that situation there is a great deal of work in building up a structure, which is both logical for the users of the municipal plan and single-valued in its data structure. The work includes two main areas: the map database that contains the (geo)graphical representation of the local areas and the alphanumeric database that contains area identification and data. The two databases are related through the identification numbers of the local areas, which are present in both databases. The structure is completely identical with the structure being built up in a GIS, and not untypical, the great workload lies in structuring the alphanumeric database and establishing a user-interface for the database.

GIS for analyses and projects

Analyses usually take their starting point in specific conditions and they use data. These assignments differ from case to case, and the focal point in the use of information technology is therefore not automation, but access to data, the practicability of the analysis and further communication of the results. Therefore, it is not unexpected that GIS gains ground in this area. This does not take place as part of a strategy in a workplace, but is a tool in which some technicians have discovered the possibilities.

Projects must be thought and developed from the bottom each time, and there is no definite way of doing things. There are examples of municipalities and consultants who at present use GIS in the development of projects, but the condition is that access to digital maps, cross-references and data collections are in place in the municipality. Furthermore it requires that there is one or more members of staff who are "super-users" of the basic software and not only of an adapted application. This is the situation right now in some large municipalities, and this is also where the first experiences are gained with GIS for planning purposes. In the majority of the municipalities there is still some way to go before GIS-based analyses are in general use.

The inquiry shows that information technology is used in largely all working areas in municipal planning and administration. Not that all municipalities are working 100% electronically, but electronic examples can be found of all ordinary planning assignments, and this indicates that the computer has gained grounds in most workplaces in public administrations, where it is part of enhancing the collaboration among individuals, occupational groups and administrative areas.

IT in planning consultant firms

The planning consultant firms make a mixed image because this is where you can find examples of the most advanced use of computers, but at the same time there is less prevalence of information technology than in the public workplaces. There are private consultants who produce qualified work without using a computer at all, and it is still widely held that other occupational groups should attend to that matter, giving room for the architects to continue doing their job in the traditional way. Internet communication will probably become a factor that will really affect this view, because if you want to use the potential of the Internet for electronic collaboration and independence of place and time, it also implies that projects are prepared electronically.

Visualisation is closely connected with the preparation of projects, and it is therefore not surprising that electronic visualisation is an area that is especially handled by private firms. These firms have developed techniques for visualisation of their own projects, but they also deliver illustrations for other planning firms and public authorities. GIS, on the other hand, is not particularly widespread in the private planning firms, but it is probably a consequence of the fact that they are in a secondary position in relation to the development of the data-basis of GIS. At the time when GIS is integrated in the local planning work, there won't be any particular obstacles for the planning consultants to make GIS-based analyses.

Perspectives in the implementation of IT

Local planning (site planning) is a large activity in the planning area within a municipality and the following brief summary of how IT forms part of the preparation of a local plan serves as a reference to point out which assignments are awaiting, now that IT is no longer an offer but a condition for many tasks.

Within the local plan area the use of information technology became clear very fast. First of all in the form of word processing and desktop publishing. Also the paintbrush programmes that were delivered with DTP-software came into use when maps were provided with regional boundaries. Many people have been fascinated by the new possibilities, and gradually

The Yellow House   The Blue House   Ecological new construction
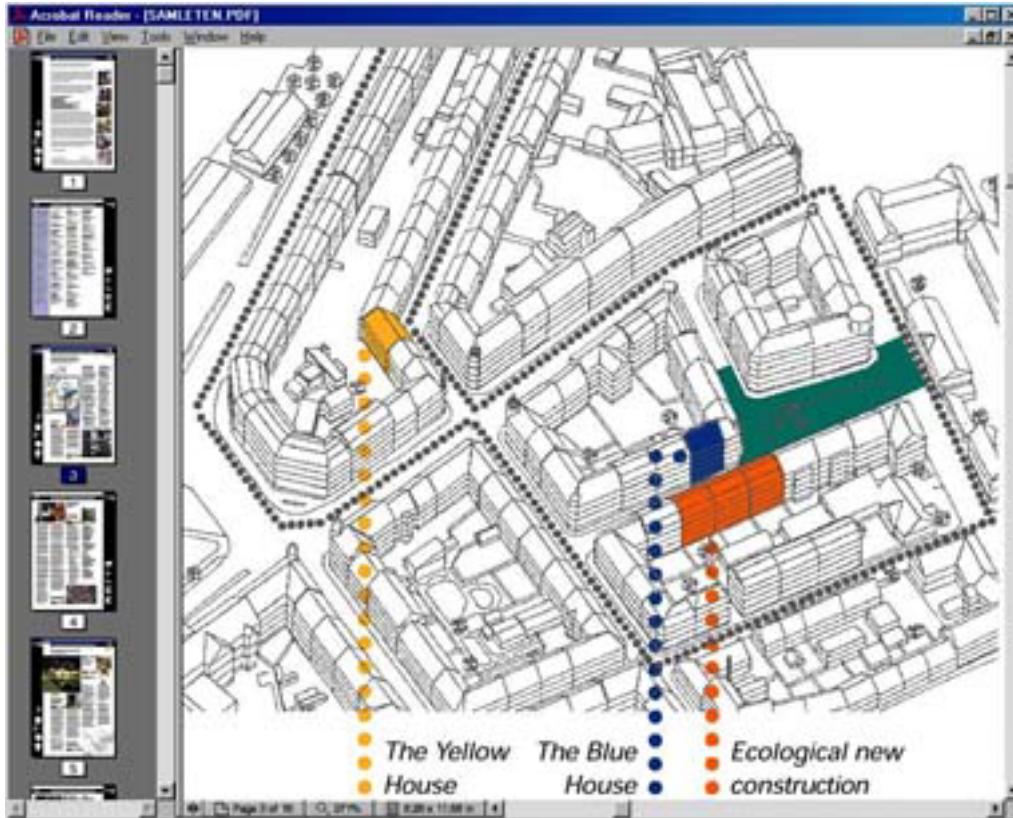
methods have been developed locally, as to how to use the technology, so that a nice product can be made while at the same time the possibilities of editing and reuse are utilised. Layout- and text templates are used and are exchanged between public authorities and consultants, and the Internet has made this work- and communication form more flexible. The map annexes that are part of the plans, are as a starting point available in digital form, but not all technicians have been familiar with the editing of digital maps, and there is great variation in the form of the illustration material, when it has been prepared and finally is enclosed in the local plans. Often the finished product is a hybrid of electronic documents that have

