Nevertheless, it is the hope of the Research Group that our documents will provide planners with a basis upon which they can compile such programs. It should be emphasized once more that the Research Group has restricted itself to planning for regions in predominantly rural areas of developing countries, i.e. to regions where the income is largely generated in the agricultural sector. Although the outline also gives attention to the infrastructure and to other possible production sectors (secondary and tertiary), which can be expected to gain in importance in the future, it deals primarily with agricultural resources and production and with the socio-economic and institutional implications for the rural population. The Research Group hopes, should its outline prove useful, that other working groups will make the effort to elaborate similar outlines for those sectors that could only be treated superficially in this publication (industry, mining, transport, tourism, etc.). Should those outlines be compiled and published, regional planners will have at their disposal a set of guidelines which can be combined as the occasion requires.

6.2 Network analysis of the planning process

In analyzing the interdisciplinary process of regional planning, we made use of network analysis, one of the systems approach methodologies developed in the last decades by Management Science. The principle of the *systems approach* is that the object of study is conceived as a 'system'. Churchman defines the concept 'system' as: 'a set of parts co-ordinated to accomplish a set of goals'. A systems approach strives to identify all the active factors of the system in question, to account for their relationships, and to depict them in a schematic model.

For the analysis of processes in which there is a question of a large number of connected activities, the network method is a very useful tool. The process to be analysed is split into components that are clearly distinguishable either by their nature or by the agent (department, discipline etc.) responsible for them. Every component thus identified (further referred to as *activity*) is described briefly and given a code number. Also indicated are the interdependences of the activities, which become apparent from their logical sequence within the operational process. Expressed abstractly, the activities are subject to a time function.

The *relationships* between the activities lend themselves to reproduction in

a relation diagram (or dependency graph), the horizontal axis of which indicates the time direction. See the examples in Figure 6.

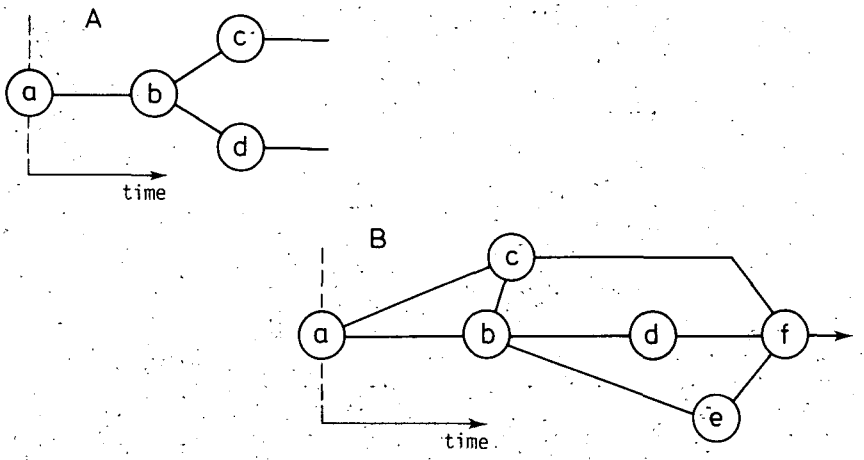

Fig.6. Principle of network representation

The activities are indicated by a graphic symbol: either a key word or a code number. Connections by lines indicate the dependence between two activities. Figure 6A, for example, expresses that activity *b* can only be done after activity *a* has been completed. Activity *b*, in its turn, is the starting point for activities *c* and *d*, which can be executed parallel to each other. Figure 6B shows a situation whereby, as a result of multiple dependency, a simple network occurs. In this case, to execute activity *c*, the results from *a* and *b* must be available; *f* can only be completed after receipt of the results of *c*, *d*, and *e*. Activity *d* must await the data from *b*, but is not dependent on *c* and *e*.

The shape of the lines (straight, broken, or curved) is not important, provided that the necessary sequence of connected activities is clear[1].

To satisfy the requirements of the Research Group and especially to give a clear insight into the interdisciplinary cooperation, we arranged the diagram as a *functionalized* (or classified) *network*.

