

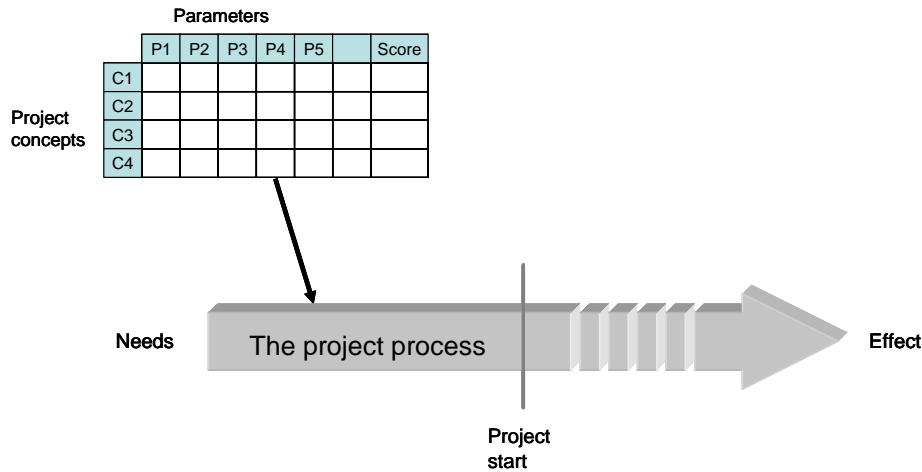
## Outcome of the Professional Exchange Sessions

- The Professional Exchange Sessions facilitated a discussion among participants with the aim to:
  - exchange ideas and experience, and identify topics and challenges for future research and activities
  - establish networks for future cooperation and motivate participants to provide papers or other inputs to the proceedings from the symposium
  
- Five topics A – E were discussed in parallel sessions of 45 minutes. The sessions were repeated successively five times so that all participants could cover all topics, and at the same time have an opportunity to exchange ideas at close range with all participants in the conference. The topics were:
  - A – Concept evaluation**
    - moderator Paul Torgersen, Metier
    - secretary Olav Torp, NTNU/Concept
  
  - B – Decision making**
    - moderator Stein Vegar Larsen, Holteprosjekt
    - secretary Ole Jonny Klakegg, NTNU/Concept
  
  - C – Uncertainty analysis**
    - moderator Kjell Austeng, NTNU
    - secretary Glenn Steenberg, NTNU/Concept
  
  - D – Incentives & Contracts**
    - moderator Dag Morten Dalen (day 1), The Ragnar Frisch Centre for Economic Research
    - moderator Knut Samset (day 2), NTNU/Concept
    - secretary Ola Lædre, NTNU/Concept
  
  - E – Portfolio management**
    - moderator Stein Berntsen, Dovre international
    - secretary Ole-Petter Holmvassdal, NTNU/Concept

Highlights, conclusions and recommendations from the sessions are summarized below, under these five headings.

## Topic A: Concept evaluation (How to identify the best project concept)

- moderator **Paul Torgersen**, Metier
- secretary Olav Torp, NTNU/Concept



The groups were asked to discuss contemporary issues and state-of-the-art regarding early identification and evaluation of possible project concepts with the aim to make sure that the best concept is chosen. Some issues:

- When to evaluate alternative concepts
- Feasible methodology and relevant parameters
- Conflicts with other analyses (eg. impact analyses)
- Stakeholder conflicts in relation to alternative concepts
- Selection of evaluators
- Etc.

The groups were also asked to draw conclusions and recommendations, and in particular focus on

- Topics and challenges in future research
- Building networks: individuals, institutions.
- Volunteers for future activities, inputs to proceedings, etc.

## Highlights from the discussion

### 1. Needs and effect assessment

There is not always a thorough review of needs and a corresponding assessment of effects at an early stage in projects. Many projects derive from a single idea that is taken up and made into a project eventually. People tend to be loyal to the first idea that comes up, and the concept is chosen too early. Usually, few alternatives are explored and considered.

A problem in the front end phase is that the project organization is not yet established. In the case of the Norwegian opera house three alternative sites were identified for the project. But since there was not a project organisation, there were no funds to do relevant analyses at that time in the process. Funds for project planning were made available only when the site was finally decided.

More time should be used to define what the needs for the project are. What are the criteria that should be used in the front-end phase? All projects are defined in financial terms, but social and cultural aspects for instance, are not focused enough.

A special framework is needed to do an evaluation of public projects. User needs have to be expressed and challenged in the project owners' strategic plans. Such documents should also include an assessment of different future operational models

Public projects are often designed without clear and unambiguous objectives. This is needed in order to assess the merit of the concept later. The objectives should be basis when evaluation criteria are established. Projects are often born from one or a few person's visions, without having in mind or considering the long term societal effects of the project.

It may be more important to have a business model than a business plan at the outset. A business model says: here are the costs and here are all the benefits. Bringing the project forwards require a complex process, and the users need to be involved.

A thorough review of needs and a corresponding assessment of effects need to be done at an early stage in projects.

- Analyse the needs before you find out how to solve them.
- We need to put much more work and time into analysing the user's needs
- The goals for solving the problem must be well defined.
- Don't identify alternatives until all objectives of the project are clearly stated
- The public utility must be defined before selecting concept
- Needs may change over time, which call for future flexibility

## **2. Time perspective - flexibility**

Commonly, not enough time is used to identify the problem before deciding the concept, and before you start to identify alternatives. Typically, careful consideration of the problem as seen from different angles will give you a good idea of what you are trying to do.

Frequently the initial analysis of how to deal with the problem is inadequate. A deeper insight into the problem will provide you with different alternative solutions to the problem.

One of the strongest arguments for investing in the front-end phase and get the concept right is that experience indicates that it is not really possible to stop big public projects once they are on the move, regardless of how they perform.

The front-end phase may need to be extended in order to allow flexibility when decisions are moving in a wrong direction. In Norway, an idea came up to build a national museum to demonstrate how democracy developed in the country. At the time there was no political will to spend funds on this project, but politicians did not have the political courage to stop it. The minister found a way to delay decisions by identifying four alternative sites for the project. The process was delayed by five years, which resulted in a better design.

Sufficient time should be allowed to identify and analyze the key problems before sorting out the alternatives and deciding the concept.

## **3. Political decision making**

We have to accept that we live in a political environment, but try to make explicit for politicians what the consequences are for the different choices. The better you define the problem the more difficult it is to hijack it, to extend it for something else. A key issue is what the politicians should base their decisions on.

Example: the Øresund Bridge between Sweden and Denmark, where the Transport industry wanted ferry links to Poland and Western Europe rather than having to go through Copenhagen and Malmø. The project was still implemented because the bridge was more than a transport route. It was a link between two countries. Again, we need a precise problem definition. Then it is more difficult to end up with something different from what you started off with.

Smaller projects are easier to handle because they are not usually initiated by the highest political level.

Clearly, one should respect political decisions. There is considerable scope for the public and different stakeholders to affect or interfere in the decision process in Norway and Scandinavia because the system is very democratic. This is both strength and a problem. In the private sector the situation is different.

There is a need to develop a model to properly manage various inputs in the political decision making process in a way that satisfies most if not all stakeholders.

