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Interactivity in Planning: Frameworking Tools

Morten Boje Blarke

This chapter presents a planning framework which is intended to support interactivity in planning, adding meaning to the term "interactive planning". In particular, the chapter explores the usefulness of developing and applying software tools as a platform for interactivity, while addressing important technical and economic problems.

What do planners do?

In June 2004, under the pretty planned skies of Putrajaya, the administrative capital of Malaysia, the Prime Minister's Economic Planning Unit called for a team of planners to produce a long-term energy plan for Malaysia, the so-called "Malaysia Energy Outlook 2020".

In January 2005, the team's findings were published in the form of an executive policy paper and a number of background reports. The executive policy paper basically discusses what could be priority measures in efforts to promote renewable energy and energy conservation in Malaysia. As such, the paper is an input to the upcoming 5-Year Malaysia Development Plan (2006-2010), which, in Malaysia, is a key policy vector in decision-making.

The policy paper process was another milestone in a programme intended to build capacity in integrated planning research under the Malaysian-Danish programme for environmental cooperation. Activities under the programme began in the late 1990s and are scheduled for completion in 2007.

Without going too much into detail about the particular process, and the successes and failures encountered, it is fair to say that the team of Malaysian, Danish, Dutch, and Australian planning experts covered much ground in efforts to submitting themselves to the particular context.

Early on in the process, in accordance with capacity building principles, much time was spent in dialogue with stakeholders, and the subsequent organization of workgroups and technical workshops took a point of departure in problems already under analysis by stakeholders. For example, one workgroup was established to support the design and construction of a new low-energy office to host the energy administration. Other workgroups were established to support the mapping of local resources, including oil and gas. Again other workgroups were researching particular technical supply options; for example, one group was assessing the problems and opportunities related to large-scale co-firing of coal and biomass at new or existing coal-fired power plants.

For a participating planner, the challenge would be to find ways for dealing with value-based influences in a setting where techno-economic rationality almost completely envelops conflicts. If this is indeed the case, an effective planning framework could be one that submits itself to dealing with ruling techno-economic rationalities, focusing on creating a sober-minded setting for bringing understanding to real conflicts of intent.

While applying the so-called interactive planning framework presented below, it was found that non-proprietary techno-economic planning software was a particularly effective instrument in establishing platforms for interaction between important social interests.

An interactive planning framework

The overall objective of developing an interactive planning framework is to support for democratic goals to rule in planning and decision-making, while promoting interactivity, transparency, and phronesis (Flyvbjerg 2004). Inherently, the framework builds upon the following principles:

- All problems must be taken seriously,
- All goals must be considered respectfully,
- All stakeholders must be acknowledged, and
- All options must be considered on equal terms using standard procedures.

As such, the overall approach builds on principles of various integrated and participatory planning practices, for example Integrated Energy Planning in the early 1980s, which was spearheaded by activists involved in community-oriented energy planning in the third world (Codoni 1986).

Under both integrated and sustainable planning frameworks, the nature of the planning strategy is fundamentally non-technical; focus is on context awareness stressing site-specific knowledge about people, needs, resources, problems, objectives, institutions, and policies. This has unsurprisingly proven to be an effective strategy in planning for a sustainable development, sometimes successfully empowering local communities and governments, supporting lasting changes.

However, the hypothesis is that an intentional focus on the technical and economic rationality resting with stakeholders, combined with the application of non-proprietary software tools that allows for cross-cultural interactive evaluation of options, provides an effective platform for “winners” and “losers” to negotiate better outcomes faster, while avoiding for decisions really to be nothing but reflections of ideological positions and decrees of the powerful.

The framework is intended for planners who strategize to mediate societal interests, while sharing personal experiences, values, and visions.

The big picture

In an interactive planning strategy, appreciation of context is the key to lasting change, and it is useful to distinguish between the external and the internal context.

The external context is the reality into which the planning process is embedded, while the internal context defines the intent of the process.

