ENVIRONMENTAL MANAGEMENT INFORMATION SYSTEM (EMIS)
Sustainable Cities Programme (SCP) of the United Nations Centre for Human Settlements (Habitat) and the United Nations Environment Program (UNEP)

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USING EMIS TO SUPPORT BETTER URBAN MANAGEMENT

Cities play a vital role in social and economic development. Efficient and productive cities are essential for national economic growth, and, equally, strong urban economies are essential for generating the resources needed for public and private investments in infrastructure, education and health, improved living conditions, and poverty alleviation.

Unfortunately, the development potential of cities is all too often crippled by environmental deterioration. Aside from its obvious effects on human health and well being (especially of the poor), environmental degradation directly holds back economic development. For development achievements to be truly 'sustainable', cities must find better ways of balancing the needs and pressures of urban growth and development with the opportunities and constraints of the urban environment.

Environmental deterioration is not, however, inevitable. Although many, perhaps even most, cities are still suffering severe environmental and economic damage, there are encouraging signs. Some cities are learning how to better plan and more effectively manage the process of urban development, avoiding or alleviating environmental problems while realising the positive potentials of city growth and change.

Environmental goods and services are the resources on which all development ultimately depends: the management of these resources is therefore an integral concern in development planning and management. The tools available to decision-makers for influencing development towards optimal and sustainable use of environmental resources are limited and can only be effective if they are applied in a consistent and co-ordinated fashion. Environmental resource management uses information to reconcile competing interests (i.e. environmental policy co-ordination) and to support development decision-making (i.e. policy implementation).

Urban managers are confronted almost on a daily basis with a number of recurrent questions. These questions cover issues such as: Which areas are available for city expansion? Where can we establish new housing areas? How can we revive certain parts of our city? How can we improve health and recreation conditions for our citizens? Where are

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flood-prone areas? How can we stop air pollution in various parts of the city? To which areas shall we guide investors? What consequences will it have to build a shopping centre at a particular site? Where can service delivery be improved and expanded?

These questions have three typical characteristics. They
- are frequently asked;
- have long-term importance; and
- are of a cross-sectoral nature.

All these questions relate to the planning and management of space in the city, so the answers have to be geographically linked. This Handbook addresses the spatial aspect of the Environmental Planning and Management process, and aims to help urban managers to give more accurate answers to these typical questions.

Spatial information about a city is usually scattered in different public institutions, according to the different work areas and specialisations. Data storage systems often differ from institution to institution, making it difficult to compare and combine information. Another important drawback is while typical routine urban management questions refer to specific areas in the city, the way spatial data is stored often makes it impossible to relate the information to specific areas. While routine urban management questions have always been answered, usually only some of the information about the consequences has been taken into consideration. Only a few possible solutions are considered and assessed. Sometimes this approach works out nicely, but sometimes it turns out to be a very costly decision for developing the city. Getting the answers to typical routine questions may take several days if not weeks, and in many cases potential investors have turned around to look for better options by themselves.

To reach sound solutions in urban management the EPM process offers an approach for inter-departmental and inter-institutional co-ordination of information through a participatory working method. Issue-specific Working Groups are the main providers and the main users of spatial information and are supported by mapping professionals, cartographers, surveyors and experts in geographical information systems (GIS). The rapid development of information technology has revolutionised surveying and mapping towards ‘geomatics’.

With the appearance of increasingly powerful computers, it is much easier to store and to process large quantities of spatial information, as well as to share information between different offices. It is becoming easier to access all the information necessary to answer routine urban management questions quickly and comprehensively. Through using an EMIS to answer routine questions, many of traditional drawbacks, such as dispersed data, incompatible data formats and the sheer volume of data, can be overcome. EMIS is designed to link dispersed data about urban and environmental issues to a series of different types of maps about a particular area or even city-wide. This linkage allows users to combine, query and analyse all this information in an area-specific way, and therefore to get more precise answers for routine questions. The proper set-up and operation of the system, will – ideally - generate a comprehensive response for a routine question within few hours.

As the EMIS is a tool for participatory urban environmental management, it concentrates on the interaction between environmental resources and hazards, and development activities. The system is designed to illustrate the various possible results of environment-development interactions. For example, establishing an EMIS in a SCP partner city supports a better understanding of this interaction throughout the various steps of the SCP process cycle. An EMIS can be operated by using a traditional manual system of storing and displaying information (library, manual drawing of maps). Today, however, a computerised EMIS usually uses a Geographic Information System (GIS) as a tool to handle and process the spatial and non-spatial data.

