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Paper 13

SOFT SYSTEMS METHODOLOGY ANALYSIS FOR SCOPING IN ENVIRONMENTAL IMPACT STATEMENT IN ISRAEL

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Preface

The current working paper will focus on Soft System Methodology (SSM) analysis of the process of issuing guidelines for Environmental Impact Statements (EIS) to developers in the Israeli context. The paper's goal is to make the reader familiar with the terminology and the concepts of SSM, while serving as a case study for practising SSM.

The paper starts with a "crash" introduction to SSM, followed by a general description of the process in the centre of the discussion - the Israeli EIS process. After these two introductory sections, the paper turns to the main issue - a SSM analysis of the problem situation - the creation of guidelines for EIS in the Israeli context.

This specific case study have been selected due to the author's familiarity with it (is served as the main research field for his MA thesis). Also the author has the shorthand transcripts from a series workshops that were held as part of an evaluation study that the environmental planning department in the ministry of environment (EPD-MoE) have commissioned on the Israeli EIS system.

Unless stated otherwise, the sources for SSM are "Information Systems Development: Methodologies, Techniques and Tools" (Avison and Fitzgerald, 1995), "Practical Soft Systems Analysis" (Patching, 1990), on-line lecture notes for the UCL "System Analysis and Design" course (Sasse and Fultun, 1997) and "Soft Systems Methodology: An Alternative Approach to Knowledge Elicitation in Complex and Poorly Defined Systems" (Finegan, 1994).

Soft System Methodology (SSM) - crash introduction

SSM was developed by Peter Checkland during the 70s in the systems department at Lancaster University, as a problem solving methodology for ill-defined problem situations in human activity systems "systems where human being are undertaking activities that achieve some purpose" (Patching, 1990). Unlike other system analysis methods, which guide the user through a structured process from problem definition to solution implementation, SSM is a set of guidelines that help the analysts in performing the analysis, while allowing a considerable scope of personal interpretation.

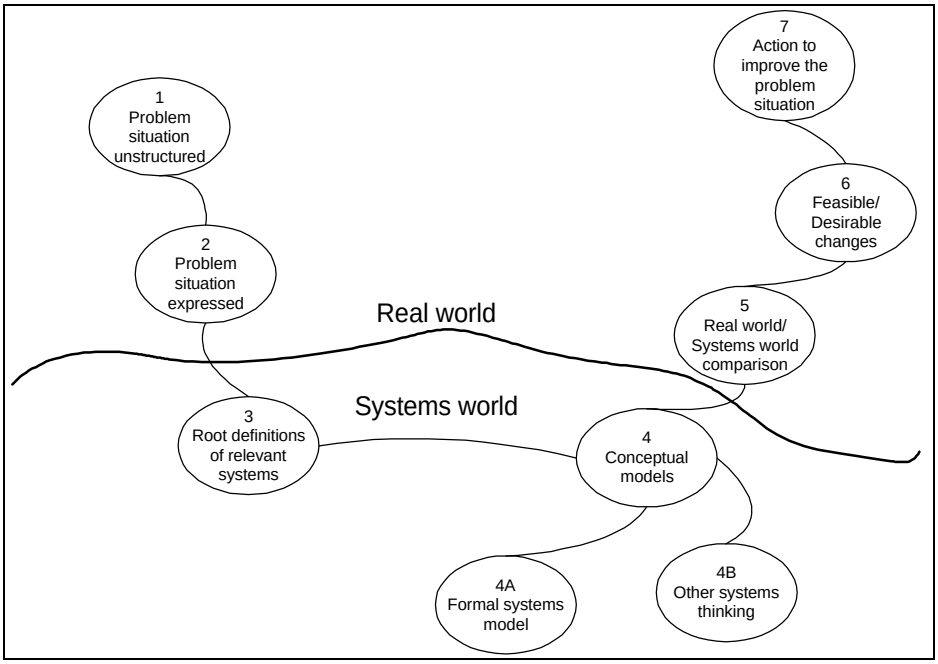

Figure 1 - the SSM model

The main feature of SSM is a 7 stage analysis process - depicted in a diagram (Fig. 1). The stages are:

1. In the first stage the analyst is learning and understanding the problem situation. The reason for the initiation of the analysis is usually a *general feeling of uneasiness* from the person/body who asked for the analysis (the *problem owner*). The term *problem situation* is used to describe the specific problem and its environment, as the analyst should approach the investigation with an "open mind" and should not limit himself to a limited context. In this stage the analyst reads background material, performs interviews and other activities that are needed in the learning process.

2. The next stage is to express the problem situation. The output of this stage is the *rich picture*. A rich picture is a schematic tool that helps the analyst in describing the problem situation. They are also a communication tool which the problem owner and other stakeholders when discussing the problem situation can use. The discussion aim is to ensure that the analyst understand the problem.

3. In stages 3 and 4 the analyst detracts himself from the system and analyses it. The first output is the creation of *root definitions*. Root definitions describe what the system is and what it aims to achieve - as each stakeholder sees it. By subscribing the root definition, the different views about the problem and the expected solution are expressed clearly

4. The root definitions form the base for the *conceptual models* - a model that describes how the activity that the root definition describes can be achieved practically - input, output,

transformation (the processes that transform input to output), control element and relations between these elements.

5. In stage 5, the conceptual model is compared with the rich picture and discussed with the problem owner. Again, the problem owner should participate and approve the conceptual models that the analyst created.

6. Stages 6 and 7 focus on the implementation of the necessary changes. In stage 6 the analyst and the problem owner deliberate and discuss what changes are feasible and practical. Some changes might be impractical due to political, structural, financial, ethical or other reasons.

7. After clearing out the necessary (and feasible) changes, these changes can be implemented and added to the system.

During the SSM life-cycle it is possible to repeat and reiterate stages as necesary. If, for example, several changes are rendered impractical, the analyst can go back and search the rich picture for different solutions, and repeat stages 3-5.

In the SSM model, there is a line separating the “real world” from the “systems world”. The “real world” is the world where the problem is occurring and the human activity takes place. The “systems world” is the analyses context in which the information from the real world is scrutinised and dissected in the problem solving process.

The major aspects of SSM can be summarised as follows:

- SSM is mainly a problem solving methodology in a systems context approach. It tries to analyse human activities as systems and subscribe a solution that will address the whole situation and not just the specific problem. As such, SSM can be described as an holistic and systemic approach.

- SSM is a participatory approach, which tries to involve the problem owners - stakeholders, decision makers etc. - in the analysis and in finding the solution. The reason for this is that SSM evolved from “action research” - a research in which the researcher immerses himself in the analysed organisation and work, with close contact with the problem owners.

- SSM offers guidelines and a set of tools that the analyst can use. However, the analyst can and should align the methodology with the specific context that he is working on. SSM encourages the analysts to iterate and repeat stages as much as necessary.

- In the original model that is described here, there is a clear distinction between the real world and the systems world. However, this separation has been disputed lately as artificial and implying a “false dualism“ which does not exist in reality (Checkland and Tsouvalis, 1997).

- SSM enables the analysts to incorporate “soft knowledge” and to expose political and cultural conflicts. Moreover, because SSM puts this conflict up front, it enables a better understanding of the problem situation and the solution constructions.

Later on, as we move into the case study, certain parts of SSM tools will be explained and demonstrated in more detail. The sections that focus on the general description of SSM will be identified visually. It is recommended that a reader who is not familiar with SSM read them through.

Case study context - Environmental Impact Assessment, Scoping and their Israeli implementation

Environmental Impact Assessment (EIA) is an environmental planning tool, designed to ensure that environmental factors are taken into account in the decision making process (Clark and Herington, 1989). It was first introduced as a legal requirement in section 102 of the US National Policy Act (NEPA) in 1970, and since then EIA requirements have become commonplace. Today, more then 55 countries have established formal EIA systems, and some reports claim that over 100 countries have instituted some EIA measures (Canter, 1996). EIA have thus become major world-wide environmental planning tools. The role and applications of EIA in the decision making process have expanded from the analysis of single projects to countrywide plans (Gilpin, 1995).

As a decision making tool, EIA is heavily influenced by the nature and structure of the local and national planning process. In spite of differences in the planning systems, it is possible to generalise and divide the process into 5 stages:

1. *Screening* - The step where the authorised body decides whether or not an EIA is needed. In most cases, the decision is based either on lists in the EIA regulation, based on project type, or on the sensitivity of the project environment (Brachya and Marinov, 1995). Other widely used criteria state that EIA should be prepared for every project with "significant" impact on the environment. Of course, when using such criteria, the main issue is the decision whether the proposed project will or will not have significant impact (Gilpin, 1995).

2. *Scoping* - Determining the scope of environmental issues to be scrutinised in the EIA, defining the scope for each issue.