Using the Malaysian case to exemplify, the external context would be a fast growing Malaysian economy with a growing middle-class oriented towards “modern” needs, the country’s geo-political ambitions, its’ status as an Islamic tiger economy, its’ cultural traditions combining four major ethnic groups, an authoritarian top-down institutional paradigm, an agricultural and industrial infrastructure build on oil and palm-oil, privatization laws in electricity production that favours large-scale producers, as well as more specific influences.

The internal context is the forces that influence the direction of the particular planning process. In the Malaysian case, the internal context was the idea of anchoring analytical planning efforts in the Economic Planning Unit, the agreement between Denmark and Malaysia for Danida to provide technical assistance, the terms of reference and its' appraisal, the client-consultancy schism, the strengths and weaknesses of individual consultants, etc.

From such initial context awareness, the planning team sets out interact with recognized stakeholders and to facilitate interactivity between interests. The process is problem and goal oriented; in fact the planning process is driven by the tension linking problems and goals as they are being expressed by recognized stakeholders. The problem-goal dynamo is the engine that drives the process forward, towards research, evaluations, decisions, and interventions.

The problem-goal dynamo drives the effort to establish an important milestone: a model-oriented description of where we are at and how we got here. We may call this the Reference Situation. For example, this may result in a techno-economic description of the energy system combined with narratives about the origin of it's' elements.

The next step is to consider likely developments, which will result in a model-oriented description of where we are going. We may call this the Reference Scenario. The Reference Scenario helps us better to see the extent of the recognized problems, while enabling us better to understand the dynamics that underlies the problems.

On the basis of the Reference Situation and the Reference Scenario, we will compare and evaluate options. Appreciating that choices have "winners" and "losers", we will put particular emphasis on a transparent breakdown by stakeholder of costs and benefits involved with each option. The notion of costs and benefits should be considered in both monetary and non-monetary terms. The breakdown by stakeholders implies that we will have to evaluate not only socio-economic costs and benefits, but also the costs and benefits for each of the recognized budgets, whether fiscal, community, company, or household.

The identification of consequential winners and losers for each option under evaluation provides information about interests and policies, and becomes an effective basis for fair action, if any.

Figure 1 illustrates this as a circular context-aware process of analysing problems