Please note: There is a clear distinction between EMIS and GIS. EMIS is an information system for managing information on the urban environment according to the EPM process. GIS is one of the tools which may be used for applying an EMIS.

What makes EMIS special is its participatory approach. Very often a GIS is reserved for specialist use. The system is set up, but then it is not fully exploited for urban management purpose afterwards, because the people querying the data are missing. Through the participatory approach of the EPM process, many people will be involved in gathering information for the system and setting up the EMIS. All these persons will become users of the EMIS, and the system will grow as they use it.

HOW DOES EMIS FIT INTO THE SCP PROJECT CYCLE?

The Sustainable Cities Programme (SCP) is a worldwide technical co-operation activity of the United Nations. It works at city level in collaboration with local partners to strengthen their capacities for environmental planning and management (EPM). Each city-level SCP project is adapted to the particular needs, priorities and circumstances of that city; nonetheless, all SCP partners cities follow a common approach and all are implemented based on the following principles:

- central focus on environment-development interactions;
- broad-based participation by public, private and community sector groups;
- concern for inter-sectoral and inter-organisational aspects;
- reliance on bottom-up and demand-driven responses;
- focus on process: problem-solving and ‘getting things done’; and
- emphasis on local capacity building.

The SCP process consists of a sequence of activities, which are logically and practically connected, together with a number of specific outputs, which are important for the progress of the project. The key point to remember is that following the SCP project cycle builds an effective environmental planning and management process which is designed to be integrated into local government practices.

The SCP project cycle has three main phases:

The **First Phase** (*Assessment and start-up*) is a 6 to 9 month initial period, which normally includes the following main activities:

- identification and mobilisation of project participants and partners;
- familiarisation of project partners with the core EPM concept and SCP approach;
- preparation of the Environmental Profile (EP) and initial identification of priority environmental issues;
- review of available resources, tools and information and initial design of an environmental management information system (EMIS) specifically adapted to the city's needs;
- working out the organisational structure, work plan and operational procedures for the project;
- organising and holding the City Consultation; and
- establishing the Issue-Specific Working Groups.

The City Consultation is a major event that brings together the work of Phase One, consolidates social and political participation and support, and launches the SCP project into Phase Two. (Volume 2 of the SCP Source Book Series - *Organising, Conducting and Reporting the City Consultation* - provides detailed guidance.)

The EMIS provides considerable support during this first stage. A basic map, showing the location of the city and some additional thematic maps on environmental and development issues will be included in the Environmental Profile (EP), and all the environmental data collected for the EP will be stored in the EMIS. During this period an inventory of existing maps and data is conducted. For the City Consultation, the EMIS can be used to prepare a map exhibition. These maps will help to identify, clarify and prioritise the environmental issues facing the city. The EMIS also supports and interacts with the Issue-Specific Working Groups. Information already compiled during the inventory period can be shared and new information from the members of the working groups can be collected for inclusion of the system. It is advisable to establish a Mapping Group (see section B1.4) during the early stage of the first phase in order to have the first mapping outputs ready for the Environmental Profile (EP) and the City Consultation.

The project's **Second Phase** (*Strategy & Action Planning*) is a 15 to 24 month period of intensive analysis, discussion and negotiation within the Issue-Specific Working Groups. The number, focus and membership of these Working Groups will change and evolve as the project proceeds, but they will remain the principal working mechanisms of the SCP Project. (See The SCP Source Book Series, Volume 3 - *Establishing and Supporting the Working Group Process*.) During this period, each of the agreed priority issues is further elaborated and developed, in order to reach a consensus on appropriate strategies for that issue. The strategies are then developed into action plans which are agreed by the organisations and groups involved in implementation. (See The SCP Source Book Series, Volume 4 - *Formulating Issue-Specific Strategies and Action Plans.)*

It is likely that small-scale 'demonstration' projects will be undertaken to test the approaches developed and to show what can be done through the SCP process. In addition, some of the first action plans will produce investment and/or technical assistance proposals which will be developed into properly formulated and 'bankable' proposals. All of these Phase Two Working Group activities will be gradual, pragmatic and co-operative, reflecting the real-world conditions for strategy formulation and implementation. During

this Second Phase, the main project activities aimed at institutional capacity-building and human resource development will also be carried out.

