# Structural involvement and specialization in the European Framework Programme: the case of Austria

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## Research subject

In the context of endogenous growth theory, innovation and knowledge diffusion are key vehicles for economic competitiveness (Romer 1990). For successful innovation, research collaborations and networks are crucial to cope with increasing market pressures in a globalising world, liberalisation of markets, new technologies and changing patterns of demand (e.g. Powell and Grodal 2005). From this perspective, it seems natural that modern science, technology, and innovation policies shift emphasis on stimulating R&D networks and interactions between innovating actors. The support of pre-competitive R&D networks is fostered by the European Framework Programmes for research, technological development and demonstration activities (EU-FP), a cornerstone of EU policy in this context.

The evaluation of participation in the EU-FPs, in particular its wider impact, is a hot topic on the national level. In the political discussion often simple measures of involvement are used, which sometimes lead to ambiguous results regarding the "success" of countries regarding their participations in the FPs. On the one hand, the number of project participations, project coordinations, or success rates is measured, on the other hand, the acquired funds are taken into account, as numerous monitoring and evaluation studies related to the national level show (e.g. Austria, China, Finland, Germany, Sweden, Switzerland, and UK). Reconsidering the focus of the EU-FPs on strengthening collaborative activities, we suggest to take into account measures of structural involvement in these networks. One of the crucial challenges in this context is to develop analytic methods of the effects of involvement in European networks, and how to translate empirical analyses of the European R&D landscape into policy implications concerning governance and future design of national RTI strategies (Barré 2010).

The focus of this study is on the Austrian participation in the EU-FP. The objective is to put input-oriented measures, e.g. participation numbers and acquired funds, in relation to the structural involvement of Austrian participants in specific thematic areas. The analysis focuses on the specific programme COOPERATION in FP7. Data is taken from the EUPRO database maintained by AIT Austrian Institute of Technology GmbH (Barber, Heller-Schuh et al. 2008) and covers projects starting between 2007 and 2009 with at least one participant located in Austria. We employ methods and tools from social network analysis, and define a new measure for the structural involvement of Austrian participants in a specific thematic area[1]. By this, the study departs from previous empirical work by pointing to further valuable indicators for the evaluation of the involvement of countries in EU-FP networks. We combine this indicator with classical performance indicators that are already used in evaluations, such as participation

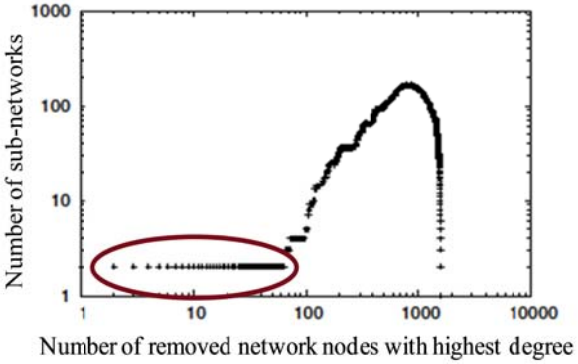
1 Health (FP7-HEALTH), Food, Agriculture and Fisheries, Biotechnology (FP7-KBBE), Information & communication technologies (FP7-ICT), Nanosciences, nanotechnologies, materials & new production technologies (FP7-NMP), Energy (FP7-ENERGY), Environment including Climate Change (FP7-ENVIRONMENT), Transport including aeronautics (FP7-TRANSPORT), Socio-economic Sciences and the Humanities (FP7-SSH), Space (FP7-SPACE), Security (FP7-SECURITY)

counts. From the findings, strategies for national policy development and its implementation can be derived for the specific thematic areas that make explicitly use of the networking potential of the existing national community.

## Methodology

The novel aspect of our structural analysis of networks is the identification of backbones. This notion refers to a set of key nodes in a network that determine its overall structure (e.g. Glattfelder and Battiston 2009). In the context of R&D networks, we define the backbone as the set of the most central organizations – regarding degree[2] – that inhibit the network from disintegrating into isolated sub-networks (Heller-Schuh, Barber et al. 2010). The backbone is identified by recurrent removal of the organization with the highest degree, until the network falls apart in sub-networks for the first time (see Figure 1).

**Figure 1: Identification of the backbone in a collaboration network (FP7-TRANSPORT)**




In this study we detect the European backbone for each thematic area of the COOPERATION Programme. To evaluate Austrian involvement therein, we characterize Austrian activities by two different parameters, first, the level of activity, and second, the level of connectedness of the Austrian organizations to the European backbones. These parameters are defined as follows: The level of activity is related to the (relative) number of Austrian participations, actors and projects, whereas the level of connectedness is defined as the average proximity[3] of the Austrian organizations to the backbone of the collaboration network.

## Existing and expected results

We find above-average levels of Austrian activity and high levels of connectedness in the thematic areas information & communication technologies, security, environment, as well as socio-economic sciences and humanities (see Table 1). This group of thematic areas is thus decidedly strong and intensively interlinked on the European level – either by being itself part of the European backbone (FP7-SSH, FP7-ENVIRONMENT), or by exhibiting many organizations close to the European backbone (FP7-ICT, FP7-SECURITY). In transport and space research, high levels of activity are accompanied by low levels of connectedness. Both fields show broad project and networking activities but lack strategic connectedness with European key players.

2 The degree of a node is the number of direct neighbours, i.e. the number of partners of an organization in the network.

3 Proximity is defined as the inverse of the mean geodesic distance.

**Table 1: Austrian participation in thematic areas by levels of activity and connectedness (FP7-COOPERATION)**

| | | Level of connectedness | |
|---|---|---|---|
| | | **Low** | **High** |
| **Level of activity** | **High** | FP7-TRANSPORT<br>FP7-SPACE | FP7-ICT<br>FP7-SECURITY<br>FP7-SSH<br>FP7-ENVIRONMENT |
| | **Low** | FP7-HEALTH<br>FP7-KBBE | FP7-ENERGY<br>FP7-NMP |

Source: Heller-Schuh et al. 2011

On the other hand, Austria exhibits high levels of connectedness despite low levels of project activity in energy and nanosciences. Thus, connectedness may serve as a strategic asset for increased national performance in these fields. Finally, low levels of activity and low connectedness characterize the thematic areas health and knowledge-based bio-economy. This finding is notable since the life sciences have attracted a substantial share of national R&D funding in Austria (Austrian Council for Research and Technology Development 2009).

## Summary and concluding remarks

The network-related analyses of Austria´s position in the different thematic areas of COOPERATION in FP7 reveal a substantial heterogeneity regarding structural involvement and specialization. These results have to be discussed in the foreground of the relevant sectoral innovation systems in Austria, and will serve as an important input for national policy formulation as well as the development of implementation strategies regarding future involvement of Austrian communities at the European level.

Furthermore, with this novel measure it becomes feasible to test whether closely involved organizations produce more output than those in the periphery of the network. Thus, the structural involvement of an organization may serve as a potential additional determinant of scientific and technological output (publications, patent applications) – this being a new step towards measuring the impact of collaboration.

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