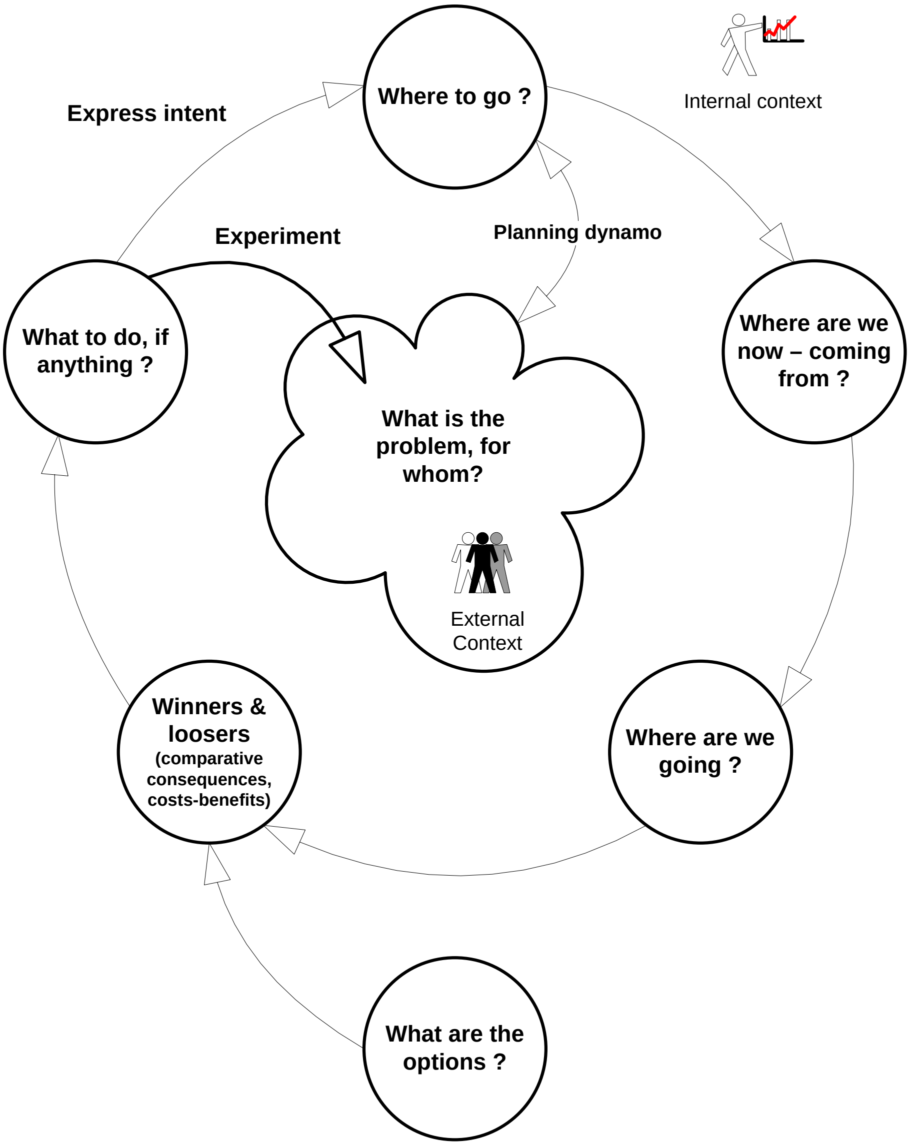

Figure 1: The interactive planning framework.

Through application of various methodologies and tools, the planner will take steps to uncover conflicts of intent, by approaching the technical and economic reality offered by stakeholders.

Step-by-step: methodologies and tools

Table 1 splits the interactive planning process into 7 steps.

Step	Output	Activity
1	External and internal contexts	Explore contexts
2	Problems and goals	Recognize problems and goals
3	Reference situation	Picture current situation
4	Reference scenario	Picture likely development
5	Options	Identify options
6	Winners and losers	Compare consequences
7	Decision and change	Experiment and express policy

Table 1: *Major steps in interactive planning.*

These 7 steps is the basis for suggesting the following partial methodologies and tools.

Step 1. External and internal contexts

Idea – go interactive, get embedded! -

Objective Recognize that the recognition of a problem will stand on an external context (the world) as well as an internal context (your world). Realize that the world consists of nature, people, institutions, culture, technology, and markets, and that any change anywhere will impact this world. Realize that your world consists of location, ethics, skills, terms of reference (if any), even family or partner etc., and that any change anywhere will impact the direction of the process.

Methodology Explore and describe the external and internal context. Go interactive; get embedded for proper anchoring.

Tools Phronetic planning research (Flyvbjerg 2004). Case studies.

Dialogue.

Step 2. Problems and goals

Idea – talk to people first! –

Objective Recognize that societal, economic, and environmental problems are complex and that they origin from fundamental root problems, in particular poverty and population growth. Recognize that the rationality of stakeholders coincides with their interests, and that a democracy deals with conflicting interests. Realize that the tension between problems and goals is a planning process dynamo.

Methodology Identify, describe, and quantify problems and goals vis-à-vis rationalities and interests.

Tools WWW analysis (Hvelplund 1998). Diamond-E analysis (Hvelplund 1998). Action-planning workshops (World Bank 1996). Logical Framework Approach (Danida 1995).

Step 3. Reference situation

Idea – take a snapshot! –

Objective Recognize and frame the current situation with respect to problems and goals, as well as the path followed getting here.

Methodology Take a model-oriented snapshot of significances.

Tools Historical analysis. Statistics and descriptive sector studies. Interviews, document studies, observations. Geographical Information Systems. Techno-economic framework models (for example in energy: LEAP, MARKAL).

Step 4. Reference scenario

Idea – picture a likely future! –

Objective Understand the long-term implication of problems and goal. Expose inconsistencies between goals and the likely future. Realize that projecting, forecasting, and backcasting are different approaches to the future, and to dealing with uncertainty. Seek consensus about the scenario.