Industrial politics strongly influence Norwegian defence projects, because it favours the survival of the huge companies like Raufoss, KDA, Mandal etc. Rational choice based on thorough analysis and other criteria may come second.

Should politicians take part in analysis, so that they better can see consequences from their own choices, or would this be in conflict with the nature of politics?

Should the requirements regarding analysis in the front-end phase of major projects be such that politicians can see that their choices also contribute in one way or another to other goals than strictly financial or economic? Projects should maybe be required to present data that could be used for such a broader kind of evaluation.

One example is the Norwegian opera in Bjørvika, Oslo, where the obvious objective was restricted to the cultural aspect, while the main reason for locating the opera in the eastern part of the city was urban development, not the opera itself.

#### **4. Utility assessment**

How to define the best concept? In the private sector measuring success is usually based on net present value or internal rate of return. In the public sector measuring utility is much more difficult.

The criteria used to measure the success of a project, and run uncertainty analysis on, lays at the heart of all of this. What are the measurable outputs? What determine success? How do stakeholders parties participate in creating this? How to continue measuring success?

It always requires a definition of what utility one is seeking. This will have to be defined before selecting the concept.

An example from Norway illustrates how easy it is to loose the grip of what the concept really is: The initial idea and main objective in a major road project was to divert heavy traffic away from Oslo and across a narrow part of the Oslo fjord instead. The suggestion was to build a bridge. However, local activists in Drøbak managed to stop the project because the bridge was located too close to the town. It was then decided to build a tunnel, which was more expensive, and also too steep to be used by big trucks. The result is that heavy traffic still runs through Oslo, while small cars use the tunnel.

Spending time to identify and analyse all possible scenarios that can arise from a chosen concept may clearly be worth while, but tend to be very demanding.

The time perspective is clearly essential when assessing utility and success. When to evaluate a project? Many projects that failed in a short term perspective have proved to be a success over time. The subway in Stockholm could not survive a strict analysis of cost and benefit.

Today, 40 years later, nobody questions the utility of the project. The same goes for the Eiffel tower, which is probably is one of the most profitable projects ever.

If a decision is somewhat crazy, at least if you actually identify clearly what it is you are seeking to do to start of with, than perhaps it doesn't spread into something quite different. Example from Australia: The navy decided to replace the patrol boats. The private sector suggested that if they build them, we could sell to the Malaysians as well. They wanted fifty patrol boats and that would help the industry. Then the patrol boats had to have a helicopter on board, and a defence system. By the time they finished they would have to have frigates defending them. So the whole thing just collapsed, and we are still trying to replace our patrol boats.

A utility function is an instrument to help getting value for money. It is relatively easy to define costs in different problems; utility is in some projects more or less impossible. In schools, roads, etc. a utility function could be established even though it's difficult. Buildings keep the rain and the snow off, and whatever inside the building produces wealth. One should think of a hospital in the same way. It is there to treat patients. That is how you measure the utility of the concept. The hospital needs to be flexible because of technological changes.

A successful concept needs to fulfil utility and feasibility requirements in order to be robust over time. Example from the UK: the UK has, at the moment, a program for building three new aircraft carriers. The lives of these are maybe thirty years, but the weapon systems on board will change many times in that period. Much more in the next thirty years than it has in the last thirty years. So the purpose of the vessels is just to stop the weapon systems from sinking into the sea. Therefore you should not get too fixated on the ship. Its main characteristic is that it has to be flexible enough to allow changes in the functionality. A hospital and a school is in principle the same thing.

The criteria used for assessing utility must come up as early as possible. It is possible to set the cost fairly accurate in an early stage. In the UK criterion today for assessing the merits of a project is how many jobs it is creating. Another is how much investment is it creating? Etc.

The problem has to be seen in a time perspective, and it is essential to establish a utility function that is flexible in a time perspective with regard to changes.

## **5. Government practices**

Once the problem to be addressed by the project is well defined there should be a formal requirement for options in cabinet papers.

The Norwegian Ministry of Finance wants to introduce an arrangement were responsible ministries at a certain (early) point in time would have to present several options and have a rational review of those alternatives.

At present the ministries define the problem, the associated needs and the solution to the problem their selves. The Ministry of Finance, which sets the financial frames, does not get insight in the evaluation of alternative concepts. In the annual budgeting process the solution to a specific problem will be presented by the relevant ministry. The Ministry of Finance would occasionally ask whether this is the best solution to the problem and whether other solutions have been considered. Maybe the ministry should be presented with different alternative solutions at an earlier stage. Then it could be brought up to the political level, which would give the politicians a real opportunity to find the best solution to the problem.

Should the options be presented to different ministries or agencies to get different views?  
How should this be done?

In the initial phase, major public projects should be analysed in the financing party's perspective. The Ministry of Finance do not have a strong influence on what is being considered in other ministries. Some projects are well conceived others not. The Ministry of Finance has to make decisions. What measures should be taken? A viable approach might be that the ministries are obliged to present their projects in a clear and precise way, and argue convincingly why the particular project alternative is the one that would have the best effects on the utility goal.

Projects can be initiated at different levels. If they are initiated by an agency, then it will usually be part of a priority plan, which allows time to make improvements. Some major projects come up through politicians, maybe initiated by a minister based on a vision. In such cases there might be no time to analyse, and what was the justification for the project might not be sorted of long after it was initiated.

Government practise in Sweden and Finland is that Ministry of Finance always requires an assessment of expected benefits and cost of major project, but this is not done very systematically. The most urgent is in principle chosen first, but sometimes political decisions may change that. Assessments of cost and benefit are commonly done by the government agency responsible for implementation of the project while the ministry would do the evaluation. The ministry initiates the project; it has a political role, and also controls the outcome. This is controversial and raises the question whether the Ministry of Finance should have more of a controlling role.

Do decision makers have the necessary procedures and enough information to make the right decisions? In many cases they have enough information. There might be cases where the information demonstrates that the project never will be social beneficial, and still the politicians go for the project. This seems to indicate weakness in procedures.

In France there is a total project model that is pre-specified, and you have to follow each step of the way.

UK has a regional master planning exercise where every project has to go trough an impact assessment. This is done by external consultants. The master plan exercise allows you to see the bigger picture. You have to identify the problem and than open your mind to the solutions.



A problem with master plan exercises is that they become political processes. They involve different stakeholders, users, contractors etc. and tend to extend the front-end period. Another feasible route might be through contractor involvement, using life cycle cost models and more focus on anticipated benefit.

The Ministries of Finance in different countries are facing similar problems, and it could be interesting to get an overview of procedures and practices in dealing with major investment projects.

## **6. Identifying alternatives**

If ministries were required to consider different alternative concepts at an early stage and government agencies were to come up with the alternatives how could this be done: by open competition like the architects have? Or by commissioning somebody some third party to review and present existing alternatives? Or by having stakeholders presenting for review by the agencies? Or what?

In the IT sector a common approach is to identify what you want in broad terms, and then to put out to tender. That gives firms the opportunity to come back with solutions of how they will solve the problem. Different groups come often up with quite different alternatives. Clearly, it is important to have that core identification of the problem.