---

[1] *A large number of variants of network planning have been developed in the last decades; many have been made suitable for computer processing. The one we used is the simplest form of the 'precedence method'. For further information reference is made to the extensive literature on the subject. A review can be found in Woodgate H.S., 1971. Planning by Network; Business Books Limited, 2nd edition.*

For this purpose we subdivided the diagram into horizontal strips that correspond to each of the relevant disciplines, reserving one strip for specific joint (i.e. interdisciplinary) activities. The principle is sketched in Figure 7.

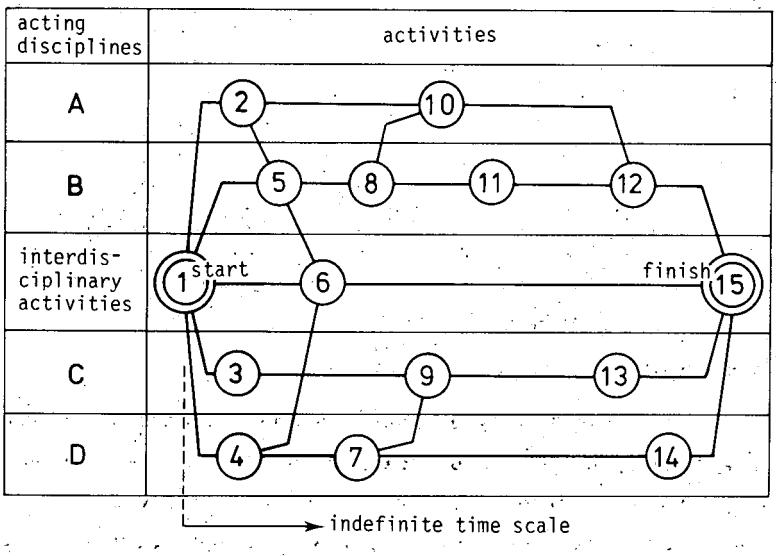

Fig.7. Principle of a functionalized relation network

In this example four strips are reserved for the activities of the disciplines A to D and a central strip for interdisciplinary activities (numbers 1, 6, and 15). Variations can be made in the graphic symbols, e.g. to express the particular nature or the relative importance of certain activities (cf. 1 and 15).

One should be aware that the time axis in such a relation diagram is only of relative meaning, merely indicating the logical sequence and not a real time interval. To make the diagram applicable to a specific case, one has to transpose it into an actual time diagram. By putting a time value on each of the identified activities, naturally in consultation with the disciplines concerned, it is possible to translate the relation diagram into an actual time diagram.

The advantages of using network planning for the process of regional planning are that it:[1]

[1] *adapted from Woodgate (1971)*

emphasizes the relations between the separate activities;

reveals the need for close collaboration;

identifies the position of each discipline in relation to the rest of the planning operation;

enables a better understanding of the timing of the contribution required from each participant;

allows more detailed planning and scheduling;

indicates possible reductions in the duration of activities or in the entire operation;

permits a better cost planning and control;

indicates possible savings in scarce resources: manpower, money, or specialized equipment;

identifies critical activities requiring management action;

makes it possible to produce meaningful progress reports during the planning.

6.3 The instrumental documents developed by the Research Group

The instrumental documents developed by the Research Groups are the following:

1. A synthesized overview; Figures 8, 9, and 10. See pages 78 a, b, c.
2. A numbered list of identified activities; Annex I.
3. A functionalized relation diagram for these activities; Annex II (Charts I, II, and III).
4. A definition of each discipline's task and interdisciplinary function; Annex III, Section 1.
5. A structured checklist of data to be collected per discipline; Annex III, Section 2.
6. A numerical review of the activities of each discipline; Annex III, Section 3.
7. Numerical reviews of the organizational activities of the teamleader and the key members; Annex IV.

An explanation of the contents of each to the these documents follows.

(1) Synthesized overview (see Figures 8, 9, and 10 at the end of this chapter)

This diagram serves as a general orientation of the planning procedure. It is a rough sketch of the groups of activities that are further elaborated in Annex II. Key words in boxes represent the major groups of activities. Some code ciphers correspond to the more detailed descriptions in Annexes I and II.

(2) Numbered list of identified activities (Annex I)

Column 3 of this list contains concise descriptions of the activities identified by the Research Group, each activity being marked by its code number. To distinguish an activity, the following criteria were applied:

> it must contain a logical, more or less homogeneous task;
>
> it must be executed by one specific discipline or by a certain combination of disciplines[1];
>
> it will usually result in an intermediate item of information, to be transferred to one or more other disciplines, either for their use or for an interdisciplinary amalgamation. Such items of information will usually be presented in the form of a document.