Methodology Develop a model-oriented picture of the likely future, call it the Reference Scenario. A typical interpretation is that the Reference Scenario incorporates the effects of what stakeholders agree to expect. The Reference scenario may be based on trends, forecasts, current social and economic policies, business plans, utility demand projections, supply expansion plans, technology learning curves. Consider applying a "Business as Usual" or "Frozen Efficiency" modelling approach, or a combination of these two.

Tools As Step 3, plus Technology Foresight Analysis (Andersen 2001), studies of stakeholder plans and programmes, including the direction of research and development programmes. Seeking consensus about the Reference Scenario requires extensive interaction with and in-between stakeholders, and their vote of confidence in the planning process.

Step 5. Options

Idea – dig deep for options, ask for help! –

Objective Learn that the people, who are experiencing the problems, will lead you to solutions.

Methodology Screen the world for options; new or old, big or small, reform or revolution. Prepare a matrix for comparing option on equal terms.

Tools Real needs analysis. Integrated resource planning. Case studies.

Step 6. Winners and losers

Idea – compare consequences, visualize, and prioritize! –

Objective For each option, identify winners and losers.

Methodology For each option, on equal terms, assess costs and benefits, both monetary and non-monetary, for each and every stakeholder. Consider the fairness. Consider options for compensating losers.

Tools Integrated Resource Planning (Swisher 1997). Life Cycle Analysis. Cost-Benefit Analysis. Strategic Environmental Assessment. Scenario and options evaluation models (for example in energy: LEAP, energyPRO, COMPOSE) that allow for comparative energy, environmental, and economic analyses for projects or programmes in a specific system context. CDM-methodologies (UNFCCC 2005).

Step 7. Decision and change

Idea – project by project, change takes place! –

Objective Recognize that change towards sustainability originates from efforts to put reasoning behind intentions. Recognize that concerting change requires for underlying conflicts to be exposed and managed. Seek power to back your ethics and priorities.

Methodology Preparing and following through on specific projects. Policy formulation. Networking.

Tools Story telling. Demonstration projects. Leadership. Conflict management.

The potential role of frameworking tools

The Malaysian case suggests that the development and application of non-proprietary software tools in the planning process, in this case scenario tools like LEAP and MARKAL, and techno-economic option comparing tools like COMPOSE, potentially may become critical platforms for stakeholder interaction, strongly supporting an interactive planning framework, thus producing the notion of "frameworking tools".

For example, when discussing electricity generation plans with Malaysia's electricity supply authority, their generation planning department would rely much on detailed energy systems analyses made with WASP software, thereby using a particular planning software tool to sustain the argument that new coal-fired power plants would be a feasible strategy for Malaysia's energy sector. As WASP is proprietary tool using confidential and market-sensitive information, it would have been very difficult for most stakeholders to communicate effectively with the electricity supply authority about alternatives.

How to establish an interactive planning process to include this key stakeholder? In the Malaysian case, the introduction of the non-proprietary software tools LEAP, MARKAL, and COMPOSE, turned out to be an effective instrument. Being co-developed by stakeholders, including the electricity supply authority, the software tools became a platform for organising activities relevant under the interactive planning framework.

The software allowed for the technical and economic complexity being experienced by partaking stakeholders to be managed in a cross-professional and cross-institutional setting.

This experience makes it interesting to take a closer look at these software tools, while suggesting some general requirements for planning software to becoming effective frameworking tools in support of an interactive planning process.

System and project tools

In energy planning, and perhaps generally in planning, it is useful to distinguish between tools for system analysis and project analysis (Table 2).

Scope	Description
System	Intends to model the larger system, and for example the relationship between energy, environment and economy, enabling the evaluation of integrated and aggregate scenarios.
Project	Intends to model individual options within a given system.

Table 2: *Main categories of energy planning software tools.*

System tools

LEAP, MARKAL, and ENPEP are classic system tools in energy planning. Their long-lasting success is secured by a growing user base, and the continuous training of researchers, institutions, and governments. Both LEAP and MARKAL was applied in the Malaysian case.