The decision model will need to have a set of selection criteria. The selection criteria should include both the utility and also robustness of the concept with regard to changes. What are you're objectives? Is it low capital cost or minimum operating cost? What is the life expectancy? How easy it is to expand? How easy it is to contract? How easy is it to change? Those are all criteria that private companies use as standards when they evaluate alternatives. It provides them with a consistent basis for decisions.

It also needs to be decided when in the process the criteria's shall be used. It is important to have enough data before taking decisions.

The focus on capital cost without looking at utility and operating cost is probably one of the reasons why projects fail. The parties that are interested in utility require changes way beyond the point were the private sector projects would not be allowed.

Flexibility is an important dimension of the utility side, but it may be difficult to establish an aggregate utility function.

Example from the justice sector: building a new prison. The consequences of the new prison for the region will be a concern. Will it cause other institutions to close-down? Is there an alternative to upgrade existing institutions? This type of analysis is essential to secure a sound decision basis.

One of the key problems in projects is that business objectives and functionality objects are clarified too late. It may not be feasible to identify alternatives before all the objectives of the project are clearly stated.

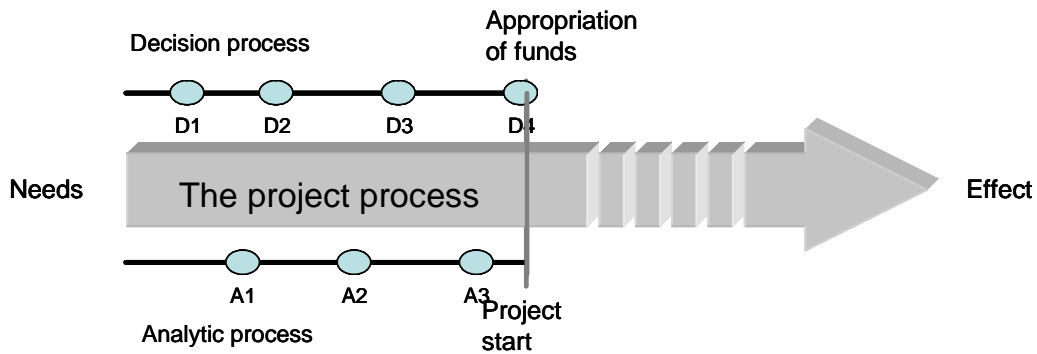
## **7. Responsibility for concept evaluation**

Concept evaluation should be done by an independent party to secure a neutral professional basis the assessment.

Political institutions should not do the analysis, but concept evaluation should be part of formally established decision model.

## Topic B: Decision-making (preparing the best basis for decisions)

- moderator **Stein Vegar Larsen**, HolteProsjekt AS
- secretary Ole Jonny Klakegg, NTNU/Concept



The groups were asked to discuss contemporary issues and state-of-the-art regarding front-end analysis and decision-making in major projects to ensure a sound basis for decisions and avoid that projects are initiated for instance as the result of political initiative without a thorough review of the feasibility. Some issues:

- The decision-making process: needs and requirements
- The analytic process: needs and requirements
- Relationship between analysis and decision making
- Ensuring a feasible and realistic project design
- Decision-making documents: requirements
- Etc.

## Highlights from the sessions:

The most important input to further work is summarized below.

### 1. The need for a common decision model

There was broad agreement that we do not have a *Meta model* for all large public investment projects, and that there is a need for such a model that describes the *phases and tollgates* required. The model should contain the following:

- Defined terminology, roles, processes definitions and cooperation.
- Standardized decision gates with a set of *minimum requirements*. This will provide guidelines in judging the projects' maturity in each phase, and will also establish a clear goal in each phase for the analysts that are producing the required decision-making documents.
- The advantage of such a generic model with very general (simple) requirements is standardization of systems, standardized criteria for making decisions, resulting in decisions that are less affected by subjective choice.

A model will help giving preference to "need-generated" projects and restrict projects that do not qualify such as some projects that emerge from political campaigns.

The model would secure a correct *level of details* in each phase. If details are not needed for the upcoming decision– efforts should be saved until the final decision to go ahead with the project.

Such a model, which should be applicable for all large public projects, should be sufficiently *flexible* to accommodate sector needs. Both organizations and the cash flow in the different sectors vary too much to have exactly the same project model in all sectors.

### 2. Decision levels

Generally speaking, with the current practice, there are too many top-level decisions in projects. Clear tollgates need to be specified, but not necessarily addressed to the top level, represented by the parliament. The following was suggested:

- Top level (parliament): one, maximum two decision gates
- Lower level (ministry or lower): two to three decision gates
- Project level: By need, not part of generic model

### 3. Standardized criteria for decision-making:

Due to the relationship between the political level and the public, and also the differences between the diverse political parties, it will be difficult to establish accepted, quantitative criteria at the top decision level.

#### 4. Decision making in the model

- Outputs from the analytic phases should not be a description of what to do, but rather describe the situation!
- Communication/presentation is important
- Decisions need to provide a clear answer regarding go/no go
- If the decision is “no-go”, the decision should include criteria for trying again.
- Interaction between project and decision makers when decisions include scope creep should be a part of the described process.

#### 5. Levels in the model

The model could differentiate clearly between the societal goals and the project goals. This could be documented through

- System mandate
- Programme mandate
- Project mandate

It is vital to establish the *sponsorship* as early as possible in public projects. Often this is not addressed early enough, causing the mandate not to address the right issues. The sponsor is to define the mandate in all phases!

Needs should normally be defined by *users*.

Non-compliance with the models requirements should have consequences. This can be taken care of through a central control unit or a scheme for quality assurance. Such a centralized unit should have its focus on the basis for decision-making and not the decision itself; and furthermore to secure that decisions are not premature.

#### 6. The analytic process (the project process)

- Cost, and uncertainty related to the cost, should be a part of the analysis in all phases. It is possible to give an estimate at *all stages*, facing the fact that the uncertainty is high in the early phases. The “successive principle” method is one among other methods that can be used for this purpose in all phases in large projects.
- How to measure utility should be standardized as much as possible, giving better (quantitative) criteria for decision.
- The analytic process should also consist of
  - Needs-analysis
  - Benefit-analysis
  - General criteria (investment cost, Life Cycle Costs)
  - NPV-analysis
  - Enhanced value analysis
  - Other utility analyses (not standard, depending on sector)
  - Etc

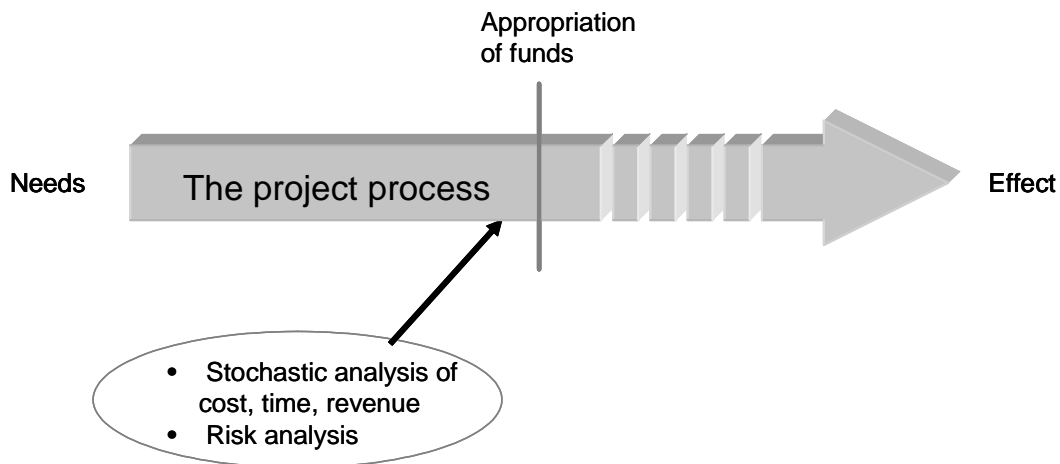
## 8. A specific suggestion for a decision model

Based on the above, one of the groups suggested which decisions should be required in large public investment projects. As a consequence of the decision, the necessary analysis for each phase between the decisions is more or less given.