3. *Impact Assessment* - Assessment of each topic selected in the scoping stage. This step takes up most of the EIA time and resources. For each topic, the current status is delineated, and the predicted impacts are forecast by means of models. In cases where adverse impacts are identified, mitigation measures are proposed.

4. *EIS preparation* - At the end of the impact evaluation, a document (Environmental Impact Statement) is prepared. This document is passed on to the competent authority. Usually, after the authority makes its decision on the proposed project, the public can inspect the EIS and in many countries can resort to the courts. Hence, the EIS is a legal document.

5. *Post Project Analysis (PPA)* - In some countries, the environmental authorities continue to follow the proposed project in order to check that the project initiator is following the orders of the competent authority and also to improve the EIA system as an ongoing process.

It is not surprising, that the first country that enacted EIA regulation was also the first to require scoping. Many of the first EISs prepared, were encyclopaedic, multi-volume documents that hide the adverse impacts of the project behind a "wall of words", while at the same time, other EISs were laconic and not very informative (Black, 1981). As a result, the US Presidential Council on Environmental Quality (CEQ), published in 1978 new regulations in which a new stage was formed (and termed "scoping")(CEQ, 1978). The purpose of this stage was to focus the EIS on the most important issues for decision making. After the CEQ guidelines, the idea of impact scoping spread quickly, and the scoping stage become an integral part of the EIA process (UN/ECE, 1987). Moreover, it was increasingly recognised that the effectiveness and quality of the entire EIA process depends primarily on the scoping stage (Kennedy and Ross, 1992).

Since scoping is carried out at the beginning of the EIA process (while the EIA itself is carried out at the beginning of project design and planning), and since impact evaluation cannot begin before completion of the scoping stage, scoping is usually carried out under strict time and resource constraints. As a result, scoping must fulfil two contradictory requirements: on the one hand, good scoping must be comprehensive and complete, while on the other hand, it must be performed within a short time and with limited resources. This contradiction determines the range and choice of scoping techniques.

In the Israeli case, EISs were introduced in the mid-Seventies and formally incorporated into the Israeli Planning and Building Law in July 1982 (Rotenberg, 1986). Since then EISs have become part of the routine of land use planning within Israel (Brachya, 1993, Enosh Inc., 1993).

To implement the EIS requirements the Ministry of Environment (MoE) has devised an eight-stage procedure (Ministry of Environment, 1992). After the decision that an EIS is required, the relevant planning commission asks the ‘environmental consultant’ designated by the regulations to provide

it with guidelines for the EIS. Although the regulations state that the "environmental consultant" is the director general of the MoE, in practice the EPD-MoE is the unit responsible for the preparations of all EIS guidelines. The guidelines state the structure of the EIS and the environmental issues that it should evaluate. The environmental planning department consults with other professional departments within the MoE, with Non Governmental Organisations (NGOs) and other local and regional authorities in order to determine which aspects and issues should be incorporated in the EIS. The complete guidelines are sent to the planning commission, and following its approval, forwarded to the developer. Usually, the environmental planning department uses previous guidelines for a similar project and adapts them to the specific circumstances of the project under review. Figure 2 summarises the scoping process in Israel, culminating in the issuance of guidelines for an EIS.

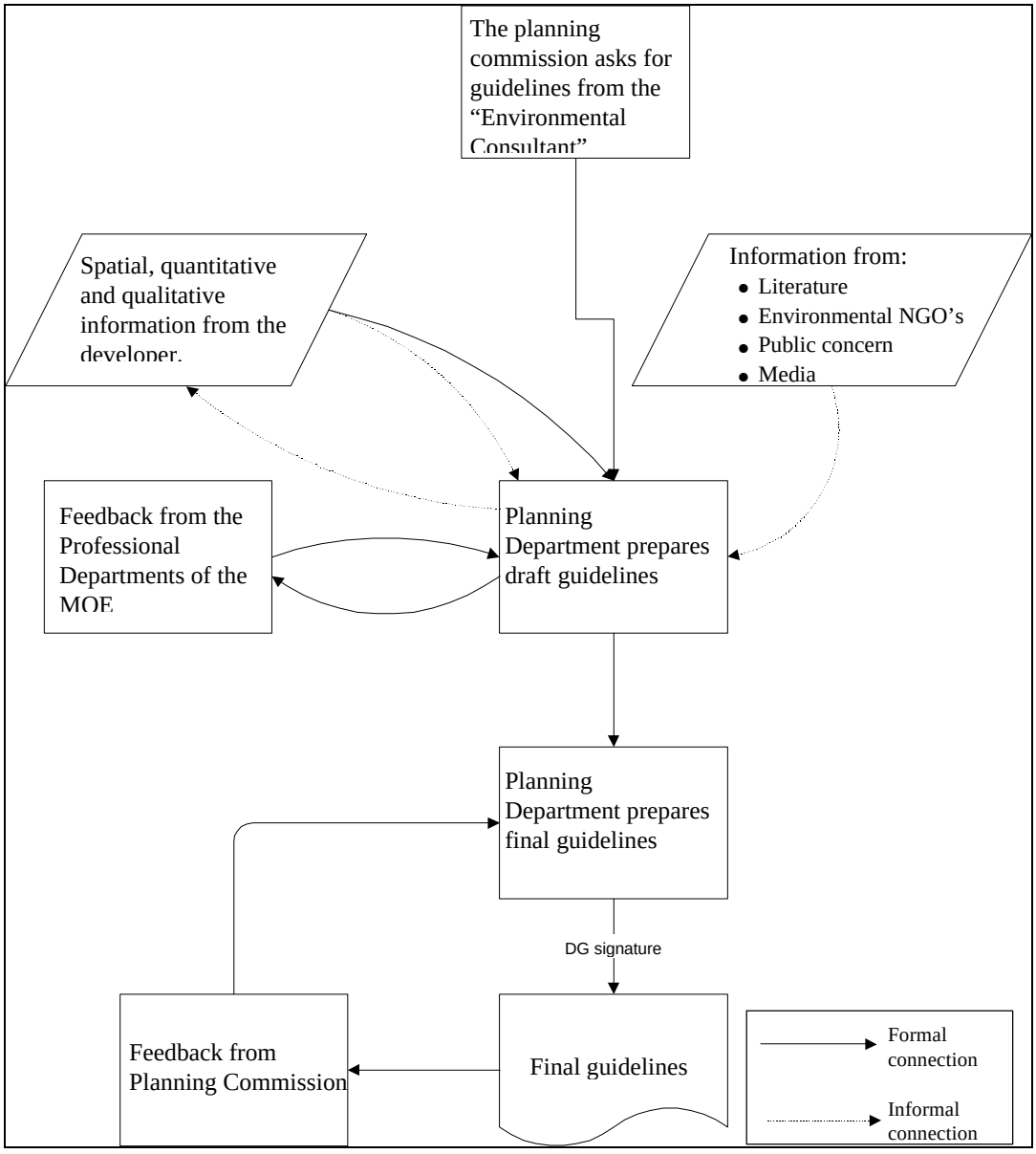

Figure 2 - the Israeli scoping system (source: MoE, 1992)

In the 15 years that passed since EIS became mandatory, more than 300 guidelines have been issued by the EPD-MoE. In recent years, about 50 EIS guidelines per year have been issued. The types of projects for which EIS guidelines have been issued includes a wide range of issues.

This introduction treats EIA as a structured method, with legal implications and almost as a hard-system. There is a process to decide whether or not EIS is needed, a process to pick up the issues, environmental science methods to evaluate the possible impact and a rational decision making process which use the EIS as its main input. In reality, there are many examples for manipulative use of EIA. For example, as mentioned before, laconic or encyclopaedic EIS was used by developers to rebuff environmentalists claims about adverse impacts of a proposed activity, or by environmentalists trying to stick a spanner in the works of developers when they initiate a problematic project (Black, 1981, Mowrey and Redmond, 1993, for a description of such use). Furthermore, a second look in Figure 2 will show that in the Israeli case, there are "informal connections" which don't have any legal or structural stance, but nevertheless are well integrated into the system.

To summarise, the process of EIA is a human activity, aimed to incorporate the environmental factors into the decision making process. Inside this larger system, the scoping is a sub system.

Stage 1: Problem situation unstructured - sources for the case study

The description of the EIA system, the role of scoping and the specific properties of the Israeli system should be considered as a part of stage 1. The main source for mapping out the stakeholders and players is the report "Environmental Impact Statements: Improvements and Criticism" (Enosh Inc., 1993). This report was ordered by the problem owner - the EPD-MoE. The analysis and description of the case study in Feitelson (1996) "Some Spatial Aspects of Environmental Impact Statements in Israel" was used to augment the findings of the main study.