maintained the attached attributes, i.e. co-ordinates, line types, etc. and traditional drawings that have been scanned. The only reliable thing is that the overall material is available in digital form.

We are now starting to make more demands because the digital form offers a number of new uses for the plan documents. The plan is to be used by other technicians in further projects and it should be possible to distribute it electronically. It has to be reported to the National Plan Register, and the municipal plan should be updated and tell that there is now an approved local plan and an area to be developed. This is nothing new. The new thing is that it can take place automatically or almost automatically.

The aim can be to make the work of remembering to file, to circulate, to up-date maps, etc superfluous. This whole field should be executed automatically as the local plans are approved.

If this scenario is to succeed it means that the procedures used today, - and which in many cases date back perhaps not more than 5 years ago, when you had the computer placed on your own table - must be re-evaluated. It should be examined what happens to the text, and what happens to the maps in the local plan during the planning process. The goal is that they are being directly included in the electronic data-collections that the municipality builds up and are made available for all staff and in most cases also for the citizens by distribution on the electronic network as a result of the approval.

What kind of picture emerges

We are still in the establishing phase. Information technology has not found its final form, and both software and hardware is still being developed. The conditions for an integrated use of IT is still under construction and the basic infrastructure is being established:

• electronic networks are being installed for internal and external communication
• a co-ordinated map-database in a nation-wide first edition is within reach
• almost all municipalities have access to up to date and detailed technical maps on digital form
• revision and testing of the data-quality in the public registers is still in course
• a nation-wide cross reference between alphanumeric data and geographical data on every physical mail address is established

The broadest field concerning procedures for the ordinary technician's access to the nation wide and municipal data bases is still at an initial stage, but there are initiatives within all work areas and there seems to be great interest in exchanging experiences.

Some municipalities prefer a slower, decentralised IT-development, whereas others aim at developing large integrated solutions, adapted to the routine in the municipality. Consulting firms develop systems that aim at automating routine work and administrative procedures. In principle that effort must be OK, but it is difficult to imagine how the systems are understood by the individual staff member for whom it may be difficult to form mental models of the electronic procedures that make the individual work efforts understandable.

Where are the difficulties?

The planners who today deal with planning did not grow up with digital technology and in many cases they simply dislike using machines in their work. The arguments vary, but the result is the same; in every respect you work more poorly when you are sitting in front of a computer. That problem will solve itself, and though it may take a decade, there is no doubt which way it goes.

To gain from the potentials of electronic supported work there is a need of co-ordination in many fields. Collaboration between public bodies and among individual technicians must be co-ordinated. Procedures and methods should be co-ordinated and also technology itself – and you can continue... The strategic point is perhaps the technological co-ordination. It *will become* easier to collaborate electronically even when you work with different software and hardware platforms, because there will be still more common standards and formats which all software developers support. And when the possibilities are present they will be used, -and that is probably the driving force in the continued reorganisation to electronically supported work.

Expectations

The anarchist pioneer times where everybody with interest in IT find their own way and method are just

about over. A lot of experience has been gained and to make use of that and the many data, procedures are now to be developed for collaboration. Local authorities, government institutions and private enterprises collaborate in the formulation of common standards for maps, and for building up and maintaining registers. Software is developed that does not take its starting point in the traditions of particular occupational groups, but build on user-friendliness and commonly familiar procedures.

GIS will become a common analysis-tool, which is, however, not reserved for planners, but is used by everybody who work with geographically attached data. In a way the planners have been slow to use the GIS-technology. Private enterprises, who are constructing their own more limited databases, have more easily been able to use the technology. The planners who work on the basis of data in the public registers have awaited revision of the registers.

There will be a democratisation of a number of technical areas within information technology, which means that it takes less special knowledge about computing to use the programmes. The limits between various software-types becomes diffuse, CAD and GIS for instance are going to be the same. Working methods with the programmes become alike, and are learned at the same time as a subject field, starting already when you learn to read and write, in the same way as today you learn to use a pocket calculator, when you learn arithmetic. This means that it becomes difficult to separate professional methods and IT-skills, it becomes two sides of the same matter.

Finally the Internet breaks down the borderlines between the individual computer work place and the surrounding world, and becomes the most important access to information and thereby a condition for the work. Collaboration relations carried by electronic communication will develop in more complex forms than we know today, and both boundaries between professions and authorities are smoothed out. You communicate with a number of media and can establish virtual offices where persons and projects that are spatially separated can meet.

………. and it becomes unthinkable that anyone would get the idea of investigating whether and how you use IT, no more than anyone would think of asking whether you use your head in your work.

Notes

[A] In Aalborg municipality all plans are part of a database, and searches can be made for particular subjects or geographical areas. All changes are made directly in the database. The illustration shows an area which is part of an urban ecological project that can be accessed from the intranet in the administration and from the internet as well.

Pia Bille
Aarhus School of Architecture
Dk 8000 Aarhus C. Denmark
pia.bille@a-aarhus.dk