Decision Gate		Phase after decision	
D 0	<b><u>MANDATE</u></b> Input: Initiative from user (or other party) Output: Mandate to evaluate need	Phase 1	Documentation of needs.
D 1	<b><u>NEED</u></b> Decision of need acceptance. Kiss or kill!	Phase 2	How to solve the needs Definition of objectives.
D 2	<b><u>OBJECTIVES</u></b> Fixed objectives /business need. "What we want to accomplish". Define criteria for choosing concept.	Phase 3	Alternatives evaluation.
D 3	<b><u>CONCEPT</u></b> Chosen concept.	Phase 4	Basic engineering.
D 4	<b><u>FINAL APPROVAL</u></b> A GO / NO GO-decision point, giving the final approval for capital expenditure.	Phase 5	Either termination or realization. If realization; Detail engineering / Procurement / Production phase

## Topic C: Uncertainty and risk analysis (prior to parliamentary approval)

- moderator **Kjell Austeng**, NTNU
- secretary Glenn Steenberg, NTNU/Concept



The groups were asked to discuss contemporary issues and state-of-the-art regarding the final analysis of uncertainties, anticipated costs, etc. in the front-end phase, to ensure a realistic budget and effective risk management when the project is implemented. Some issues:

- How comprehensive should the analysis be?
- Feasible methodology and relevant parameters
- Who should commission the analysis
- Selection of analysts
- Should alternative concepts be included in the analysis?
- Etc.

## Highlights from the discussions

### 1. Why doing uncertainty analyses

Uncertainty analysis is a management tool as well as a decision tool, because it highlights the areas where action is needed.

A much used approach in decision making is to suspend decisions as much as possible until it has to be done. Allowing time may be a way to reduce the effect of uncertainty.

Uncertainty analysis can help time decisions based on systematic assessments of what is expected.

Uncertainty analysis can also be used as a tool to help politicians understand the possible and probable effect of their decisions, both in quantitative and qualitative terms.

The use of uncertainty analysis has increased and improved the recent years. Earlier the reports tended to end up in the drawer. Today they are more accepted and used.

Uncertainty analyses can be used as a tool to choose between alternatives. In Hong Kong uncertainty analyses of time and cost are made in the early conceptual phase. Costs are quantified in monetary terms, and supplied by assessments of user-value, market value, life cycle cost etc. in the detailed analyses.

Uncertainty analysis is useful for the contractors as well as for the financing party and projects owners.

The essence of UA is that it is useful for the management. It should be a means for the management to make the right decisions and implement actions. One of the main challenges of the uncertainty analysis is to follow-up, through making risk mitigation plans and gets the projects to implement them.

### 2. The scope and contents of uncertainty analyses

The techniques are fairly well established, i.e. to identify relevant risks, assess probabilities and magnitude, establish which action to be taken to reduce risks, assign responsibilities, Make people follow up the actions and ensure a constant feedback loop. The focus in this process should be on improving input data, timing of the analysis and follow-up of the uncertainties.

There are two types of uncertainty analyses, the blind risk analysis and the open-eyed risk analysis. The uncertainty analysis should also consider the blind risks, which often are the most significant. A blind risk analysis is basically done by making scenarios for the future. The open-eyed risk analysis is easier, and not so much of a challenge. We need to think the unthinkable. Experience indicates that this is not commonly done.



Some issues for further discussion. Should uncertainty analysis:

- take into consideration the risk connected to political/socio-economic issues?
- make a distinction between political/socioeconomic and market/technical issues?
- divide the analysis into controllable and uncontrollable risks?

Life cycle cost as well as the life cycle benefits needs to be part of the analytic model. It is easy to forget why the project was conceived in the first place if the benefits are not focused.

Uncertainty analysis should also analyze the zero option i.e. not going forward with the project, and use this as a main reference.

The uncertainty analysis needs to be able to quantify uncertainty in order to compare it with other projects.

There is a need to focus on the right risk parameters, and to use data bases that gather and organize the risk parameters to identify the most important ones.

### **3. How to do uncertainty analyses**

The first issue to be resolved is to determine which analysis should be done when, as seen in relation to agreed decision gates, etc. The second issue to be answered is whether this is the right project.

Some main challenges in an uncertainty analysis include.

- Which parameters to use
- Uncertainty of parameters
- Quantification of important values
- The timing of the analysis.

The first uncertainty analysis in a project should be done very early where there is little data, and be refined as the project develops.

In order to be able to “think the unthinkable”, the composition of the team selection is important. All stakeholders and interest should be involved in this process. A team with broad representation will be able to see the projects from different angles and identify more risks, which is necessary to do the right actions.

Uncertainty analysis needs to focus on risk within the project, the business units, the project portfolio and the whole institutional setting.

The uncertainty analysis should come up with possible mitigation measures to reduce risk, for possible adoption and implementation by the project organization.

#### **4. Problems encountered and restrictions**

The traditional and typical uncertainty analysis focuses on internal factors instead of external, even though it is the external factors that often ruin the project.

To quantify the effect of the human influence on the projects may be the most difficult part of the analysis. Such effects could possibly be quantified through a life cycle cost perspective, in terms of flexibility, functionality, etc.

A problem in financing public projects is that government agencies occasionally apply tactical budgeting, i.e. keeping cost estimates low until the project is approved. This also adversely affects the uncertainty analysis, which is commonly based on existing cost estimates.

The users' expectations may change through a project. This represents a challenge and considerable risk. This needs to be taken into account in the analysis, and the models should be flexible and robust to change.

Quantification of benefits is often neglected in Norwegian public projects. The positive effects on communities and businesses need to be considered in benefit analyses, as well as the effects on environment, health, etc.

Experience suggests that there is a need for a formal review scheme, especially in public projects, that gets all participants and stakeholders involved. In the UK there is a public inquiry scheme, which provides a setting for uncertainty analysis. The downside is that the process can stall the project and delay it for years.

In some cases changes in the project environment, for example change of government, new laws, etc. could change the whole project. This might be difficult to foresee and to build into the uncertainty analysis.

One approach to uncertainty analysis is to focus on the physical items in the project, give each a maximum and minimum value and calculate the cost range for the project. This often disregards overall issues like project management, market, etc. Also the differences between dependent and independent uncertainties are not reflected in some of the known methods and techniques.