Stage 2: Problem situation expressed - the rich picture

*In stage 2, the first tool that characterises SSM is introduced: the **rich picture**. The rich picture is a diagrammatic representation of the problem situation. It represents what the human system is "about", and can be considered as a mental map (Avison and Fitzgerald, 1995) (though not in the way that this term is used in Cartography). The rich picture should be self-explanatory and easy to grasp.*

*The rich picture contains **structures** - factors that are slow to change, **parts of the processes** that are carried out within the system, and the **connections** between these factors (the climate). The issues that individuals and groups have expressed about the situation are depicted - usually as "cartoon balloons". There is no strict guidelines about the way to draw rich pictures, but some of the more common elements include:*

- ***Crossed sword** - indicators of areas of conflict.*
- ***Eyeballs** - indicators of external scrutiny*
- *Cartoon-like **balloons** to indicate issues.*
- *Clipart images of people.*

Also common is the use of a key to make the picture itself clearer and to avoid clutter of text strings.

Figure 3 presents the rich picture for the case study. In general, the picture depicts the main stakeholders that are involved, or take part in the process and the relations between them. The picture conceals the fact that the Israeli planning system is a three tier system, with National, Regional and Local planning committees. As the local aspects effecting the regional committee (of course, less intensely then the local committee) the two levels have been merged. The National Planning and Building Board is a different entity and was depicted as such.

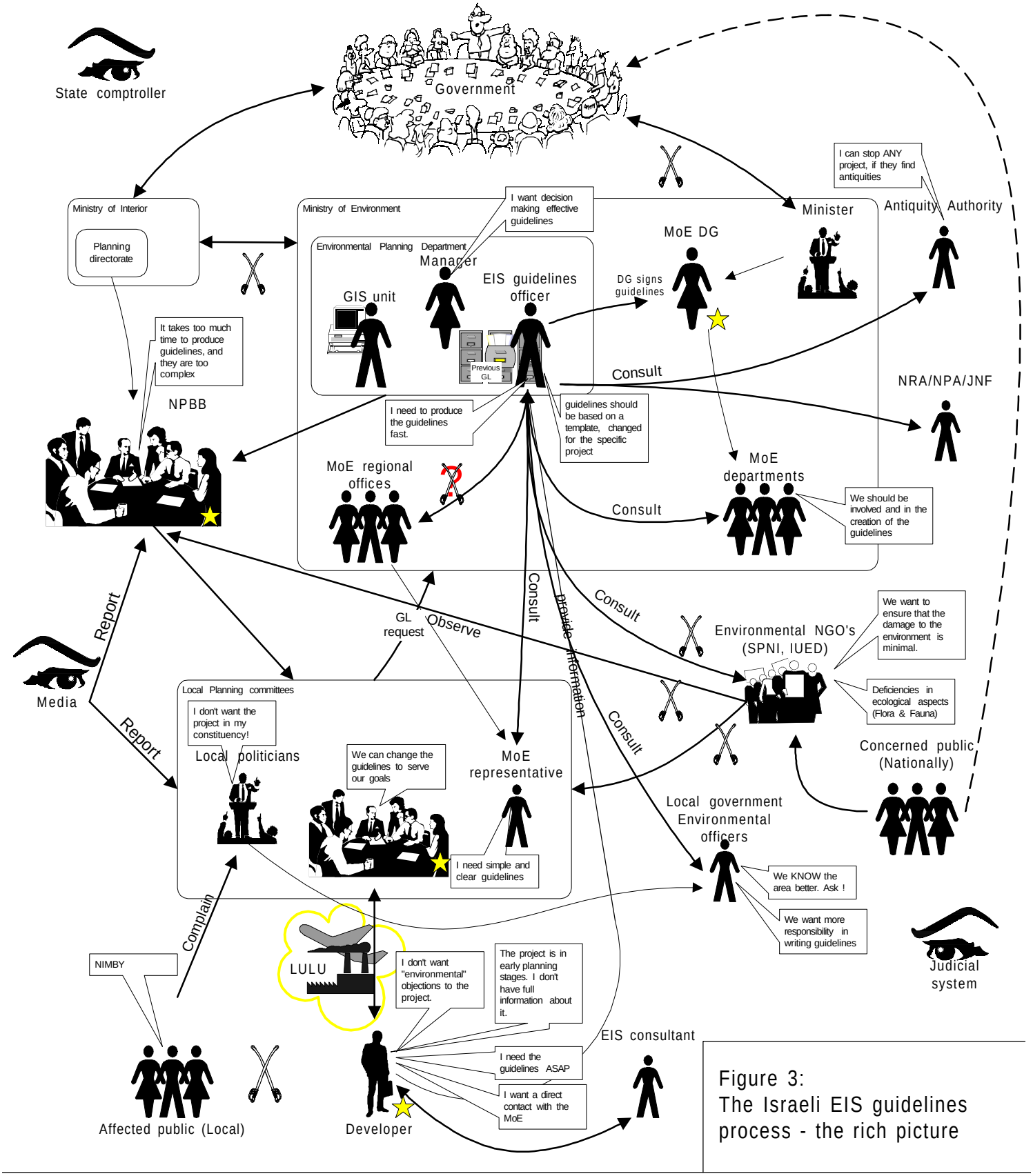

Figure 3:
The Israeli EIS guidelines process - the rich picture

NPBB	National Planning and Building Board	LULU	Localy Unwanted Land Use
Previous GL	Previous Guidelines (archive)	→	
NRA	Natural Reserve Authority	⇒	Control
NPA	National Parks Authority	★	EIS guidelines relation
JNF	Jewish National Fund (forestry bureau)		
NGO	Non Governmental Organization		Statutory role
SPNI	Society for the Protection of Nature in Israel		
IUED	Israel Union for Environmental Defence (Adam Teva V'edin)		
NIMBY	Not In My Back Yard		

The three semi-governmental “green” authorities - the Natural Reserve Authority (NRA), the National Parks Authority (NPA) and the Jewish National Fund (JNF) who act in Israel as the forestry bureau - have been merged, as their role in the process is similar. Due to the special legal stance of antiquities in the Israeli planning process (stated simply, the antiquity authority has the right to halt any project if any archaeological site is found during construction) the Antiquity Authority have been separated from the other bodies.

Inside the MoE, the different departments (e.g. air pollution, coastal protection) have been merged - to reduce clutter. Regarding the EIS guidelines process, their views are not inherently different. Another element in the MoE are the regional offices. In every district, there is a regional planner. The planner has a working relationship with the EPD and with the regional office, therefore, there is a possible conflict between the headquarters and the regional office. It should also be noted, that the MoE representative in the local planning committee is part of the regional office and in many cases it is the regional planner - not a different entity.

As the main planning body , the planning directorate in the Ministry of Interior is drawn “not to scale” in terms of overall importance in the planning process, but according to its role in the EIS guidelines process.

It should be noted that the NPBB does not have a statutory stance (regarding EIS) in plans that were submitted to local or regional committees.

The status of the environmental NGOs in the Israeli planning system is “interesting”, as they don’t have a role in the legislation, but do have observers in the regional and national committees. Furthermore, it is noteworthy that in most cases the NGOs are similar to the American “Sierra club” rather then “Greenpeace”. The extremist organisation, don’t have any role in the process, and usually they are not consalted (though the EPD-MoE have some dialogue with them).

Stage 3: Constructing root definitions

In stage 3 we cross the line to the systems thinking world. The main output of this stage is the ***root definitions (RD)****. As stated above, root definitions describe the system that will be modelled in stage 4. Each root definition uses a certain perspective of the system.*
The RD should include the next elements (usually referred in the mnemonic ***CATWOE****):*

1. ***Client*** *- customers or victims of the system who benefit or are affected from the output of the system.*
2. ***Actors*** *- those who carry activities within the system.*
3. ***Transformation*** *- changes that happen within or because of the system.*
4. ***World view (Weltanshaung)*** *- assumptions made about the system or how the system is perceived from a specific viewpoint.*
5. ***Owner*** *- those who have control over the system.*
6. ***Environment*** *- the environment in within which the system operate and which influence the system, but the system has no control over.*

CATWOE can be viewed as answers to the questions: Whom? (Clients) Who? (Actors) What? (Transformation) Why (assumptions) ? (World view) Where? Or what influences the system? (Environment). The CATWOE elements are used as a checklist for the construction of the RD, to ensure that it answering those questions.
In practice, the order of analysis starts with T and W, then the E and finally O, A and C - in some order.
Noteworthy is the difference between ***primary task*** *RD and* ***issue based*** *RD. Primary task RD are detached and less contentious ("objective") while issue based RD represent specific viewpoints ("subjective").*

For the EIS guidelines case study, I will focus on subscribing primary task root definition and issue based root definitions for the next stakeholders:

- EIS guidelines officer in the EPD-MoE
- Regional planner in the MoE
- Local planning committee member (assuming local interests as the main motive)
- Developer

The selection of stakeholders is according to their role in the system. The first two have an active role in subscribing the guidelines and the others have a legal role

1. Primary task RD

The EIS is a legal document, therefore, the requirements for the guidelines derive from the EIS regulations, which can serve as the base for the primary task RD. However, the first step to formulate the RD is to identify the CATWOE elements:

C	Developer
A	Planning committee, Environmental consultant (MoE DG)
T	To receive proposed plan and prepare guidelines for EIS that will include 5 main chapters.
W	To evaluate the impact of the proposed plan on the environment and to subscribe means to reduce adverse impacts.
O	The government, the Knesset (Parliament)
E	The Israeli planning system, the Israeli judicial system.