Since 1987, the Long-range Energy Alternatives Planning System (LEAP) has been developed by the Stockholm Environment Institute in Boston, USA. The LEAP model has been applied by "...hundreds of government agencies, NGOs and academic organizations worldwide ... for a variety of tasks including, energy forecasting, greenhouse mitigation analysis, integrated resource planning, production of energy master plans, and energy scenario studies." (LEAP Website 2005). The current online LEAP user forum hosts 1300 members.

LEAP's scenarios are based on the comprehensive accounting of how energy is consumed, converted and produced in a given region or economy under a range of assumptions for population, economy, technology, etc. LEAP's data structure is flexible and allows for an analysis as rich in technological specification and end-use detail as the user may choose.

LEAP stands out as one of the most interesting efforts to build an interactive cross-professional energy planning community for sharing of experiences and visions. The development and success of LEAP give evidence to the hypothesis that tools under an interactive planning framework need to support more than just the ruling paradigm in energy planning – the need to build policies upon a techno-economic or market-economic rationale. To support sustainable development, the tool will need to work well as a playground for interactive communication between stakeholders, and for the organization of technology experiments, learned lessons, and interdisciplinary visions.

MARKAL is being developed under the International Energy Agency programme on Energy Technology Systems Analysis (ETSAP). MARKAL is used for purposes similar to those of LEAP, but applies other principles. While LEAP allows the planner to develop his own techno-economic model, bottom-up, MARKAL uses principles of market-economics and optimization so that it becomes the model that identifies which technologies should be preferred, and the model that provides the ranking as a result. Also MARKAL is widely used; "77 institutions in 37 countries" (MARKAL Website 2005).

ENPEP, which has been developed at Argonne National Laboratories under the auspices of the International Atomic Energy Agency over the past 20 years, uses a combination of techno-economic bottom-up analysis and optimization. According to the developers, ENPEP has been used in training courses reaching an estimated "1200 experts from 87 countries" (ENPEP Website 2005).

The common strength of LEAP, MARKAL and ENPEP is that these models are model building tools rather than rigid models, which allow for partaking planners to develop customized frameworks at various aggregation levels and for various locations.

In 1999, researchers at Aalborg University began developing the EnergyPLAN model to allow for a rather aggregate, but detailed hour-by-hour simulation of an electricity system, enabling the analysis of large-scale penetration for intermittent production technologies, mainly wind power. As of now, the EnergyPLAN model is used in-house and by some partners.

From studying these models, it appears that the energy planning community distinguishes particularly between principles of engineering-economics and macro-economics, thereby also reflecting fundamentally different academic traditions of analysis in-between engineers and economists. Furthermore, it appears that plans for any large-scale penetration of intermittent production technologies, like wind power or photovoltaics, call for advanced system simulations, a requirement which is currently not met by the most widely used energy system models (though the ENPEP modelling environment internalizes the use of WASP that simulates the electricity generation system in great detail).

Table 3 provides a comparative overview of these and other significant system models. Certainly, countless models have been excluded, though many are still available to the research community. But more often than not, these models have disappeared due to insufficient support and a weak user community – or they are only available in-house, sometimes only being developed and used by a single researcher.

Tool	Scope	Methodology	Developer
LEAP	Integrated energy/environment analysis	Accounting	Stockholm Environment Institute – Boston.
MARKAL	Integrated energy/environment analysis	Optimization, Equilibrium	International Energy Agency's Energy Technology Systems Analysis Programme.
ENPEP	Suite of model for integrated energy/ environment analysis	Various	Argonne National Laboratory for the International Atomic Energy Agency.
WASP	Long-term electricity generation planning including environment analysis	Optimization	International Atomic Energy Agency.
PRIMES	Integrated energy/environment analysis	Partial equilibrium	National Technical University of Athens.

	for EU-25		
EnergyPLAN	Large-scale intermittent electricity supply systems	Simulation	Aalborg University.

Table 3: *Selected system tools in energy planning.*

Project tools

Project analysis has traditionally been, and is still often handled by ad-hoc models, typical spreadsheets, that cater only for a specific project, for example using techno-economics to analyse a combined heat and power plant. In terms of producing an energy balance or a simple cash-flow, ad-hoc models are often an effective way to go about evaluating a single project.