It is difficult to make a database that gathers information about uncertainties, because each project and the corresponding uncertainty are different. It is easy to make a standard list of the most frequently occurring uncertainties. By doing this, however, essential uncertainties can be neglected. Such standard lists should be used as check lists after the process of identifying risk factors is completed, to ensure that all relevant factors are on the table.

## **5. Requirements and means to improve uncertainty analyses**

Uncertainty analysis should precede action. The high risks are usually few and this is where the resources should be used. It is important to establish action plans and allocate resources to the right actions. An uncertainty analysis without an action plan is not very useful.

The cost model needs to be robust and accepted by all involved parties. Examples from the oil industry, where costs in oil refinery projects are easy quantified because of existing models. Similar models could be developed for infrastructure projects too. The models should be generally accepted, also by local authorities. It would help against the problem of systematically underestimated costs in infrastructure projects.

There are no standards for calculating costs in hospital buildings. A lot of data is available, but they are often not comparable. Input data need to be standardized.

Uncertainty analysis should precede the decision to build, and should give an answer to the question: what type of building should be built to meet the identified needs? In Norwegian projects, you often see the opposite: the architect is commissioned and engineering is started before the first uncertainty analysis is done.

There is a need for repeated uncertainty analyses after the initial one, for example annual revisions, even after the project has been approved.

Both external and internal uncertainty analyses should be done in the early phases of any project.

The most effective tool for controlling project uncertainty in UK is to use a rigorous regime for following up the project. This regime measures the progress and compares it with earlier measures.

Risk mitigation plans are important.

The human and cultural factors should be more emphasized in the analysis. Many engineering methods are reluctant to include these matters in the analysis. The qualitative matters are important, but the procedures, methods and techniques for quantitative analyses also need more development.

Life cycle cost is a key parameter in most projects and should be a part of the uncertainty analysis. It is required from the Norwegian state agency to do life cycle cost analyses in all defence projects, but this is not always done.

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## **6. Other issues**

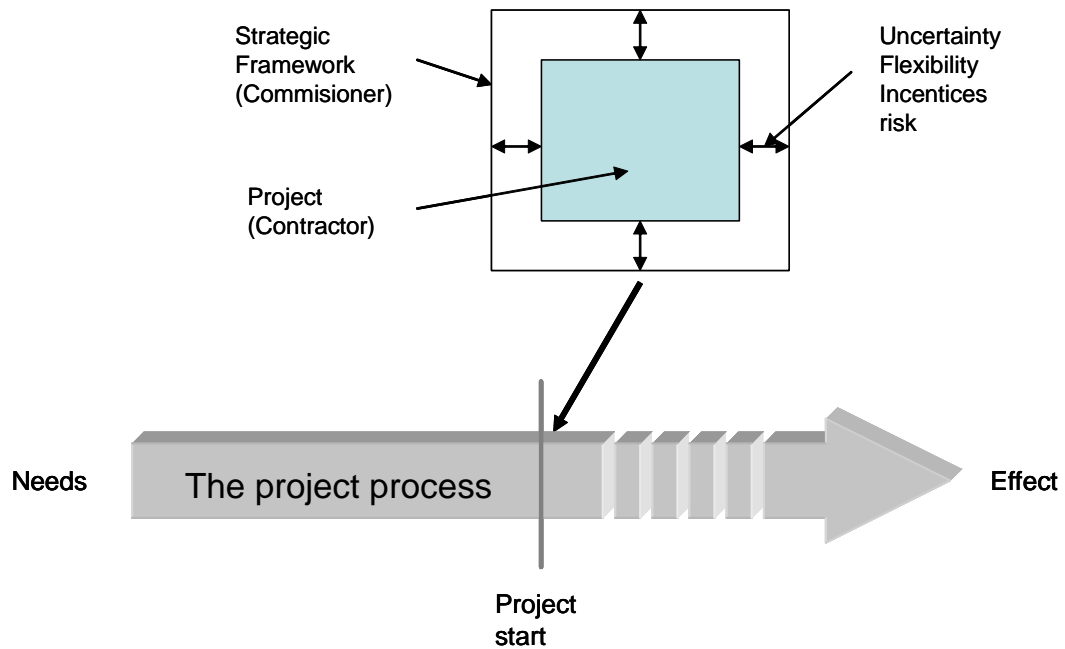
Uncertainty analysis should also be applied to aggregates of individual projects in support of portfolio management. There is a need for models to simulate portfolio uncertainty, which can take into consideration both costs and benefits.

An interesting topic for research is to evaluate projects that have been exposed to uncertainty analysis to see if the identified uncertainties occurred, to which degree risk mitigation plans were implemented and the effects of actually implementing them. Successful projects could be compared with less successful projects.

The Norwegian Opera project could be used as a case to analyze if actions plans are working, because the opera has been heavily analyzed and has been exposed to many unforeseen problems.

## Topic D: Incentives and contracts (between different stakeholders)

- moderator **Dag Morten Dalen (day 1)**, The Ragnar Frisch Centre for Economic Research
- moderator **Knut Samset (day 2)**, NTNU/Concept
- secretary **Ola Lædre**, NTNU/Concept



The groups were asked to discuss contemporary issues and state-of-the-art regarding distribution of incentives and risk among main stakeholders, to ensure smooth operation when the project is designed and implemented. Some issues:

- Contract regimes: commissioners vs. the contracting party
- Choice of contracts and transfer of risks
- Incentives and choice of contracts
- Incentives in the public administration at various levels
- Etc.

## Highlights from the discussions

### 1. Planned and actual focus for the incentives & contracts sessions:

The intention with the sessions was to focus on contracts and corresponding incentives between Ministry/Agency level and Agency/Project level. The aim would be to devise contract regimes that reward cost-efficient project execution without reducing quality.

The discussion included incentives on both organizational and individual levels; and monetary and non-monetary incentives as well. The differences between formal and non-formal incentives were only discussed to a limited extent.

Contracts encompass both formal agreements and non-formal agreements. Legal documents and written agreements are examples of formal agreements. Verbal agreements, common practices, customs and habits are examples of non-formal agreements.

The terms incentives and contracts tended to draw the attention from the higher administrative levels to contracts between Projects/Suppliers. After the first two sessions the discussion shifted more towards the originally intended focus.

### 2. The role of the Auditor-General

The Auditor-General would potentially have an important role in relation to the contracts between different public organizations. It is within the Auditor-General's brief to evaluate to what extent the parliament's intentions are followed up at Ministry level, Agency level and subsequently at operational level in major Government-funded projects.

Project organizations need to focus more on the overall project purpose and goal, and not just on the project results. Correspondingly, the Auditor-General should focus less on implementation in terms of time, cost and quality, and more on what gains the society in the long run, i.e. the achievement of the project purpose and goals.

It was suggested that the Auditor-General be instrumental in initiating ex post evaluations of projects in order to identify potentials for improvements. Both success and failure projects should be covered.

The end-users seldom participate actively in implementation of public projects. Hence there is a need for independent reviews. The Auditor-General might have a role in pointing out the importance of securing that the end-users' needs will be satisfied.