According to this elements, the RD is:

"A system, owned by the parliament and government, operated by the developers, planning committees and the environmental consultant, that receives a proposed plan and prepares guidelines for EIS in the context of the Israeli planning system, constrained by the orders of the judicial system".

As the rich picture depicts, this RD describes only the legislative aspects of the EIS guidelines, but as a legal process, these are the aspects that must be considered in the system. To give the broader picture, and to relate the RDs (and the subsequent conceptual models) to the real process, a set of issue based RD will be formalised.

2. EIS guidelines officer RD

The EIS guidelines officer in the EPD-MoE is the person who runs the process on a day-to-day basis. His work includes writing guidelines, reading completed EISs and responding on them. His viewpoint includes both the formal and the informal parts of the process.

C	Planning committees, the developer, local public, general public.
A	MoE DG, colleagues in the professional department of the MoE, regional planners in the regional districts of the MoE, developers and EIS consultants, NGOs, green bodies (NRA/NPA/JNF/AA), local government environmental divisions.
T	To receive proposed plan from the planning committee and prepare guidelines for EIS.
W	To produce complete guidelines (i.e. that will identify all the significant impacts and will be useful for the decision making process), in a short time.
O	The government, the Knesset (Parliament), EPD manager
E	The EPD-MoE, working relations with consulting bodies, pressure from planning committees, public attention from the media, the Israeli planning system, the Israeli judicial system.

The RD is, therefore:

"A system, owned by the parliament and government, operated by the EIS guidelines officer that receives a proposed plan, consult with MoE department and regional offices, green bodies, environmental NGOs and local authority environmental division and prepare (as soon as possible) complete guidelines for EIS that will enable an informed decision making process in the context of the Israeli planning system, constrained by the scrutiny of the media, the political pressure from planning committees and by the orders of the judicial system".

3. Regional planner

The regional planner has a day-to-day working relationship with the planning committee. He will also offer a world view of someone who has influence on the process without having a statutory role.

C	Planning committees, the developer, local public.
A	EIS guidelines officer at the EPD-MoE, regional planner, planning committee
T	Follow a proposed plan as it goes to the MoE headquarters, advise the environmental aspects that should be included in the guidelines and follow the approval process in the committee.
W	Present the MoE position in the planning committee and ensure that the EIS will be relevant for the decision making process.
O	The government, the Knesset (Parliament), the planning committee
E	The EPD-MoE, pressure from planning committees, pressure from developers, public attention from the media, the Israeli planning system, the Israeli judicial system.

The RD:

"A system, owned by the parliament and government, operated by the EIS guidelines officer and the planning committee that receives a proposed plan, ask the MoE for EIS guidelines, consult with the regional offices and prepare (as soon as possible) complete guidelines for EIS that will enable an informed decision making process, approve them and pass them to the developer, in the context of the Israeli planning system, constrained by the scrutiny of the media, the political pressure from planning committees and developers and by the orders of the judicial system"

4. Local planning committee member

Assuming that the local planning committee member represents the local interest, it is possible to subscribe a contentious RD. This RD could suit a local politician. A very similar RD can be subscribed for environmental unfriendly project that the local politician wants. In such cases the type of conflict between the planning committee and the MoE will swing from a situation where the MoE is the minimalist, to one where the MoE tries to constrain the development, while the planning committee try to minimise the demands. For the sake of the discussion I will focus only on one option.

C	Local public, developer, general public.
A	Planning committee, EIS guidelines officer in the MoE
T	Receive a proposed plan for LULU, pass it to the MoE, receive the guidelines, change them in a way that will render the project as harming the environment and pass them to the developer.
W	The EIS guidelines is a tool to stop LULUs.
O	Planning committee*
E	Political pressure from constituents and developers (entrepreneurs), public attention from the media, the Israeli planning system, the Israeli judicial system.

* In some cases, the committee can decide that EIS is needed.

The RD:

"A system, owned by the planning committee, operated by the EIS guidelines officer and the planning committee that receives a proposed plan, ask the MoE for EIS guidelines, receive the prepared guidelines for EIS that will render the project unfeasible, change the guidelines in the committee, approve them and pass them to the developer, in the context of the local politics and the Israeli planning system, constrained by the scrutiny of the media, the political pressure from constituents, developers and by the orders of the judicial system"

5. Developer

The developer, naturally, wants to finish the statutory process with minimal costs and in a short time. He is also interested in working on his project and wants to reduce as many nuisances as possible. There might be conceptual differences between an environmental conscious developer and a developer that is not interested in the environmental implications of his activities. Nevertheless, on the operational level there aren't many differences, especially as the developer has no control over the process.

C	Developer, Planning committee
A	Planning committee, EIS guidelines officer in the MoE, EIS consultant
T	Submit a proposed plan to the planning committee and receive - as soon as possible - simple and clear guidelines.
W	EIS is an another hurdle in the planning process. It should be done with minimal costs and in the shortest time.
O	Planning committee*
E	Reaction of NIMBY from the local public, public attention from the media, the Israeli planning system, the Israeli judicial system.

* In some cases, the committee can decide that EIS is needed.

The RD:

"A system, owned by the planning committee, operated by the EIS guidelines officer and the planning committee that receives a proposed plan, ask the MoE for EIS guidelines, receive the prepared guidelines for EIS, approve them and pass them to the developer, in the context of the local politics and the Israeli planning system, constrained by the scrutiny of the media, the political pressure from NIMBY public and by the orders of the judicial system"

Stage 4: Conceptual models

After subscribing root definitions, stage 4 focuses on modelling the activities within the system. As Fig. 1 shows, the conceptual model happens in the "system thinking" world, and is an analytical part of understanding the problem situation. Even in this stage, no solution is prescribed (that will happen later - in stage 6).

The root definitions can be described as "the root from which the model grew" (Patching, 1990) and as such form the base for the creation of the model (and the connection between stage 3 and 4).

*The **conceptual models** should show the minimum necessary activities that must exist for the described transformations. Therefore, the model is built from the activities (based on the verbs in the RD) and the relations between them. The models should be simple, and include 5-10 activities. Where needed, the analyst should continue and analyse each activity, in what is known as **decomposing**.*

It is noteworthy that the models depict the activities without explaining how the activities are accomplished, as the models should focus on the what.

*During the creation of the model, the analyst should compare the model with the **formal systems model** (stage 4a). Stated simply, this is an evaluation of the question "is this a model of a system?".*

The formal systems model can be described as:

"Systems have the following characteristics:

- *an ongoing purpose*
- *an expectation of continuity*
- *a measure(s) of performance*
- *control process*
- *components which are systems*
- *components that interact*
- *resources for its own use*
- *the whole system is part of a wider system*
- *it is possible to draw a boundary which enclose the area under control"*

At least two of these elements can originate from the RD - the ongoing purpose (the transformation) and the relation between the system and the wider system (the environment).

In the case study, and for the sake of this SSM introduction, a conceptual model will be presented for each root definition. The conceptual models are represented in the same order as the root definitions, and as the regional planner doesn't have a major role in the process, his CM will be excluded.

1. Primary task conceptual model.

The first CM follows the regulations exactly. It is noteworthy that the regulations do not give any lower level description of the processes. Hence, only this level will be explored.