However, even for single project evaluations growing complexities in control strategies and system integration are pushing for standardization. When several projects – often different in nature – need to be compared on more than simple financial criteria, more advanced modelling principles are required. And in an interactive planning process, the project tool should also support and record the learning process, which ad-hoc models cannot always do (unless organized as a participatory development from scratch).

RETScreen, energyPRO, and COMPOSE, are model suites which have been developed to allow for consistent and comparative project evaluations under specified system constraints and control strategies.

RETScreen is a suite of tools developed and distributed by the Institute of National Resources, Canada, enjoying the financial and technical support of NASA, UNEP, and GEF. RETScreen software combines the principles of technology-specific spreadsheets with a common user-interface and database, and allows the user to produce a financial cost-benefit analysis for a particular energy project, such as wind turbines, small hydro, photovoltaics, combined heat and power plants, and solar heating. RETScreen boasts an incredible “64,283 users in 207 countries” (RETSCREEN Website 2005).

Since 1986, EMD International has been developing the energyPRO software for commercial applications in design, optimization, and evaluation of advanced combined heat and power plants. Today, energyPRO is a recognized industry standard in Denmark and Germany, and is widely used in many parts of Europe by engineers, project developers, and plant managers.

Since 1999, COMPOSE has been developed by this author for externality-oriented techno-economic energy project analysis that offers cost-benefit and cost-effectiveness analyses based on a wide range of important benefits and costs - energy resources, environment, economic costs, financial costs, employment, balance of payment, fiscal costs. COMPOSE has a solid institutional user base in Malaysia, and is furthermore used by a few Danish energy consultancies as a platform for project analysis and capacity building in energy.

The major differences between these models are their scope in terms of which feasibility criteria are included in the analysis, as well as their abilities to compare demand-side and supply-side technologies.

Table 4 provides a comparative overview of these modelling tools.

Tool	Scope	Methodology	Developer
RETScreen	Financial costs-benefit analyses of individual technologies	Database and techno-economic energy project analysis	CANMET Energy Technology Centre.
energyPRO	Simulation of advanced CHP projects, financial cost-benefit analysis	Simulation and optimization according to market constraints	Energy and Environmental Data.
COMPOSE	Externality-oriented comparative assessment of demand-side and supply-side options	Database and techno-economic energy project analysis including economic costs, employment, balance of payment, fiscal costs.	Aalborg University

Table 4: *Selected project tools in energy planning.*

Requirement specifications for frameworking tools supporting interactivity

This chapter has discussed the concept of a planning framework that emphasizes the importance of interactivity within context, relying on a platform of sober-minded techno-economic analysis. In supporting this framework, the potential usefulness of certain modelling tools is suggested, hence introducing the notion of "frameworking tools".

In conclusion, the framework and toolbox may be identified or developed under a set of general requirement specifications. Textbox 1 lists ten requirements for a software tool to be supporting interactivity in planning:

1) Builds on context embeddedness.
2) Stimulates learning and enables the reuse of previously learnt material.
3) Is open and inclusive towards stakeholders and disciplines.
4) Engages the values and interests behind the identified problems and goals.
5) Uses the recognition of problems and goals to formulate the criteria against which to compare options.
6) Is accurate in addressing technical and economic problems experienced by stakeholders, allowing for identifying winners and losers.
7) Complements or replaces proprietary methodologies and tools.
8) Allows for a transparent and uniform evaluation of alternatives with respect to the feasibility criteria as derived from recognized problems and goals.
9) Allows for the visualization of visions.
10) Enables cross-cultural exchange of stories and data.

Textbox 1: *Ten requirements for a software tool to be supporting interactivity in planning.*

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Visit MARKAL at http://www.etsap.org
Visit ENPEP at http://www.dis.anl.gov
Visit WASP at http://www.iaea.org
Visit PRIMES at http://www.e3mlab.ntua.gr
Visit EnergyPLAN at http://www.energyplan.eu
Visit RETScreen at http://www.retscreen.net
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