In Australia the Auditor-General might be instrumental in evaluating project performance repeatedly after the implementation period. As the result, projects are judged not only by their immediate results, but also by the achievement of the project purpose and project goals.

### **3. Measuring performance:**

In Great Britain, Key Performance Indicators (KPI) are used in order to measure the overall performance in projects. One advantage is that the figures cannot be manipulated.

A disadvantage is that it will take time to establish and maintain a feasible database of Key Performance Indicators. In Great Britain the two first years there were numerous problems, but after the implementation period using Key Performance Indicators have proven to be successful.

External reviews should be used systematically to monitor project management. This could be an integral part of the quality assurance scheme. The output could for example be an end report written by the project management, which would thereafter be reviewed by external staff in order to secure neutrality. The reports could be made conform based on a common format. The review should ascertain the effects of good or poor project management, and the effect of external uncertainties. The report could be used to reward, or eventually to sanction project management. Therefore, the review must have some authority and the reviewers the necessary credibility.

### **4. Contracts:**

To establish formal contracts between different levels in the public administration might not be feasible since all parties represent the public and incentives and disincentives are very restricted. This applies especially between ministry level and agency level.

### **5. Types of incentives:**

However, formal incentives can be given to organizations in the public sector. For example, projects can be encouraged to return unused funds, the reward being that these are added to a contingency fund by the agency, from which projects can benefit later.

Incentives cannot be used as punishment, at least not for individuals. A project result can be evaluated against the three main parameters time, cost and quality. If the time schedule is tending to be exceeded, this can be compensated through an intensified use of resources. This intensified use of resources can cause extra and unpredicted costs, which implies a budget overrun. The budget overrun can be compensated through lowering the quality. A fear of triggering punishment can make the project individuals go far.

Monetary incentives for individuals in public sector are hardly realistic. The use of public funds should not be affected by incentives given to individuals. Results of projects will depend on the combined efforts of all project members, and therefore they all should be rewarded. Individual salaries ought to be sufficiently high to attract competent personnel to the project organizations.

Non-monetary incentives, such as positive acknowledgement, promotion and challenging assignments, has a well proven effect on individual performance in the public sector, and might in many cases be regarded more important than salary increases.

If the user is involved in the project and contributes to savings or improvements, he should benefit from that, either in terms of positive acknowledgement, improved performance in the operational phase or some share of the saved resources.

Some organizations have a policy which encourages personnel to change positions successively within the organization. In long lasting projects the effect of this is hard to measure. Using personal incentives might be less feasible in organizations with this type of frequent internal turn-over.

## **6. Incentives between ministry/agency level and agency/project level:**

In some sectors funds for investment projects are allocated at ministry level, while resources for public services are allocated at agency level. If resources for both investment projects and public services are allocated at agency level, the incentives for co-coordinating these activities will be stronger.

Today it seems like the main disincentive for a project to request additional funds from the responsible agency is that this may cause unwanted negative media attention. The risk for such media attention is probably small so long as the budget overruns is less than, say 10 per cent.

The main disincentive for agencies to request ministries for authorization to allocate more funds than originally budgeted is that it might strain confidence. Usually, it would have to be a great deal of funds involved before it attracts media attention.

Projects usually have no incentives for returning funds that are allocated. The incentive for spending them in the project is usually stronger, since it will probably benefit the users. It is not feasible to punish or reward projects when there is a discrepancy between costs and budgets. That would create an incentive to try inflating the initial budget.

In many cases, when projects are completed below budget, the balance of funds will be available neither for the agency nor the responsible ministry, but for the Treasury. This clearly creates a disincentive for savings.

## **7. Resource Allocation, Agency/project levels:**

One way to make project organizations strive for a total project cost at or below the P50 – estimate is to allocate for example 90 per cent of the P50-estimate to the project and 10 per cent to a contingency fund. If the first 90 per cent are used, the project has to ask for the 10 per cent and eventually for additional funding if necessary. The contingency fund would be a common resource for all projects. If the last 10 per cent of the budget is hard to get, it will be an incentive to limit spending.

For a ten-year period, the Norwegian Directorate of Public Construction and Property used to put 2 per cent of the P50-estimates in a contingency fund. The fund was to be used for projects in severe trouble. In earlier years, it was easier to adjust cost, time and quality in a



specific project by reducing the number of square meters produced, since the buildings were allocated to the users and operational expenses were covered by the state. Now the users pay rents for the areas they occupy, and therefore are more restrictive.

## **8. Resource allocation at the ministry/agency level**

Some of the Norwegian ministries are responsible for a large number of projects, and it will therefore make sense to introduce a project portfolio management system at ministry level. Such a system can be used to help prioritize and make better use of public funds.

Funds allocated by the Ministry of Finance that are not used within the budget year, must be returned to the Ministry of Finance. This gives the ministries incentives to overbook in order to spend their whole budgets.

## **9. Contracts and incentives in general:**

Public projects have to commit sufficient funds to secure quality advises in the front-end. The long-term cost of using advises that are not sufficiently qualified in the front-end tend to be high.

Agreed project frames would have been taken seriously also by the funding party. Unlike the situation in Sweden, where there is no abundant oil-money, there is a "problem" in the Norwegian public sector that we have too much money. In other countries cost overrun can cause other projects to be postponed.

There is also a need to look at incentives and disincentives affecting performance of the external consultancy firms that carry out the quality assurances, when estimating project cost and time schedules. Low estimates might increase the opportunity for overruns, and that would attract negative attention in the public. Projects finished at or below budget will attract none or positive attention.

## **10. Contracts and incentives between projects and suppliers:**

It is no longer feasible to evaluate bids and tenders purely on price. Such evaluations need to take into account experience, former results, ability to co-operate and the suppliers' economy.

The use of coalitions of contractors or joint ventures in major public investment projects has proven to be successful. The contractors put their best personnel into these projects, and they are willing to do their best in order not to get a bad reputation.

One incentive for the supplier in a major public project is that he might be assigned for another job if the current project is succeeding.