For the sake of the exercise, I will describe the comparison between this model and the formal systems model implicitly:

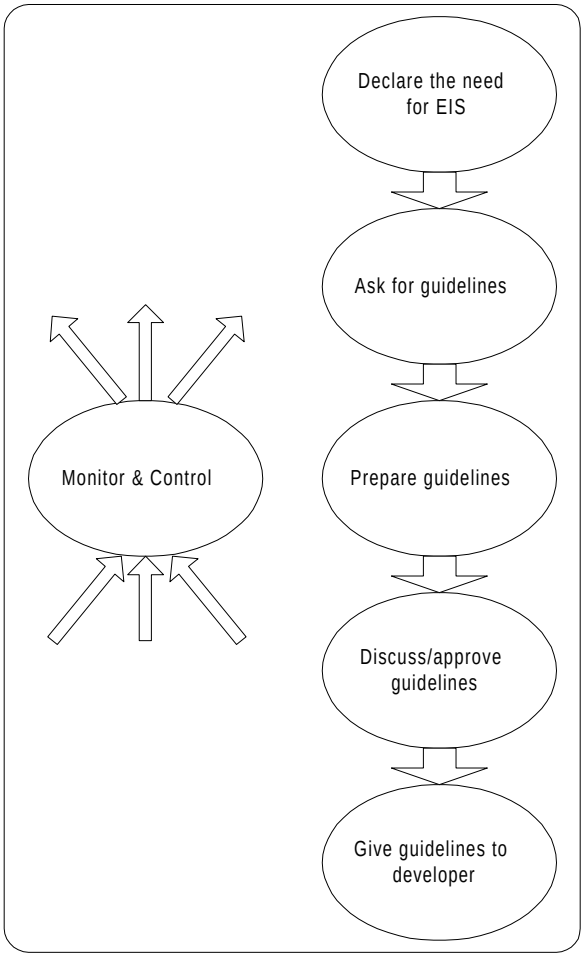

Figure 4 - CM for primary task RD

1. *the ongoing purpose* of this system is to produce guidelines for EIS.
2. this activity is *expected to continue* as long as EIS is part of the statutory elements of the Israeli planning process.
3. The number of guidelines issued each year, and the time that passes between the decision that EIS is needed and the submission of the guidelines to the developer could be used as *a measure of performance*.
4. The EIS guidelines process is *controlled* by the government and scrutinised by state and ministry level comptrollers.
5. The planning committee, the EPD-MoE are systems in their own right.
6. The CM presents the *interaction* between the system component that the RD described.
7. The EIS guidelines officer is dedicated to the operation of the system, and can be regarded as a *resource*.
8. The EIS guidelines system is *part* of the Israeli planning *system*.
9. The *boundary of control* includes the EPD-MoE and the planning committee (the two rounded boxes in Figure 3).

In the next CMs step 4a will not be explained explicitly - as it is inherently the same.

2. The EIS guidelines officer CM.

The EIS guidelines officer is working within the legalistic framework of the Israeli EIS. As such, he must follow the regulations (See Figure 2). At the same time, the day-to-day operation of the system is based on many informal contacts and processes (informal in the sense that they are not an integral part of the regulations). Figure 5 should be seen as an expansion (level 2) of the second blob in the primary task CM - “prepare guidelines”.

The reader should refer to figure 2, as this figure was taken from an EPD-MoE document and it represents the ways in which the EPD is involved in the process (and their world view).

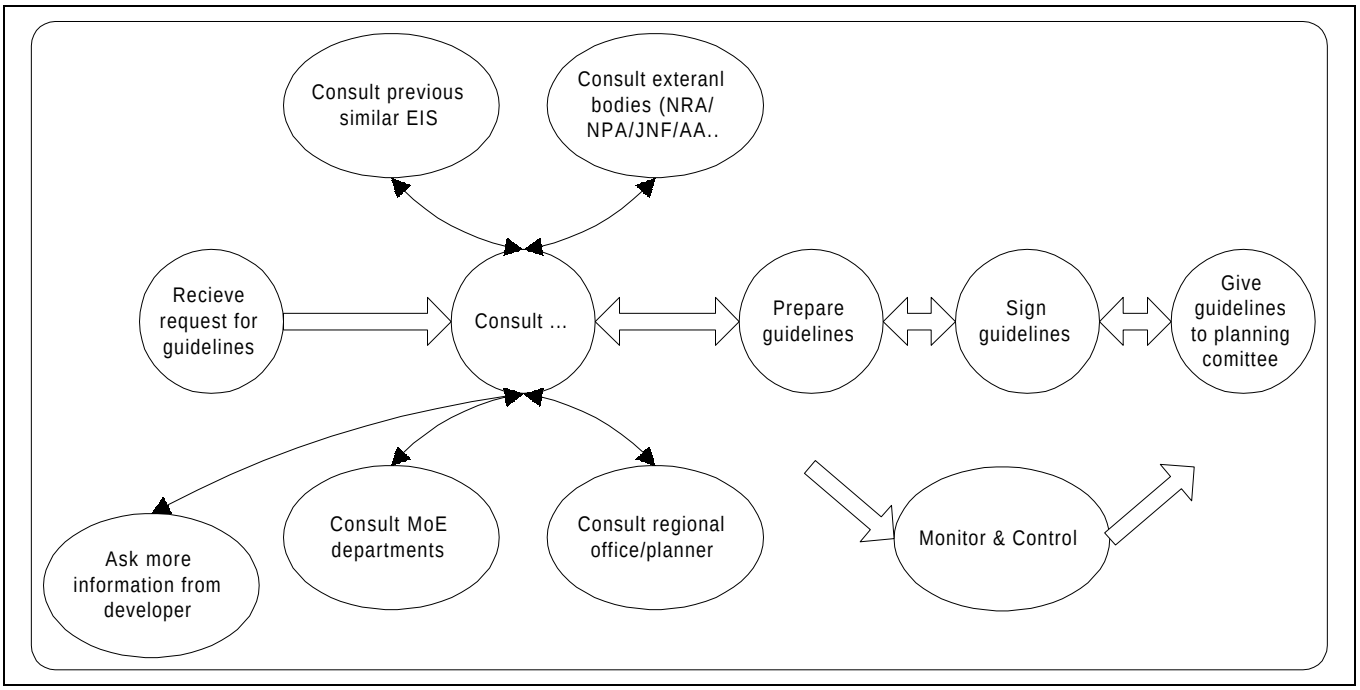

Figure 5 - EIS guidelines officer CM

3. Local planning committee member CM

As a reminder, it is assumed that the committee member is against the project, that the project is LULU and that he sees the guidelines as a tool to stop the project. His CM starts and ends in the external boundaries of the primary task CM.

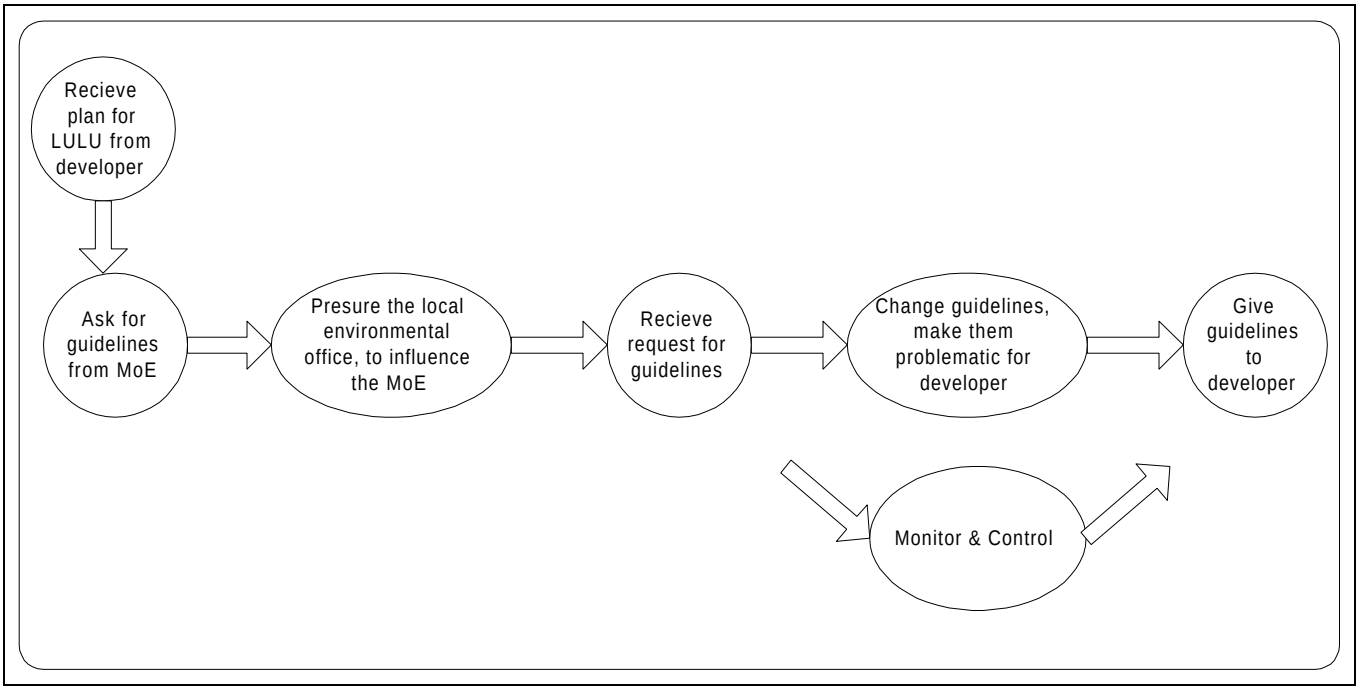

Figure 6 - Local Planning Committee member CM

4. Developer

The final CM in the case study represents the point of view of the developer. As noted before, the developer doesn't have much control over the process and does not have an active role in the subscription of guidelines. Nevertheless, he should try to influence and pressure the other actors to produce guidelines that will be best for him.