During the Second Phase the EMIS supports the participatory decision-making process in a number of ways. The Working Groups will formulate their needs for specific maps and generate the data for new maps. During this stage a great deal of maps and data will accumulate and the EMIS will evolve rapidly as a functional tool. The system can produce many outputs, such as identifying environmentally sensitive areas ('hot spots'), can help to select sites for specific projects and can support project design for a specific site. With the help of the EMIS detailed strategies can be formulated and action plans prepared and illustrated with maps. The Mapping Group and the Issue-Specific Working Groups will interact closely with each other in order to ensure genuinely participatory mapping.

The **Third Phase** of work (*Follow-up & Consolidation*) is an open-ended follow-up and implementation period, which begins towards the end of Phase Two and carries on for an extended time afterwards. The strategies and action plans coming out of the Working Groups are further elaborated, building towards an over-all citywide environmental management and urban development strategy. Investment proposals are worked out in detail, subjected to rigorous analysis, and pursued vigorously with funding sources. The task of institutionalising the environmental planning and management (EPM) process, initiated during Phase Two, is undertaken in earnest (see The SCP Source Book Series, Volume 5 - *Institutionalising the EPM Process*). In addition, the remaining training and institutional development activities are implemented. Finally, there will be regional and/or national workshops and meetings to explore ways of extending SCP activities into other cities, building upon the experience gained in the project.

This is the stage where the EMIS is fully functional. A considerable amount of data has been gathered, allowing further analysis of the data, and the production of outputs such as a development pattern map, issue specific strategy maps and an environmental management framework. The system still needs continuous input to stay up to date and increasingly comprehensive in order that it remains a powerful urban management decision-making tool in the future. In addition, an EMIS can support the monitoring of the environment situation and the evaluation of the achievements of the EPM approach.

SPECIFIC APPLICATIONS OF EMIS

Different levels of city administration require different information about their city. For example, the city assessor needs a detailed, large-scale land information system to improve the collection of property taxes. The water department requires precise spatial information on the water utilities for better operation, maintenance and revenue collection. The forward planning department is concerned about the expansion of the city, while the environment department needs to manage environmental resources and hazards better. Equally important is the issue of information outreach: for example, the mayor presents a self-explanatory "snapshot" of the city's environment and development situation at a conference in order to attract tourism, investors etc.

The EMIS can support various requirements mentioned above. Colourful attractive maps draw attention and can quick-start discussions. The EMIS supports different tasks in urban management decision-making such as project design, site selection or investment planning. It can be further used to attract donors and investors by providing maps which show the best locations for investment in the city.

The need for a new urban management approach

During the last decade it was recognised that traditional planning practices did not sufficiently address the urban management problems cities faced. The Charter of Athens considers the city as a "masterpiece of architecture" to which functions can be attached on the drawing board. Reality has shown that this approach is unworkable, especially in cities with growth rates of five per cent and above. An open planning tool, however is able to react quickly to rapid changes in city development. The EMIS complements (but does not necessarily replace) existing planning tools, such as Landuse Plans, Master Plans, Zoning Plans and so on. The strength of the system lies in its capacity for cross-sectoral analysis and the facility it offers for the overlay of multiple environment and development information sets. This approach also supports better urban governance, because it incorporates issues and norms into the decision-making process which will be otherwise ignored. The information stored in the EMIS is a consensus interpretation of information, gathered and discussed in the working group process. The participatory nature of the EMIS responds to a gender responsive EPM by, for example, collecting data and information in a gender disaggregated way where applicable and necessary. However the decision-making process is transparent and traceable through the map layers and through the documentation of the working group meetings. EMIS also helps better disaster prevention by providing policy makers with early warnings about hazardous situations regarding the environment.

Which projects to design for a specific site?

For **project design,** information from several maps is combined and the analysis will provide options for selecting a site or area of interest. A table of information will show the information available about that site including the findings of the working groups about 'rules and conditions' regarding the environmental and development conditions for this specific site. The next step is to prepare a report listing all the information and regulations, making suggestions for the best uses of this plot. If a project document already exists, the information gathered can be used to refine the project design according to the findings. With the inclusion of some more information it is even possible to estimate the costs of different investments at this specific site. Based on the report, the investor can decide on the type of investment she or he will make, or whether the design of the project has to be changed.

Which sites to select for a particular project?

Site selection requires some advance considerations and decisions. This is best explained with an example: A site suitable for a sewage plant is needed. The rules applying to a suitable site for a sewage plant are that it is best placed downwind from settlements, but still near housing areas. The site should be accessible by road and the area must have

suitable soil conditions and a low water table. To find sites fitting these requirements, several EMIS maps will be queried to find all the areas with suitable soil conditions, a low water table and good access to roads. From these areas, sites will which lie downwind from settlements but not too far from them will be selected. There will be several sites matching this query. Not all of them will be available. The ones available will have different obstacles. A report will be prepared describing the advantages and disadvantages of the different available sites.

