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REVIEW ON RESEARCH ACTIVITIES CONDUCTED AT THE INSTITUTE OF NATIONAL PLANNING CAIRO WITH THE HELP OF THE COMPUTER IBM 1620

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THE INSTITUTE OF
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The utilization of computers in the preparation of national development plans in U.A.R. dates back to the early days of 1957 i.e. almost twelve years ago when the huge computers of today were still under the process of design and research.

The necessity of seeking the help of computers, in the preparation of these plans, cale as a consequence of development of operational models at the sectoral level and hence at the comprehensive national level. These models bringing into existence the attractive idea of optimality appeared to be superior to classical techniques of planning based on sets of balances and target setting approach. For example the formulation of linear programming models for investment planning were initiated prior to the preparation of the 1st five years plan covering the years 1960-1965. Work on this field started in an experimental basis and was initiated by Prof. Dr. I. HELMI ABD-EL-RAHMAN Under Secretary of National Planning at that time and by Prof R. FRISCH who was leading the first group of Operations Research Specialists formulated in this country by the support of Dr.ABD-EL-RAHMAN at the National Planning of that time.

In fact, there was a great competition between two approaches and two groups; one using traditional balances and target setting, the other trying to build up an operational model for global planning using as I said principles of linear programming and seeking computer help.

I do not like to disappoint you; by saying that 1st group won the battle. Our experiments were conducted without parallel effort in other inter connected fields of knowledge to supply the model with relevant data and information. The outputs were not completely workable. It was clear as one would expect that the success of effective plans is not a matter of computing facilities only, of course it is something more complicated than that. It is the outcome of a much more wider sphere of knowledge and research as we all know covering such fields as statistics, national accounts, mathematical programming and the like. But even these fields of knowledge are of little use unless scientific and technological progress touches closely every activity of our life. In this sense computers once more open great possibilities by the progress they bring to scientific research in a multitude of fields including social sciences & humanities.

The importance of tracing technological progress and planning the economic introduction of new & efficient means of production is a matter of great concern in our recent researches for the creation of more effective techniques of planning.

However, I would like to say that these earlier experiments were the real front for much more useful, septematic and effective methodologies of today.

Let me introduce few examples from these techniques:

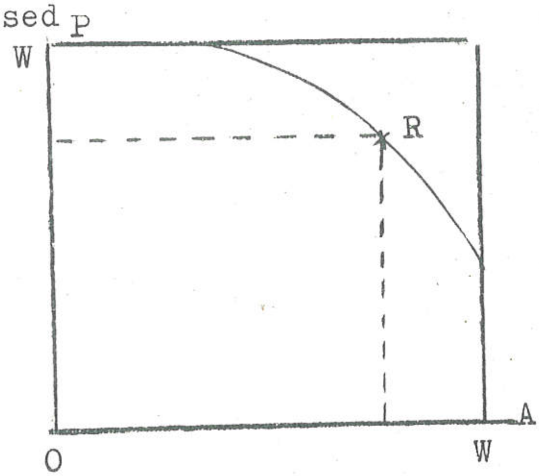
Ex (1) <u>The Optimal Utilization of Water Storage</u>

If a water storage, is to serve several purposes such as control of irrigation water, hydropower generation, protection of flood... etc.

If moreover the utilization of each purpose necessitates a certain seasonal pattern of discharge of water down-stream. A competition between seasonal uses may exist, one purpose may need more water at a certain season while the other needs less in this particular season. It is therefore necessary to find out a policy which compromises between alternative purposes and maximize some national or general objective.

For this purpose we may define a Complementarity Curve giving the levels of effective utilization of each purpose.

If this effective utilizations is expressed in terms of water units fully utilized in a certain year, the following conditions should exist at each point R on the complementarity curve



$$\alpha_i A \leqslant X_i$$
$$\beta_i kP \leqslant X_i$$

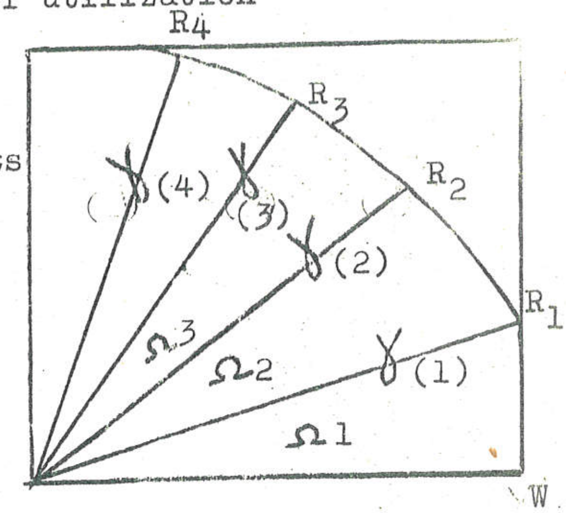
$$\Sigma X_i = \text{Operating storage } W \text{ say} \quad \text{Max } \Sigma f_i X_i$$

where A & P are two uses (Irrigation water & hydropower generated) ; α_i & β_i seasonal coefficients of demand for irrigation & power

X_i the discharge in seasin i, k energy transfer coefficient and f_i preference coefficient.

A simple rule of solving this program may be established when we define the relative coefficients of utilization

$$\gamma_i = \frac{\alpha_i}{\beta_i}$$



Hence if we rank these coefficients

$$\gamma_{(1)} < \gamma_{(2)} \ldots < \gamma_{(n)}$$

we notice that on

$$\beta_i \; kP < \alpha_i \; A$$

for all $i = 1, 2, \ldots n$

Thus R_1 the 1st point on the complementarity W curve is (W & $\frac{\gamma_{(1)}}{k}$ W)

On Ω_2 however $\beta_i \; k \; P \; \alpha_i \; A$ for $(i)=2,..n$

$$\beta_{(1)} k \; P > \alpha_{(1)} A \quad \text{for } (i)=(1)$$

Hence R_2 is defined by

$$X_{(1)} = \beta_1 \; k \cdot P \quad , \; X_{(i)} = \alpha_{(i)} \; A$$

for $(i) = (2), (3) \ldots . (n)$ and $\sum_{(i)=(1)}^{(n)} X_{(i)} = W$

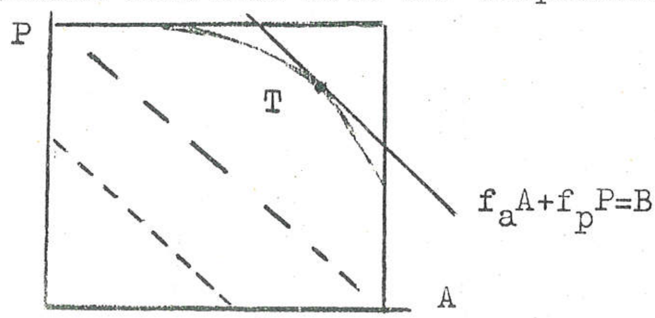
Proceeding in this manner $R_{(k)}$ is defined as follows:

$$X_{(i)} = \beta_{(i)} \; k \; P \qquad (i) = (1), (2), \ldots (k-1)$$

$$X_{(i)} = \alpha_{(i)} \; A \qquad (i) = (k), \ldots . (n)$$

$$\sum_{(i)} X_{(i)} = W$$

Proceeding in this manner, the complementarity curve can be generated. Hence the optimal point is derived as the tangent of the direction of objective function with the complementarity curve.



This is a simplified form of the original program which is a non-linear one when we take differences of head between up-streams and down-streams into consideration.