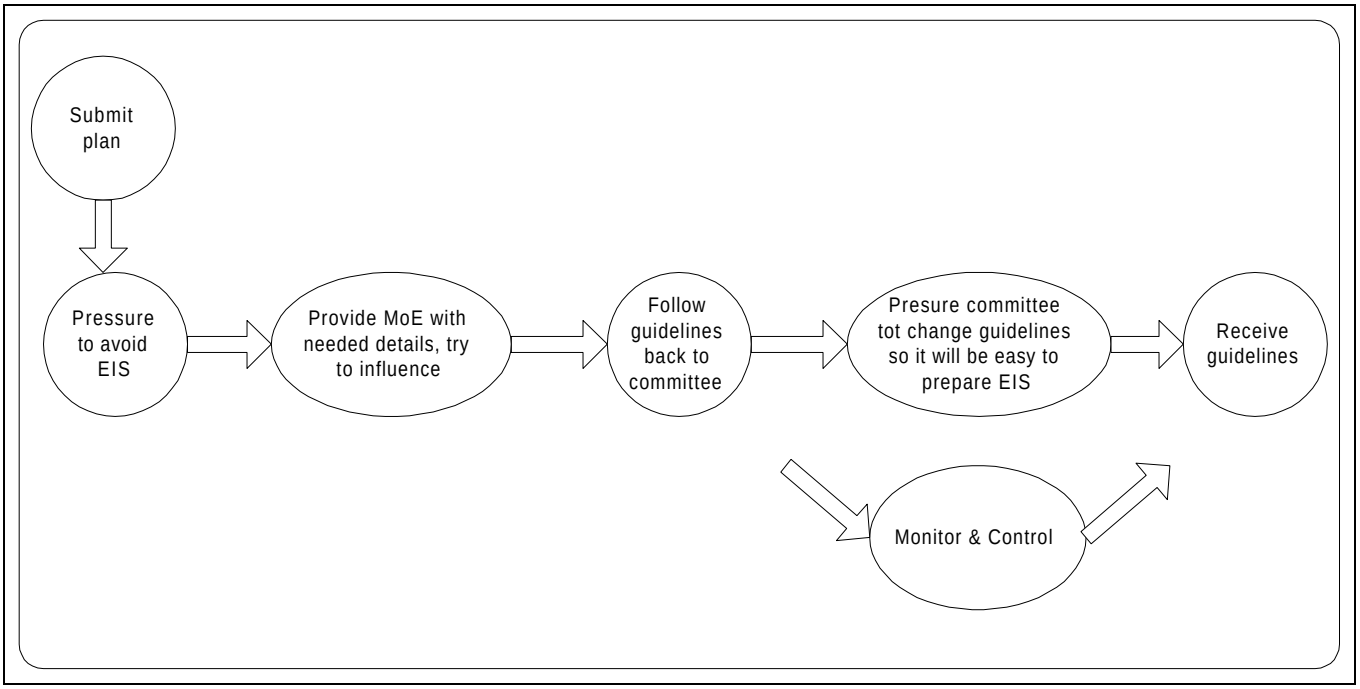

Figure 7 - Developer CM

Stage 5: Comparing the conceptual models to the rich picture and reality.

After completing the "system thinking" tasks of SSM, the analyst should "float back" to the real world and compare the conceptual model(s) and the root definition(s) with the real world situation. The comparison is aimed to validate the model and give answer to the question "does the activities that the model/RD depict really exist?". It can be viewed as cross-checking the model to ensure that no activity that takes place in reality was missed and is not represented in the model, or that the model depicts an activity that simply doesn't exist. As noted before, this stage is still part of the problem situation learning.

The analyst is expected to discuss and deliberate the models and the RD with the problem owner (who usually commissions the whole analysis exercise). In case of deficiencies and disagreement about the output from the system thinking stages, the analyst should repeat stage 3 and 4, alter them and return to the problem owner again, until a consensus is reached (or until the analyst is sure that he understands the situation properly).

The comparison is made by comparing the CMs to the Rich Picture and other information that the analyst has gathered about the problem situation. Figure 8 is taken from Patching (1990) and represents stage 5:

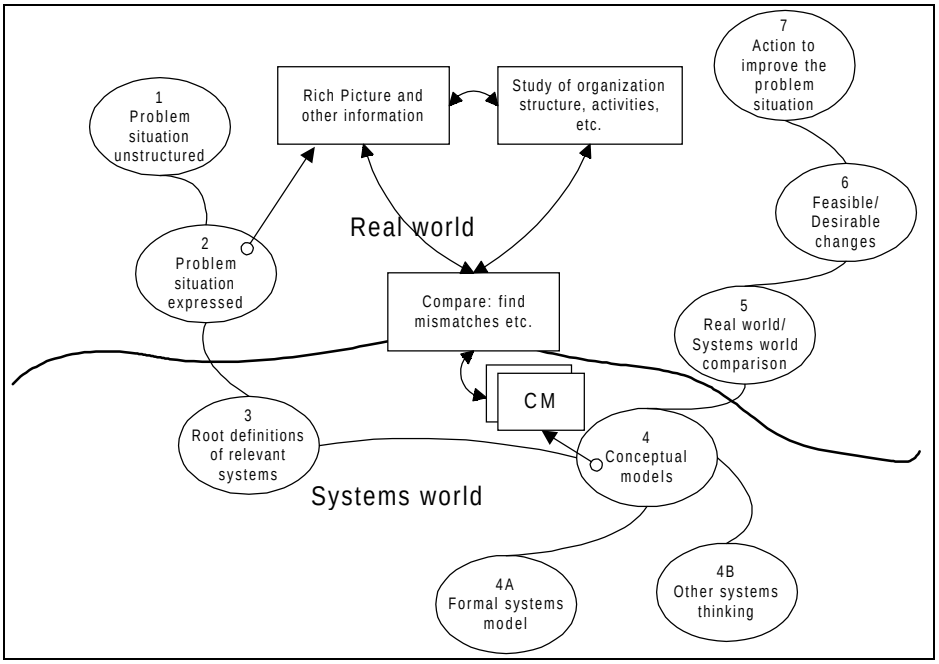

Figure 8 - stage 5 of SSM (after Patching,1990)

Practically, the comparison can be done through structured or semi-structured interviews, discussions or with the aid of tools like model-overly in which a model of the current situation is drawn and then compared with the CM.

It is not surprising to learn that the conceptual model seems to compare well with the rich picture and the documentation about the process, as this information was known before the analysis.

There are several observations that rise from the comparison of the conceptual models to reality and between the CMs themselves.

Different scope of control

One of the most striking observation that rise from the different CMs is the different scope of control, and how much the different actors in the process don't have full control over it. As a matter of fact, there is simply no-owner to the EIS guidelines process.

To some extent, this deficiency was deliberately introduced to the system. The rational behind this, is that the EIS should check the environmental impact impartially, that the EIS should be part of the decision making process and should be tightly coupled with this process. Finally, the developer has best knowledge about the project and by forcing the responsibility for the EIS upon him there is a greater chance that he will include the implications of the EIS into the project. Figure 9 represents the primary task conceptual model, this time with a callout that shows the body who has an active role in the process.

In the Israeli system there are basically two origins for a request for EIS. The first one is when EIS is mandatory - for example when the project belongs to one of the categories included in the regulations, or when the project is part of a master plan that the NPBB have decided that EIS is required (for example a project in the coastal area)[1]. The regulations also gave the planning committees and the ministerial representatives in them a special power to demand EIS, where they find this appropriate. This forms a second origin for EIS - an optional one (Ministry of Environment, 1992).

[1] In Israel, the national master plan have a statutory stance equivalent to lows.

The implications of these types of EIS, is that in some cases the planning committee is band from discussing the plan without an EIS and therefore do not have any control over the project - only over the content of the guidelines. In the second type, the planning committee have far more control over the process as their judgement (and the persuasive talents of the developer) can play a major role.