The activity descriptions are meant as suggestions, to be adjusted according to needs.

The code numbers refer to the relation diagrams in Annex II. For the code number grouping see under (3).

The three other columns in the list contain the following data.

Column 1. Preceding activities. Listed in this column are the number(s) of those activities that directly precede the described activity and must be completed before the activity proper can be undertaken.

Column 2. Succeeding activities. Listed in this column are the number(s) of those activities that directly succeed the described activity and can be undertaken only on completion of the activity proper.

Column 4. Responsible executor(s). Indicated by abbreviations in this column are the participants (agency, discipline) who will execute the activity. Because an activity is often a collective effort, each participant's degree of responsibility must be indicated. The following distinctions were therefore introduced:

> *Mainly responsible:* he is responsible not only for his own disciplinary contribution, but also for the coordination of the contributions from the other participants.
>
> *Obligatorily assisting:* he is responsible for providing the coordinator with his contribution.

---

1 *The term 'discipline' is used here as meaning the team member responsible for the execution of the activities in a specified branch of science. This interpretation allows one and the same expert to be responsible for several disciplines at the same time.*

Optionally assisting: he will probably be requested (by the mainly responsible) to provide a certain contribution; this will be decided by circumstances.

Some activities require everyone's participation. This is indicated as: 'all disciplines' or 'all team members'.

(3) Functionalized relation diagram (Annex II)

In accordance with the principles described under 6.2., the identified activities are arranged in the network of a functionalized relation diagram. The horizontal axis is divided to correspond to the stages and (where possible) the steps that were distinguished in Chapter 4. On the vertical axis, areas are blocked out for each of the required disciplines. Operationally-related disciplines are grouped into five major functional blocks (broad fields) on both sides of a central block (synthesis bar) which is reserved for the interdisciplinary activities. By means of numbered symbols the activities are set out in the relevant areas and in their logical succession. The interdependencies between activities are indicated by connecting lines.

The graphic presentation leaves a certain choice open. The rules we used were:

Major interdisciplinary items (two or more obligatorily cooperating disciplines) are represented in the synthesis bar.

Monodisciplinary activities (even if optional assistance from others is to be expected) are represented in the relevant discipline area.

In the case of collaboration between related disciplines within a major broad field, the simplest form of presentation has been chosen to avoid a confusing graph with numerous up and down connecting lines.

To avoid an excess of connecting lines, these are combined where applicable; e.g. where an activity precedes a number of others, or the reverse. For further details, see the legend of Annex II.

The code numbers of the activities function exclusively as a reference between Annexes I and II. For a quick identification of the groups of activities, the digit series have been brought together per major functional block (broad field), the first digit indicating the relevant group.

Code numbers	Major blocks
1 - 200	synthesis
201 - 400	social/institutional
401 - 600	economics
601 - 800	production-oriented
801 - 900	physical resources
901 - 999	physical infrastructure

It should be noted that the digit series are not complete (i.e. space left for additions as required), and that the numbers as such do not necessarily indicate the sequence of the activities.

For practical reasons the diagram is spaced over three separate sheets:

- Chart I : contains the stages: Preplanning (0) Preparation (1) and Reconnaissance (3)
- Chart II : contains the stages: Main field studies (4) and Additional field studies (5)
- Chart III : contains the stages: Preparation Draft Plan (5) and Final Reporting (6)

Annex III presents, for each separate discipline, three separate documents. These documents were prepared not only to outline the assignment content of each discipline but also to give team members an insight into the work of their fellow team members and thus provide them with a better understanding of the need for well prepared collaboration.

(4) The discipline's task and interdisciplinary function (Annex III, Section 1)

Section 1 contains usually the following sub-sections:

- Main features of the task
- Interdisciplinary function
- Required professional expertise
- Normal working methods and sources of information
- Specific constraints.

(5) Structured checklist of data to be collected (Annex III, Section 2)

This checklist is meant to serve as a guide in compiling a program of activities for each discipline. It will also serve to remind the discipline concerned whether certain data should or should not be included in his studies.