A city wide view: The Environmental Management Framework (EMF)

A major EMIS output is the Environmental Management Framework (EMF). An Environmental Management Framework has three major components: one, spatial analysis; two, project and investment requirements; and three, a management framework for effective implementation of strategies. The spatial component refers to the geographic interpretation of competing interests in the use of space and the aggregation of potential strategies for solving those competing interests. By mapping and overlaying the geographic distribution of the critical environmental resources, areas can be classified or ranked by their degree of exposure to environmental risks, and sensitivities to particular development activities. This ranking or categorisation of areas helps to determine which development activity is compatible to specific areas, and to articulate rules and principles applicable to development taking place in the different areas. Such rules and principles may not necessarily exclude certain areas from development; they rather enable the incorporation of the long-term costs necessary in investment decisions.

The spatial analysis component of an EMF would allow the determination and prioritisation of potential development areas for city expansion and growth. The selection of areas for future urban expansion will depend on the interaction between push factors (growth deterring), pull factors (growth stimulating) and the environmental sensitivities prevailing in the different areas of the city. The exercise results in the selection of areas with least foregone opportunities (say in terms of loss of agricultural land), benign environmental risks, higher carrying capacity, least infrastructure development cost and high economic efficiency. The spatial analysis component of the EMF makes extensive use of maps and Geographic Information Systems (GIS).

The EMIS can directly link into existing GIS applications such as Land Information Systems (LIS) or Utility Management Systems, provided, the different systems are compatible to each other. Those systems contain information about each plot in the city, such as details on houses, tenants, and owner. This information can then be used for property taxation and water and power supply charges.

EMIS and ISO 14001

The EMIS complements the voluntary environmental management system (EMS) defined through the ISO 14001 series. Used in conjunction with appropriate goals, and with the management commitment, the ISO 14001 helps to improve environmental performance and reduce negative impacts. They provide an objective basis for verifying claims about a local government's performance in its day-to-day operations. The ISO 14001 series

addresses environmental management systems, environmental auditing, environmental labeling, environmental performance evaluation, and life cycle assessment. These international standards are voluntary standards for the establishment of a common world-wide approach to management systems that will lead to better urban environmental planning and management. Even though the standards do not prescribe performance levels, performance improvements will invariably be achieved by any entity if its commitment to environmental care is emphasised and employees are trained and are aware of the policies in place to protect the environment. The ISO 14001 voluntary environmental management standards and guidelines are intended to be practical, useful and usable for organisations of all sizes (Source: ANSI Online, link: http://www.soc.titech.ac.jp//uem/)

HOW TO INTRODUCE EMIS INTO THE CITY

Establishing a fully functional EMIS can take several years. The system can be built incrementally from a low-cost set-up to a sophisticated and complex system without compromising the value of the outputs (a bicycle gets you to your destination just as effectively as a luxury car!). The basic EMIS is essentially no more than a set of checklists of questions that should be asked when making decisions, with 'pigeonholes' to record and store the answers in simple formats that are directly usable, together with some advice on how to go about it.

After the initial stage certain amount of information will have been gathered and good outputs may have been produced to improve urban environmental management. However, it must be remembered that the EMIS can never be regarded as final, it has to be continuously updated and maintained. Any new investment will change the pattern of the city's fabric, and this has to be reflected in the EMIS. A city, therefore, has to commit itself to a long-term investment in the EMIS. This commitment includes not only providing the appropriate equipment, personnel and funding to run the system, but also providing clear policy guidelines for the purpose and the use of the results.

An EMIS works best if the following principles are accepted:

- An EMIS is a dynamic, learning system, so information has to be fed into the system continuously. "Rome was not built in a day". An information system does not have to be complete to be useful, and in any case takes significant time to assemble and fill. In the meantime, decisions on environmental issues will and have to be taken. Provided that attention focuses on the priorities of the users, even modest, incremental improvements in knowledge of an issue can be very useful. This tends to be especially valid in the environmental area, where the major problem is not necessarily a complete lack of information, but unawareness of its existence and whereabouts, its fragmentation and disposal a reflection of the fact that 'environment' is not generally recognised as a technical sector in its own right. Over time, as new issues crop up, the information system will increase its coverage and scope, through both 'passive' and 'active' collection efforts, provided that a framework is in place. In the beginning, the framework can be no more than a set of folders or 'message boxes' in which to 'pigeonhole' information under different headings. At an advanced stage, the

framework can be a sophisticated computerised GIS. The important point is that the system receives regular maintenance and updating.