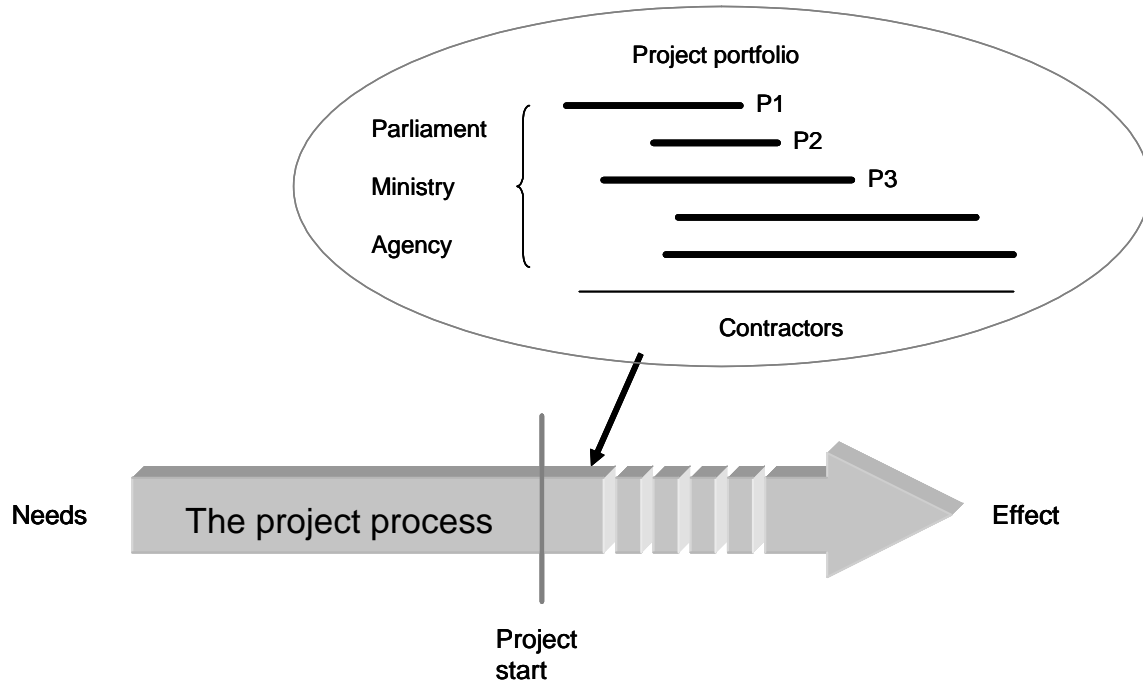


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The Competence Network for Hospital Planning (Kompetansenettverket for sykehusplanlegging) will work with implementing of trail research in Hospital projects, contact person Asmund Myrbostad (proposed by Asmund Myrbostad)

## Topic E: Portfolio management (managing clusters of projects)

- moderator **Stein Berntsen**, Dovre international
- secretary Ole-Petter Holmvassdal, NTNU/Concept



The groups were asked to discuss contemporary issues and state-of-the-art regarding selection and financial management of portfolios of individual projects, in order to improve selection and management of project, and exploit the opportunities in budgeting based in stochastic cost estimates. Some issues:

- Criteria for portfolio selection
- Estimation of reserves in a portfolio of projects
- Incentives to generate reserves
- Authority to draw on unused reserves
- Management of systematic and unsystematic risk
- Etc.

## Issues from the discussion and the Concept report “Portfolio management in public projects”

In 2002, Concept commissioned Dovre International to study the feasibility of introducing portfolio management of major projects in the Norwegian public administration. Dovre is one of four consultancy firms currently with frame agreements with the Ministry of Finance for doing external quality assurances of large public projects.

The report is only available in Norwegian, and can be downloaded from homepage [www.concept.ntnu.no](http://www.concept.ntnu.no): *Styring av prosjektporteføljer i staten. Usikkerhetsansetning på porteføljenivå.*

The report discusses the advantages of managing projects at portfolio and programme levels, instead of only at the project level. A programme is defined as a group of projects sharing the same goals, while a portfolio can consist of a mix of projects and programmes. One part of the study was to identify best practice for portfolio management in private companies.

Portfolio management can be seen to consist of two problems:

- 1) Selection of projects
- 2) Allocation of resources

The scope of the report was management of the provisions, with focus on liquidity management in annual budgets for a defined planning horizon. Evaluation and selection of projects was outside the scope of the study.

The report focuses on the management of provisions for uncertainty in projects. It proposes to manage such provisions at a portfolio level (e.g. at the ministry level).

A project is subjected to both systematic and unsystematic uncertainty. Systematic uncertainty affects all projects in a portfolio (for example exchange rates), while unsystematic uncertainty is project specific. Since the unsystematic uncertainty in a portfolio of projects is reduced as a result of diversification, the total provision for uncertainty can be reduced. Good project management practice also dictates that provisions should be controlled at administrative levels above the project manager, to make it less likely that a project manager exceeds his budget (which, for example, can be set at 45% confidence in the probability interval).

The aim of the report was to produce a simple, ready-to-implement method, in the form of a relatively simple Excel spreadsheet. To reduce the complexity of the proposed model, some simplifications had to be introduced in the initial model, for example:

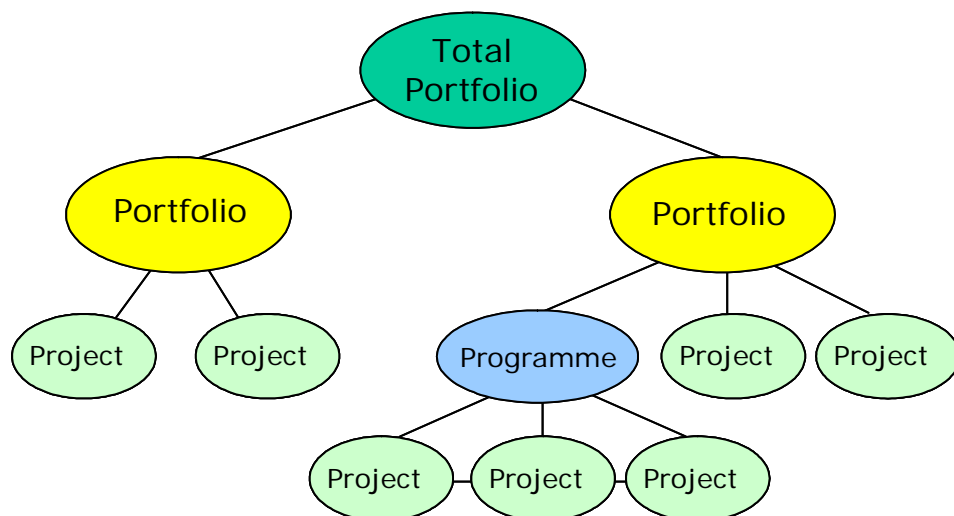
Exchange rate uncertainty. Only three exchange rates are included: NOK vs. 1) USD, 2) GBP and 3) EUR+.

Market uncertainty (for transportation and construction only). The uncertainty is based on a simple analysis of the past developments of the construction market in Norway.

The report recommends that the model should be tried out as a pilot project in the Ministry of Defence and/or the Norwegian Public Roads Administration. These both have a sufficient number of large projects to make them good candidates for portfolio management. At the same time, it is believed that

current practice need only be slightly adjusted to allow for a successful implementation of the proposed model.

The report discusses the advantages of steering at portfolio and programme levels, rather than at the project level.



Although the model is rather simple, the report argues that it is sufficiently accurate for most practical purposes. One important consequence of using such a model is also that it may guide a ministry into the new mindset of portfolio thinking. There are many examples in Norway of public projects living their own life, with little regard to what is happening in their external environment. Thus the report can be a starting point in improving the impact of large public investment projects in Norway.

### General issues discussed in the exchange sessions

Uncertainty associated with funds allocated for major public projects in the annual fiscal processes are common.

- Can portfolio management of provisions help reduce the cost of large governmental projects?
- Can a switch to portfolio management lead to a more effective mindset in public projects and in the public administration?
- Can portfolio management help or speed up the introduction of longer-term budgets, giving projects more predictability?
- At what level should portfolio management be carried out (agency, ministerial, Ministry of Finance?)
- How should a portfolio be selected/defined?