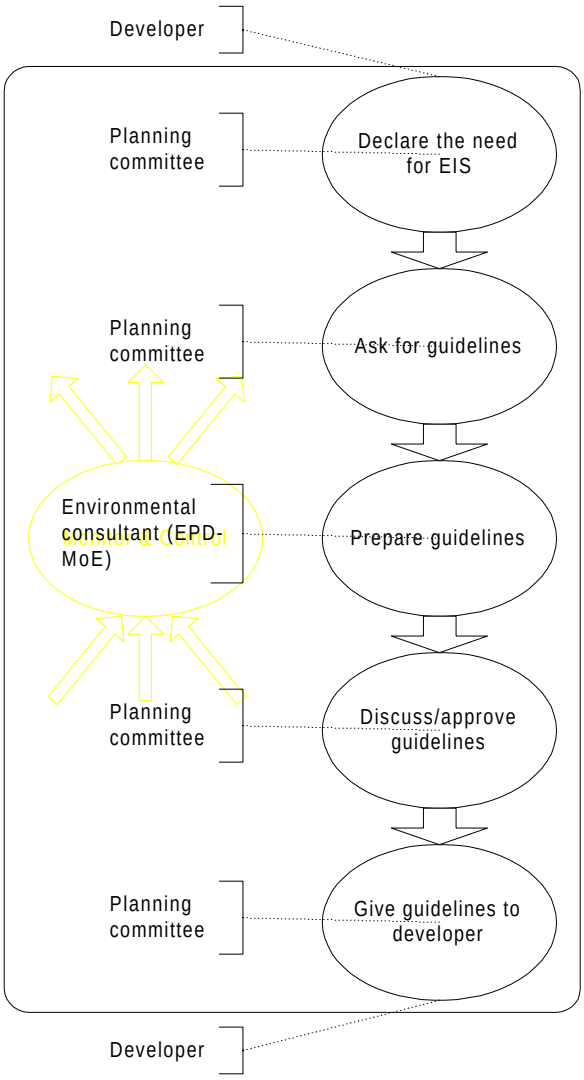

Figure 9 - Primary task CM (responsibility)

The issue of control is even more complicated as the real power over the system lie in the hand of the parliament and the government, and from time to time, they try to exempt a single project or a class of project from the EIS system. This power, and the decisions of planning committees is challenged through the judicial system. However, the Israeli courts tend to scrutinise the procedural aspects of the decisions about the EIS without intervening in the content of it (or the content of the guidelines).

To summarise this section, the control and authority over the process, and over different stages in it, is shifting from the developer to the committee, from the committee to the EPD-MoE and back, and then back to the developer. A very similar process happens later on, when the developer submits the complete EIS.

Informal connections and blurred communication channels

Focusing on the EIS guidelines officer role, it's clear that his work is not done in a vacuum, where he analyses the project and writes the guidelines. In the regulations, there is a paragraph that prescribes the **structure** of the EIS but the content of the "guidelines" is not explained or expressed explicitly. By exploring the rich picture, Figure 2 and the EIS guidelines officer CM, it's clear that

he is playing a pivotal role in the process, with a need for information and contacts from many other stakeholders.

Yet, his work and relations are more informal then formal. Moreover, even though the regulation deliberately detached the developer from the "environmental consultant", in reality they must have some sort of contact - by providing more information about the characteristics of the project and so forth.

Time constraints

As the rich picture portrays, the issue of "time" plays an important role in the whole process. There are records from all the stakeholders that they want to produce/receive the guidelines in the minimum possible time period. This is not particularly a special feature of the Israeli system, and as mentioned above, it's a major issue in any EIA system.

Finally, the reader should note that a full comparison between the real world situation and the CM/RD in the current case study was not possible, as its still an "Ivory tower" case study.

Stage 6: Feasible / desirable / needed changes

The sixth stage of SSM is the first stage where a problem is clearly expressed and the effort turns to finding a proper solution. By this stage, the analyst is expected to have a very good knowledge about the system, "what makes it ticks", what are the main issues in it and what are the particular opinions about it - both in the structural level (according to the role/position of the actors) and the personal level.

In this stage the analyst should describe the main problems that he found in the system, and try to prescribe solutions. The solutions should be discussed with the problem owner to find which are feasible and/or desirable.

According to Checkland, there are three types of possible changes. The types are:

1. ***Structural*** *- changes to the static or factors that don't tend to change in the short term.*
2. ***Procedural*** *- changes to the activities that relate to achieving the goals of the organisation and communication activities.*
3. ***Attitudes*** *- changes in influence and expectations of individuals.*

The analyst is expected to use the proper methods and techniques in accordance to the problems that he has found. For example, if the preferred solution is by introducing a new computerised system, then an information systems analysis should be performed for the specific system and the appropriate tools should be used: Data Flow Diagrams (DFDs), Entity Relation Diagrams (ERDs) or Computer Aided Software Engineering (CASE). In this stage SSM gives the analyst complete freedom in the selection and implementation of the problem solving method.

During the years that have passed since the introduction of EIS into the Israeli planning system, many ideas on how to improve and changes the EIS system have been provided by practitioners, academics and the aforementioned EIS review report. The next list represents the main suggestions regarding the scoping stage (the issuing of EIS guidelines):

- The EPD should prepare standard guidelines for more common project types. By using these guidelines, the time and effort of the guidelines subscription process will be reduced.
- There is a need to revise the regulation and the statutory context of the EIS. This need stem not just from the scoping stage, but also from other aspects of the EIS system (such as the types of projects that must have EIS).
- There is a need to improve public participation throughout the EIS process. This is also a general issue in the Israeli planning process, where public participation happens only at the end of the process (Schifman, 1985)
- Some voices have called for a greater involvement of the judicial system in the process, and expect the court to address issues of content and not just procedural issues (in the case of the guidelines - what is the content of the guidelines and not just approving/rejecting the guidelines subscription process).
- A better use of data repositories and the GIS system that is already installed and in use by the EPD.
- Making the connection between the EIS consultant and the EPD explicit and statutory.
- Making the consulting stage of the guidelines preparation more formal.
- Defining some deadlines for the preparations and submissions of the guidelines.

By comparing these recommendations to the main observations from the SSM analyses, it is possible to suggest some changes to the system.

The most apparent change is a structural change. Currently, there is a mismatch between the scope of statutory control of the EPD *de-jure* and it's role *de-facto*. It looks like the EPD is the *de-facto* owner of the EIS system: the official guide for the EIS system, the review report and other documents point in this direction. Furthermore, in the government decision on the creation of the environment protection service (from which the MoE was created) in the beginning of the 70s, the development of the EIS system was explicitly defined as one of the goals of the new body, therefore, the role of the MoE and the EPD should be recognised in the regulations. This could be done by recognising the EPD as the main authority in environmental planning in the Israeli system. Such change can be initiated by the MoE, but must go through the legislative process though the government and the Knesset.

Several procedural changes can be advised, firstly, adopting the recommendation for formal consultant process in the creation of the guidelines. By making the process formal and obligatory,

the stakeholders will have to respond in a short time span and will have to consider their response to the project carefully. Secondly, the communication channel between the EPD, the developer and its EIS consultant should receive formal recognition. It is possible to trust the professional judgement of the EPD and to believe that they would not be easily influenced by the developer during the guidelines preparation process. There is simply no need for false "Chinese walls" that don't exist in reality. Finally, it is recommended to use a computerised system to streamline the guidelines preparation process, to help evaluate the local properties of the plan and to exploit the facilities that are already installed in the EPD (this will be discussed later on).

The attitude changes are the most contentious. The meaning of those changes is that the power of the planning directorate is now split with another body, and that this split will go on throughout the system. This is a major change in positioning of the different bodies and probably will be the main source of obstacle for a change.

Stage 7: Changing the system

The final stage of SSM is the implementation of the needed and agreed changes.

As the case study is hypothetical and based on secondary sources for analysis, it will be quite daring to offer any implementation of the above mentioned ideas. The conclusions and recommendations should be considered as tentative and relevant only in the context of the current paper on the basis of the information that was presented in it. Furthermore, a proper analyses should not stop with the scoping stage - the whole EIS system should be evaluated to produce coherent conclusions, that are feasible and politically acceptable.

Is SSM suitable for analysis of environmental decision making processes?

As the case study quite vividly demonstrated, SSM focuses more on learning the problem situation, understanding the richness of the activities in reality and contextualising the specific problem in a global (or holistic) context.

In SSM, the problem solution stages (6 and 7) are open-ended and the analyst is expected to adopt and use the appropriate problem solving methodology.

As Patching (Patching, 1990) *notes, stages 1,2,6 and 7, are common in any problem-solving methodology (even though the rich picture tool is unique). It's mainly the root-definitions and the conceptual models, coupled with "system thinking" that makes SSM special.*

SSM was created and used mainly for analysing organisations. In such a set-up, it is usually clear who the client is (problem owner), the boundary of control and also it is possible to subscribe a primary task root definition easily. In practice, SSM have been proven successful in cases where the client have "a vague feeling of uneasiness that things are not as they could or should be". In such cases the analyst is expected to understand what are the needs of the organisation before he moves to the question of how to accomplish these needs.
SSM have been integrated into system analysis methods, as a first stage with the intention to gain a better understanding of the problem situation before subscribing a solution.

These general characteristics of SSM pose the question "Is SSM suitable for analysing environmental decision making (EDM) processes?".