- An EMIS accepts the best information available. "*Better is the enemy of good*". It is tempting when defining 'systems' to be too ambitious, and attempt to be complete and all-encompassing. This, of course, can never be achieved, and is more often than not counter-productive, in that time and effort are diverted from content to form. The law of diminishing returns should be kept in mind; beyond a certain point additional information does not really contribute much to deciding one way or another on concrete actions and policies. Very often projects can be delayed or halted because essential information is missing, and time and resources do not allow in-depth research. In this case you may have to rely on estimated figures, common sense or community knowledge. The more the data is partial, missing, inconsistent etc, the more judgmental expertise is required to convert it into meaningful and reliable information. This is especially likely to be the case for environmental issues (indeed, it is one of the reasons for introducing an EPM process). 'Non-scientific' information may be used as long as the source is stated. There is usually a minimum 'critical mass' of information needed to support well-founded conclusions. The challenge is to find the right balance. Of course the aim will be to replace this kind of information in a later stage of the EMIS with more scientific data. But for the moment, what counts is that some information is better than none.
- One has to avoid falling into the '*data trap*', i.e. getting bogged down in a large, general purpose, open-ended and unfocused data collection exercise, almost invariably unsuccessful and therefore largely irrelevant. The purpose is not to substitute for general purpose or even sectoral statistical services or research institutions. Nor is 'information' synonymous with 'data'; only with analysis, interpretation and synthesis does data turn into information. An example to illustrate the difference: a list of sample results, for example values of 'BOD5' from testing of water quality, is data which is incomprehensible to the non-specialist but which, when interpreted, may state, for example, that the values exceed the legal health standards and render the water severely unfit for human consumption due to excessive organic contamination.
- An EMIS makes a clear distinction between *factual information and policy information*. Factual thematic maps show quantifiable or 'countable' data, for example geology maps, soil maps, population density maps, etc. Policy maps show information about certain policy decisions such as national acts, laws and by-laws, global environmental standards or rules and conditions developed by stakeholders during the working group process. Policy maps can be classified as Suitability and Sensitivity Maps. Suitability and Sensitivity Maps interpret information from factual maps and rank areas as 'more and less suitable', 'good' and 'bad', etc. according to specific rules and conditions. For example, a map on water pollution compares the chemical composition (facts) of the water and relates it to standards, rules and conditions (policies). If a certain chemical exceeds a certain level then we call it polluting. Policy maps are based on an intensive participatory process. They are subjective as they show policy aims and represent different opinions which have been negotiated during the working group process. These maps will be always disputed and discussed.
- An EMIS sticks to a consistent *mapping rationale*, so that the maps are easy to interpret. Many similar maps will be produced, showing, for example the suitability of

areas for different development activities. It will be much easier for the user if all maps show the same pattern for very suitable land.

- Information in the EMIS has to be accessible for everyone in the public, private and popular sectors. This is an important principle, because an information system is derived from many users. The more people using the system, the more information entering into the system. This principle addresses the typical '*data bank syndrome*'. The information system should not be viewed as static hoard of 'valuable' information, deposited by its owners to be carefully guarded from 'unauthorised' access, like in the vaults of a bank. Rather it should be seen as a continual flow, like a newspaper, where information is incessantly and actively sought out, quickly analysed and summarised, and rapidly distributed widely and without restriction. Information is like news, a perishable food that loses value over time. The usefulness and influence of a newspaper comes from immediately disseminating new information, not retaining it. An effective information outreach strategy is absolutely necessary for the success of the EMIS.

EMIS STEP BY STEP – AN OVERVIEW

Step 1: Setting up the EMIS

Setting up an EMIS unit takes quite some resources, and must be supported by an adequate number of personnel at least a GIS officer and one GIS assistant. An EMIS system can be built without computer equipment, but it is much easier to use a computer-based Geographic Information System (GIS) to handle the amount of data the system will contain. The standard EMIS set-up requires a high-end desk-top computer, an A0 inkjet printer and input devices such as a digitising board and a scanner. For fieldwork, a Global Positioning System (GPS) receiver will be essential. The office which contains the central EMIS set-up and the filing system (map filing cabinet) should be free of dust, cool and spacious enough to handle large printouts. A light table is essential for group discussions around particular maps printed on transparent material.

