


Subject:	ORGAPET Annex B3-1: An introduction to network analysis (Version 4)	
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Network Analysis

A network is defined as a set of actors and a set of relationships connecting them (Wasserman & Faust 1999). Prior to an analysis one has to decide which actors to include in the network. It is crucial to clearly define the network boundaries and network analysis is best used for a clearly defined process. With regards to the evaluation of organic action plans one should therefore decide which phase in the policy cycle should be evaluated and include those stakeholders that participated in this phase. That is, the network actors to be considered will vary according to preparation, formulation and implementation of the action plan. To identify the most important stakeholder participating in the process one should consider a multi-step approach:

1. **Choose the relevant actors of the process**
 - a. View the list of organisations and institutions participating in this process, e.g. in hearings
 - b. Delete all those belonging to one and the same organisation and are just from different departments; choose one of them as representative for the whole organisation
 - c. Check who of the organisations/ institutions is regularly attending the hearing (or whatever the process may be) and delete those who are not, e.g. this could be youth organisations of organisations attending
2. **Identify other important organisations** who, in principal, play an important role for agricultural policy and / or organic farming policy, but (for some reason) were not participating in the policy process chosen under 1.
3. **Ask state institutions** (on national level) which organisations and institutions they consider as important in the two policy fields of general agriculture and organic farming policy. (It could possibly be useful not only to consult the Ministry of Agriculture, but also the Ministry of Environment). For finding the right informants you should especially focus on the persons responsible for writing statements of views in the ministries as they might have the best overview over the network.

Step 2 and 3 are only relevant when the evaluator believes that stakeholders who were not directly involved in the Action Plan process have had a considerable influence on it.

Network analysis can focus merely on the formal participation of stakeholders documented through their comments or participation in hearings etc. A more comprehensive analysis however also includes informal relationships between the stakeholders. This may be relevant as in policy processes influence is often exerted

not only through the official channels, but also by informal contacts, lobbying and agreements. In this case, interviews with the stakeholders identified in step 1 to 3 complement the information about the relationships between the network actors. Relevant relationships are (Moschitz & Stolze 2006):

- Joint participation in events related to the Action Plan preparation/formulation/implementation
- Collaboration
- Exchange of information (whereas giving and receiving information can be covered by different questions)
- Reputation: Who is (are) the (three) most important actor(s) for the process?

Network analysis uses different measures to describe the networks and analyse the position of actors within:

Density

The density of a network is defined as the proportion of arcs (directed links) present (Kephart, 1950). It is calculated as the number of arcs L , divided by the possible number of arcs $n(n-1)$, where n is the number of nodes in the network. In a directed graph (as in our case) the density Δ is:

$$\Delta = L/n(n-1).$$

The density of a network gives an idea of how much interaction takes place between actors within a network. It varies between a value of zero and one; a density value of zero indicates no links between the actors and a value of one the maximum possible links between the actors. Density is usually presented as a percentage value, where 100% would then signify that all actors are interacting with each other reciprocally.

Network density indicates the importance of a policy. If the organic farming action plan was of low interest there would not be much activity in the network, because all actors would focus more on other policy issues than on organic farming (probably except for the organic farming organization). In consequence, we could not expect much influence of policy networks on policy outcome.

The power of actors: reputation and prominence

Finding the actor that is most powerful or that has the strongest influence in a network is one of the primary targets of network analysis. One way of conceptualizing power is on the basis of positively related networks of influence.

Reputation

One can describe power in such a network of influence simply by looking for the expression of power, that is the reputation of an actor to have influence in the network. Power thus is perceived power. We index this reputational power of an actor as P_r and define it as the proportion of interviewees who named this actor as influential for the policy in question (Sciarini 1996). **This is a measure that can only be evaluated by interviewing the stakeholders.**

Prominence: prestige and centrality

The second power model based on positively related networks considers those actors as powerful which exert an influence on many others. Different authors have discussed this concept and particularly Knoke and Burt (1983) contributed to the discussion by distinguishing two types of actors' power which they called

prominence: prestige and centrality. An actor is prestigious when it receives a lot of ties from other actors in the network. An actor is central when involved in many ties (regardless of the direction of ties).

Prestige

A common measure of prestige is the degree centrality C_D (Freeman 1978/79). It is a local network measure of the level of activity of an actor with its immediate neighbours. In a directed graph it is necessary to consider two cases depending on the direction of the arcs between two actors, the in-degree and the out-degree. For comparison between networks of different size these measures are standardized to C'_D by dividing the absolute values by the possible maximum value of the degree which is $n-1$:

$$C'_D(n_i) = d(n_i)/n-1$$

The in-degree, d_i , of a node n_i indicates the number of arcs terminating at this node. It describes the number of actors that name this specific actor as a target of direct interaction. Thus, we can interpret it as an indicator of the actor's prestige (degree-prestige). The more other actors from the network name a specific one as target of immediate interaction, the higher its prestige.

The out-degree, d_o , of a node n_i is the number of arcs originating from this node. It informs about the number of actors with which one specific actor states direct interaction and can thus be seen as a measure of how pro-active an actor is in a network. However, the out-degree is not used for building a concept of power.

Betweenness Centrality

Betweenness centrality C_B (Freeman, 1978/79) is a global network measure of the power of an actor, i.e. it measures the involvement of an actor in relations with other actors regardless the direction of relations. Furthermore it also considers indirect links with other actors (Wassermann and Faust, 1999).

Actors with a high betweenness centrality have the potential to control communication within a network and take the role of coordinators in group processes (Freeman, 1978/79). Hence, this measure describes the potential of a network actor to act as information broker and informs about its overall activity level. An actor is central if it lies between other actors on their shortest link (the so-called geodesic), i.e., if these two actors want to interact with each other they have to pass via the central actor. A large betweenness centrality of an actor signifies that it is between many pairs of actors on their geodesics.

Again, this measure is standardized to enable cross network comparison. For a directed graph the standardized measure of betweenness centrality C'_B is:

$$C'_B(n_i) = C_B(n_i)/[(g-1)(g-2)]$$

$$\text{With } C_B(n_i) = \sum g_{jk}(n_i)/g_{jk}$$

where g_{jk} is the number of geodesics linking the two actors j and k .

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