- Can public sector practices and budgeting requirements be adjusted to make portfolio management of reserves possible?
- Is it possible to go further, and use portfolio management as a part of the project and concept selection process?
- What effect can portfolio have on flexibility in projects?

#### **Use of allocated funds**

- What would be the effect of allocating resources per region as opposed to per sector? In the UK it is believed that local projects are more accountable to the public than nation-wide projects. Is greater autonomy for regions the way to go?
- Allocation of provisions for uncertainty. Keeping provisions for uncertainty out of reach of the project manager may result in cheaper projects
- Social net present value (NPV), including life cycle costs (LCC) and life cycle benefits (LCB). Can use of these criteria help public investment decisions? UK uses for both road and defence projects.
- Maximizing regional GDP in 15-20 year perspective. Can use of this criterion help public investment decisions?

#### **Decision making process**

- The problem of resource constraints. Will portfolio management help in identifying competence available, etc.
- Public vs. private salary levels. A threat to improved practices?
- Portfolio effect on cash-flows. Public projects often do not feel the effects of time-value of money. Large amounts can sit in current accounts.
- Business case model approach. Should public projects be required to write a “business plan”?
- Current project management culture threat to overall optimization. Strong project managers may resist portfolio thinking
- Flexibility Scope reductions resulting from portfolio management of projects, delaying/stretching projects in time

#### **Implementation challenges**

- JIT in projects Can projects become cheaper if focus is on rapid execution? Will this allow for easier portfolio management?
- Incentives to under run budgets. Use of stretched-target budgets. External audits/peer reviews. Scope reductions. What incentive mechanisms are available for project managers and levels above in public projects?

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### **Strategic budgeting**

- Reduction in end-user benefit. Will an increased budget discipline result in lower value to end user (decreased social NPV). Private companies tend to invest more provided positive effect on NPV.
- Owner competence. What competence should the project owner have (i.e. the responsible Ministry)

## Ideas for future research

1. Develop techniques for identification, development and evaluation of concepts during the front end phase of major projects.
2. Explore pros and cons of overall Master planning as an aid in project identification and management
3. Identification of relevant effects in major projects
4. Measuring the utility of public works concepts
5. Overview of practices and experience with different processes in different countries
6. Reviewing experiences with stakeholder working groups in needs assessment and concept evaluation
7. Developing a model/documentation for concepts in health sector
8. Organizing stakeholders in concept development work, implementation procedures and way of working.
9. How to review and critically analyse anticipated needs: (Political, Technical, Economic, Environmental, Institutional, Flexibility, as well as life cycle costs)
10. Acceptance and correspondence with “owners” strategies and missions
11. Broadening the perspective when alternative solutions for public projects are evaluated. How to change users practice. How to promote creativity in finding alternative solutions.
12. Political influence on major decisions in civil engineering mega projects?
13. How to combine optimum design in major projects and satisfaction of politically expressed needs.
14. Improving evaluation methods, with particular emphasis on the qualitative/soft values
15. How to define what is meant by “user needs” and specify what it would imply in operational terms
16. Future research on decision making in relation to major public projects should focus on the following topics:
  - Decision making criteria.
  - Timing of decisions.
  - Planning for decisions and corresponding analyses.
  - Identify the right parameters and quantify them.
  - Ensuring flexibility in the projects to meet future changes.
  - Ensuring sufficient analysis of the situation around the project.
  - Ensuring target-oriented, not output-oriented focus.

17. Using scenarios in the front-end phase of projects to identify uncertainties and exploring the extreme.
18. Analysis of major events and their impact on projects and project stakeholders. Methods for doing single event analysis could include:
  - Econometric technologies
  - System dynamics
  - Intelligent agent simulation
  - Chaos theory
  - Initial condition analysis
  - System thinking approaches
  - Scenario definition
  - Structure information after certain pre defined UA factors
  - Methods to think the unthinkable
19. Incentives for external consultancy firms carrying out quality assurance of cost estimates on major projects.
20. The feasibility of using PPP/PFI type of contracts in public works projects
21. Effects of incentives within the public sector – such as bonuses, contracts with strict sanctions, promotion schemes, etc.
22. How to share risk in public private partnership projects
23. Incentives and improvements in the light of the role and interests of different stakeholders in major projects
24. Incentives in the front-end phase of public projects, such as the use of project reviewers, performance measurement, competition within a given economic frame/budget etc.
25. Practices and performance in the Public Sector in Australia
26. Project reviews and Public Private Partnerships as incentive
27. Contract formats that make use of the knowledge of the contracting firms and in the same time allows efficient competition
28. The use of Key Performance Indexes (KPI) and Joint Venture-models
29. Early involvement of contractors – Measurement regimes – incentivation (measures/benefits/consequences)
30. Implement trailing research with external resources. Develop a procedure/routine for indicators to be measured and criteria for evaluation together with a tool for accumulating experiences

## Network resources

### Web-sites

- UK Government's Web-sites (Andrew Thomas)
  - Masterplan – (rail, road, rivers/sea)
  - Regional Development Agencies – Regional Plans/Strategy
  - Local Authorities (County + Town)
  - Northwest region/Salford University etc, UK
- Ministry of Defense, UK
- Office of government and commerce, UK
- PART (George W Bush)
- The EU has a lot of experience
- EU Health Property Network
- IPA Netherlands (research paper). [www.ipaglobal.com](http://www.ipaglobal.com)
- The National Museum of Australia
- Analytical Architects, E. Skavang

### Individuals

- Bent Flyvbjerg, Aalborg University, DK
- George Steel, Indeco – Establishment of criteria and measurement methods for dealing with the functionality/utility of public works projects.
- John Clinton, Indeco - Contracts and organizational incentivitation
- Asmund Myrbostad, Health property planning. (Kompetansenettverket for sykehusplanlegging)
- CKWong, HyD, HKSAR
- Per Lægveid UIB, Rokkansenteret and Tom Christensen, UIO, Statsvitenskap (public management research, use of contracts at higher level administration, parliament, government) (Sture Berg Helgesen)
- Roger Miller (Roger Miller)
- Andrew Thomas/ccinw.com/ Construction Best Practice Programme/Constructing Excellence
- Dennis Lenard (proposed by Andrew Thomas)

## Models for decision-making in projects:

- USA, Capital Programming Guide
  - o <http://www.whitehouse.gov/omb/circulars/a11/cpgtoc.html>
- USA, OMB Program Assessment Rating Tool
  - o <http://www.whitehouse.gov/omb/budget/fy2004/performance.html>
- UK, Gateway model
  - o [http://www.doh.gov.uk/dh\\_nhsgatewayreviews/index.htm](http://www.doh.gov.uk/dh_nhsgatewayreviews/index.htm)
- UK, Prince 2 model
  - o <http://www.ogc.gov.uk/prince/>
- OECD best practices for budget transparency
  - o [http://www.oalis.oecd.org/oalis/2000doc.nsf/0/c125692700623b74c1256a4d005c23be/\\$FILE/JT00107731.DOC](http://www.oalis.oecd.org/oalis/2000doc.nsf/0/c125692700623b74c1256a4d005c23be/$FILE/JT00107731.DOC)
- Australia National Audit Office's homepage.
  - o <http://www.anao.gov.au/>