The case study that was discussed in this paper, is structured, to some extent, by the regulations and the statutory stance of the main actors. However, the first response for the rich picture is "how complex this process is", and the whole case study focuses on one part of the EIS life cycle - a vital part but not the most complex or contentious. This complexity - in the number of actors and their positioning vis-à-vis the process - is common in the environmental decision making processes. Furthermore, it appears to exist in different scales of EDM - from local EDM (in cases similar to our case study) to national and international EDM. To make things even more complex, the actors are constantly changing and there is enough evidences that they are "moving targets" throughout the process, as Hajer (1996) have demonstrated in the national case or as Wolsink (1994) demonstrated about the shift from NIMBY (Not in my back yard) to NIABY (not in anyones back yard).

As noted throughout the paper - SSM should be treated as a set of guidelines for analysis and not a closed, structured method (hence the use of the world methodology). Even though the paper moved structurally through SSM stages, in SSM literature it is stressed that iteration is an inherent part of its applications. Therefore, it is possible to follow the conceptual changes that the stakeholders are moving through and to "calibrate" the problem situation during the course of the analysis or the problem solving process.

Another advantage of SSM is the ability to present and consider contentious viewpoints and incorporate them into the analysis. This is particularly important in EDM, as a way to present different world-views and at least present "unheard" voices. As an example, in the "sustainable development" discussions, it is argued that one of the most important voices is that of the "next generation". In SSM it is possible to subscribe RD and CM for this hypothetical point of view.

Finally, the different outputs of SSM can be used as a communication tool between the different stakeholders: the rich picture can be represent as a common ground for the problem situation and the RD and CM can help in conveying the different perspectives among stakeholders.

Is SSM suitable for developing PPGIS for EDM?

Reaching the conclusion that SSM is adequate for the EDM area, the next question that rises is its suitability for development of Public Participation GIS for EDM. PPGIS have been in the centre of several research projects in recent years. A possible critique on the existing and on-going research, is that most exhibit a top-down model, in which the GIS expert declares the problem, analyses it in a technical manner and provides a technical solution that answers the problem in the way that he/she understands the situation. A clear example of this approach can be found in Carver (Carver and Openshaw, 1995). SSM offers a different approach for the whole issue. As noted before, the analysis will start by identifying the problem situation, understanding the various world-views, and then understand and realise what the role of information technology and what are the expectation from the GIS.

A major question that rises in this stage, is what problem solving method should be used in stages 6 and 7. Multiview, an information system analysis method that uses SSM as its first stage might be adequate for PPGIS, but that aspect will need to be researched separately.

Finale: Why the EPD GIS unit appears in the rich picture?

During previous research, a GIS-based scoping technique has been developed for the Israeli context. The SSM analysis of the Israeli scoping, enable the review of this technique assessment of the main pitfalls that might appear during implementation of this technique.

The proposed technique

The GIS based scoping technique proposed for Israel is described in Figure 3. It is based on two databases: a thematic database, which stores the links between environmental issues and elements and potential impact of the proposed project; and a spatial database, which contains the spatial data sets. The sources for those data sets can be physical data (such as topographical data in the form of Digital Elevation Model - DEM), coverage data (buildings, infrastructures etc.), ecological data (sensitive species) and results of environmental studies (such as aquifer sensitivity).

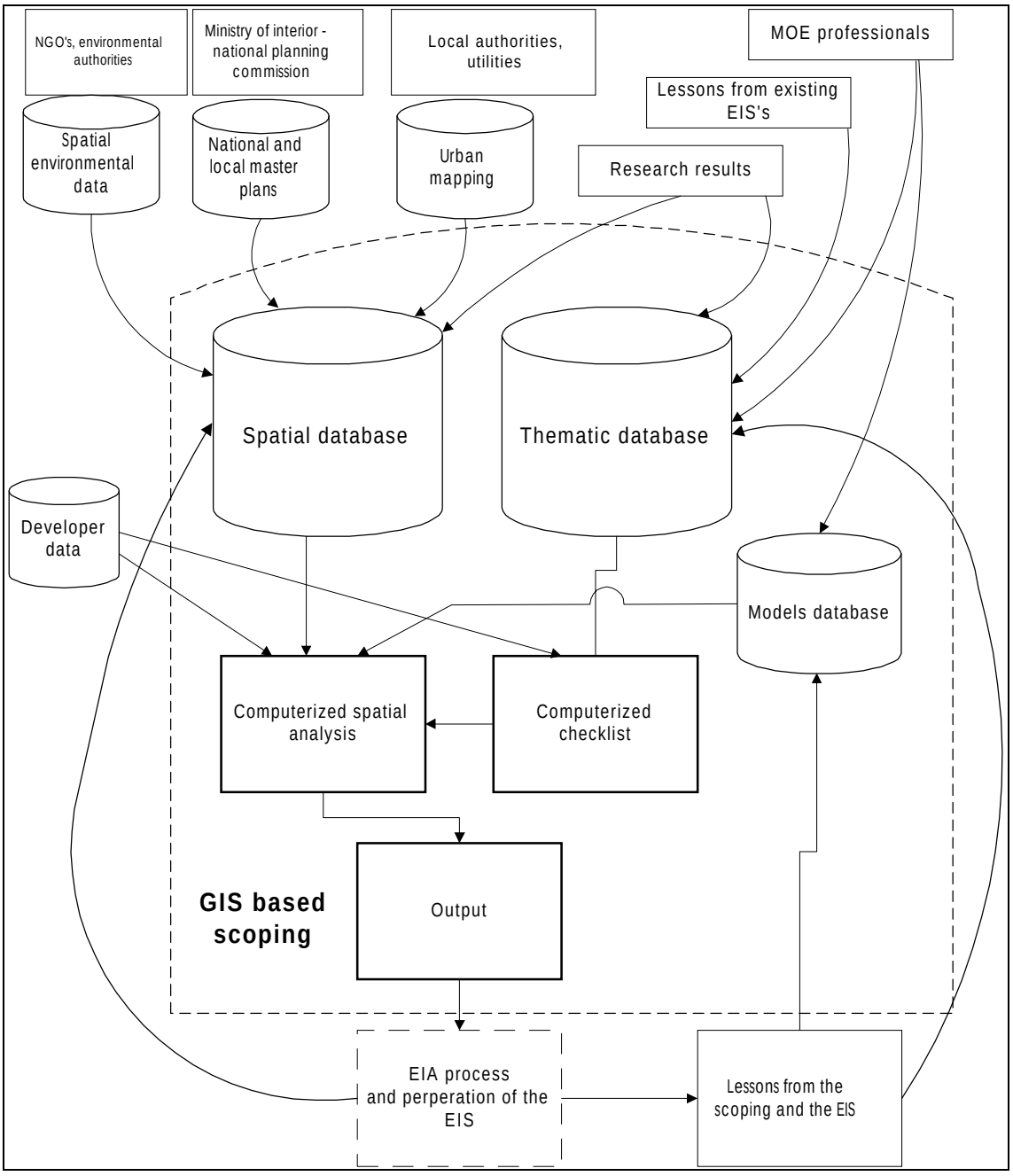

Figure 10 – GIS based Scoping

The mechanism proposed to scope the impacts is based on a computerised check list in which the user selects the type of development and environmental issues that might be affected by the project. The checklists of the proposed technique have a special feature - for every meaningful connection between an environmental element and a possible impact the database will store the particulars of the spatial analysis method required for examining the likelihood of impact. The database will also store the thresholds for possible impacts, where such thresholds are appropriate. Those thresholds will be used at the end of the spatial analysis, for making the decision of whether or not the impact and the environmental issue should be included in the EIA. The scoping process will usually require

that a basic data set be received from the developer. This data set will include the spatial properties of the project - such as the general scheme - and attribute data on the physical properties - such as the type of energy source for a power station. The data set that the developer will supply would thus be minimal and generalised.

The data from the developer would be inserted into the system database. The operator would then use the check list to determine which spatial analysis techniques are suitable for the current type of project. After the computer run, the output is compared against the thresholds for issues that are threshold dependent. Another role of the output is to define the spatial borders for the EIA research.

Comparing the scoping technique with the SSM analysis

The SSM analysis have shown that there are many sources for conflicts in the system. Based on these results, it is quite possible to predict that if such system were to be installed and used in a mechanistic way - i.e. that the EPD will use it as a replacement for the consulting process - it will not receive a “warm welcome” from the other departments and bodies that should provide the data-sets. It might also meet a hostile reaction from the local planning committees, who might question the models that the system use, their objectivity and their accuracy/relevance.

Therefore, the main conclusion is that if the EPD want to implement such a system ,it should not approach the project as internal and private, but it should incorporate the views and opinions of all the stakeholders. Special attention should be given to the internal connections - the professional departments and the regional offices of the MoE as they are probably the most important “environment” for the system. However, the opinions and needs of the planning committees and the developer should be taken into account, as they are the users of the output.

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