Systematic project planning and appraisal

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ABSTRACT

This paper outlines a version of the systematic approach to project planning (SAPP) adapted for water supply projects.

An extension of environmental impact analysis, SAPP is a flexible investment planning tool, incorporating global and human contexts, while being comprehensive, multi-disciplinary, integrated and interactive.

Based on previous work (Ref 1) by the author, this methodology recognises that sustainable human development is only possible through appropriate planning and investment.

A case study based on a major water supply project is used to illustrate the practical application of SAPP.

INTRODUCTION

As a part of her doctoral research, (Ref 1) the author reviewed the following:

- history of development
- history of technology
- case histories of technological development in Kenya and Britain

These studies led to the formulation of a developmental trend model (Ref 1, 2). When used to forecast future scenarios this model highlighted the urgent need for global human development calling for major changes in resource investment methods (Ref 1). These methods will have to be geared to meet the challenge of attaining sustainability in development. This will call for the development of investment planning methods which will ensure optimum and appropriate resource usage under global free market trade conditions.

A detailed study of existing appraisal methods (Ref 2) showed that, to meet future needs, this process will have to:

- include a global and human context
- be multi-disciplinary, comprehensive, flexible, integrated and interactive.

The systematic approach to project planning (SAPP) is the result of an attempt to develop an appraisal methodology fitting this framework of requirements.

THE SAPP FRAMEWORK

In the context of the systematic approach to project planning (SAPP), the planning process is viewed as shown in Figure 1.
Within this framework of project planning, components of the appraisal process which constitutes the bulk of decision-making are viewed as shown in figure 2 below.

**The Rationale**

To ensure a global and human context in project planning, the objective functions are linked to human qualities formulated in terms of the physiological, psychological and material needs of the target population in relation to general population. Next, measurement indicators are identified for each of the several aspects of the investment that will have to be integrated into a single system. Accordingly, the project analysis will involve use of many interactive variables. On the basis of Jewell's (Ref 3) assertion that a systems approach particularly lends itself to analysis of large and complex problems, a systems approach is adopted.

The systems analysis approach consists of the following steps (Ref 4):

1. State a goal, establish an appropriate measure of effectiveness and develop an objective function.
2. Determine the limits and establish a set of constraint conditions.
3. Determine a solution that achieves the stated goal and satisfies all relevant constraint conditions.

Several well tested appraisal methods, in particular cost/benefit analysis and the Environmental impact methodologies are currently used for project analysis. SAPP is not an alternative to these or other well known methods. Rather, SAPP, by creating a systematic framework for project analysis, extends the scope of application of these existing methods.

**SAPP Applied to Water Supply Projects**

**Step 1: System Definition**

The objectives are defined as:

<table>
<thead>
<tr>
<th>Human Need</th>
<th>Objective Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Physiological</td>
<td>Provide sufficient quantity and quality of drinking &amp; irrigation water</td>
</tr>
<tr>
<td>2. Psychological</td>
<td>Stress self sufficiency, management &amp; development of the project</td>
</tr>
<tr>
<td>3. Material</td>
<td>Provide as much water as possible for industrial and secondary needs</td>
</tr>
</tbody>
</table>

**Step 2: Define Limits and Constraints**

The user must define exactly which areas of activity will be considered. For a water supply project the system may be limited to the one shown in figure 3.

**Step 3: The Solution**

The solution proposed is to draw up a matrix of considerations against human needs as shown in figure 4 below. Each cell of the matrix is then analysed separately against a set of indicators.

Since all the effects of the project may not be quantifiable, qualitative analysis may have to suffice for some cells. Lack of data may also make it difficult to quantify some of the effects.

The user will also have to define the weights he may wish to attach to various cells. An example of a weighting system is shown in figure 6. The user can adopt a different system if required.
CASE STUDY – ACTUAL APPRAISAL

In 1897, construction was started of a railway line from the African coast to a cotton growing area inland. Preceding this a transport depot was established at a small watering place along the proposed rail route. This watering place has since developed into a major city. While the initial capacity of this initial water supply is not known, it has since been extended nine times. This case study is based on the eighth phase which upgraded this scheme by 53550m³/d to 203000m³/d. Figure 5 shows details of the actual appraisal done for this project.

GENERAL DESCRIPTION OF WORKS: Intake on river c, raw water pipeline, pumping stations, treatment works, distribution pipelines.

INITIAL CAPITAL COSTS

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost, K2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Intake</td>
<td>50 000</td>
</tr>
<tr>
<td>2. Raw water p/l</td>
<td>74 900</td>
</tr>
<tr>
<td>3. Treatment wks</td>
<td>740 000</td>
</tr>
<tr>
<td>4. Pumping sta</td>
<td>441 150</td>
</tr>
<tr>
<td>5. Dist pipelines</td>
<td>347 160</td>
</tr>
<tr>
<td>6. Power supply</td>
<td>8 200</td>
</tr>
<tr>
<td>7. Engineering 12%</td>
<td>392 407</td>
</tr>
<tr>
<td>8. Contingencies</td>
<td>339 308</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>3 303 214</td>
</tr>
</tbody>
</table>

DISCOUNTED CASH FLOW DETAILS:

- Internal rate of return: 10.14% p.a
- Mean output: 53 550 m³/d

OTHER COSTS: Annual costs: K268 000 (year 1) to K275 000 (year 1). Regenerative costs at years 15 & 30: K265500, Maintenance: K262 000 p.a

CASE STUDY – A SYSTEMATIC APPRAISAL

Figures 6 and 7 show results obtained by applying the systematic approach to appraisal of the case study project.

The analysis only shows part of the system matrix. In spite of this, a more comprehensive decision base than the actual analysis is evolved by using SAPP. Weighting of each cell offers a mechanism for measurement of relative importance of each cell in the final decision. The illustration contained in figure 6 shows 58.3% of the decision is in favour of accepting the project. By varying weights slightly a sensitivity test can be done. Thus if the weight of economic consideration is dropped to 0.6 and 0.1 of weight thus released is spread evenly over the rest of the decision, only 50.9% of the decision would be in favour of accepting the project.
REFERENCE


2. BAMBRAG K G. Technology, development and investment appraisal methods. ICE Conference on 'appropriate development for survival - the contribution of technology, 9-11 Oct 1990, London

3. ADAMS C R & SONG J H. Integrating decision technologies - applications for management curriculum. M.I.S quarterly, June 1989, p200 (article from periodical)