Step 2: Mapping Group

To link the EMIS with the stakeholders and users of the system, it is very useful to establish a Mapping Group. The major task of such a group is to backstop the EMIS unit and to make sure minimum mapping standards are kept. This group has to solve problems and decide many things during the EMIS-building exercise. In Step 1 they advise on purchasing equipment. For Step 3 they can provide information about existing maps and for Step 4 they can decide on the content and lay-out of the Basic Map. The Mapping Group facilitates the link between the Issue-Specific Working Groups and the EMIS unit, and it is this group which discusses the needs of Thematic Maps, the mapping rationale for Suitability and Sensitivity Map, and the overlay procedures. Finally, the Mapping Group provides training during Step 9.

Step 3: The Inventory

The EMIS inventory stage covers finding existing data and maps, setting up a filing system for hardcopies, developing a filing system for the digital data, and establishing a database

of all relevant maps and data. It is frequently surprising how many maps already exist, often even in digital format. It is not necessary to reinvent the wheel; it is better to get hold of these maps. It is important to file hardcopies properly in a map filing cabinet. This makes the maps easy to find, and keeps them in good condition. It is even more important to create a logical filing system for the digital data. Otherwise it will be soon difficult to find the most recent maps and to know what kind of information is stored in a file named "lnsds.apr". A well-designed database stores information on the location, date, status, scale, etc. on the maps.

Step 4: Basic Map

A Basic Map includes the main features of the city such as major rivers, main roads and basic landforms. These basic features should be used in each map created later on to give some guidance and orientation on the location. The layers of the Basic Map function as master layers, so rivers, roads or boundaries will never ever be digitised again unless they undergo physical change. When printing the first Basic Maps, it is essential to decide on a standard layout which can be used for all the EMIS maps.

Step 5: Thematic Maps

In the EMIS, Thematic Maps show strictly factual information. Thematic Maps, show, for example, height of water table level in metres underneath the ground, soil eroded each year in centimetres, population density per hectare for each administrative sub-unit, and so on. The input for these Thematic Maps will come from existing maps, scientific reports or existing data, which can be found in different city departments, research institutions or which is generated by the Issue-Specific Working Groups. The information in the Thematic Maps will be displayed as symbols (e.g. location of ground water wells), unique codes (e.g. administrative areas), class ranges (e.g. population density) or charts (e.g. content of chemical substances in water).

Step 6: Suitability and Sensitivity Maps

The Suitability and Sensitivity Maps are usually the main outputs of the Issue-Specific Working Groups as regards mapping. The creation of a Suitability and Sensitivity Map includes the interpretation of factual data found in Thematic Maps and the evaluation of these findings. This focuses on drawing conclusions about conditions in specific areas and defining and applying 'rules and conditions' according to these conditions. The Issue-Specific Working Groups will assign ranks to these 'rules and conditions' according to the environmental impact on development or the impact of development on the environment. A Sensitivity Map shows areas which are highly, moderately, less or not sensitive to an environmental issue, whereas a Suitability Map shows areas highly, moderately or less suitable for a development activity. The most crucial point at this point is to link the areas of the maps to the rules and conditions established by the working groups. Storing the 'rule and condition' information in a database and linking the maps to it makes this possible.

Step 7: Overlaying of fact and policy maps

For some outputs of the EMIS it is necessary to combine information from several maps. The interaction between environment and development issues, meaning the identification of crucial 'hotspots', will be simulated by overlaying a variety of maps. Meaningful combinations of overlays will generate the necessary outputs which are crucial for urban environmental management. Typical outputs include strategy maps, landuse maps, zoning maps, and spatial management frameworks such as the Environmental Management Framework (EMF). These outputs help to answer routine questions in urban environmental planning and management.

Step 8: Information Outreach

Like the Environmental Planning and Management (EPM) process, the EMIS uses a participatory approach. Therefore public information activities are an important part of the system. This brings new information into the system, and can be very effectively supported by the EMIS itself. Methods to promote the system and the SCP process include exhibitions, the world-wide-web, printed publications, and interactive map publication on CD-ROM.

Step 9: Maintaining the System

An EMIS is a learning system. Thus, even though the design of the system is completed, the data content will grow and change continuously over time. In order to maintain the system it is vital to anchor the system in the most appropriate department or institution, ensure public involvement and acquire a regular budget on a long-term basis. The anchoring department has to commit itself to continuously up-date the system (undertaking the costs involved) and must provide a continuous training programme for the EMIS users and operators.

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