As already mentioned the research project on institutional collaboration will be extended with the links between USA and Europe. But in the paper about collaboration (Chapter 5, Section II) some other issues were raised that deserve more attention. The first one is the issue of collaboration between more than two partners creating more different types of collaboration and the second one deals with the assumed complementarity of collaborating partners.

3.1 Combination of types of collaboration

Striking in the paper about collaboration was the difference between citation indicators for international collaboration and those for ‘Within Europe’ or ‘Outside Europe’. Both the latter types had higher citation indicators than the set of papers with international collaboration. Table 47 contains the average RCR values for the three types of collaboration.

<table>
<thead>
<tr>
<th>Collaboration</th>
<th>International</th>
<th>Within Europe</th>
<th>Outside Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO</td>
<td>1.19</td>
<td>1.28</td>
<td>1.28</td>
</tr>
<tr>
<td>AGR</td>
<td>1.24</td>
<td>1.32</td>
<td>1.38</td>
</tr>
<tr>
<td>MDS</td>
<td>1.18</td>
<td>1.26</td>
<td>1.22</td>
</tr>
<tr>
<td>GSS</td>
<td>1.32</td>
<td>1.38</td>
<td>1.42</td>
</tr>
<tr>
<td>TNS</td>
<td>1.10</td>
<td>1.16</td>
<td>1.15</td>
</tr>
<tr>
<td>CHE</td>
<td>0.99</td>
<td>1.02</td>
<td>1.11</td>
</tr>
<tr>
<td>GRM</td>
<td>1.67</td>
<td>1.87</td>
<td>1.87</td>
</tr>
<tr>
<td>SPM</td>
<td>1.51</td>
<td>1.66</td>
<td>1.59</td>
</tr>
</tbody>
</table>

Table 47. RCR values for papers with different types of collaboration

‘International Collaboration’ implies at least one of the two other types. So whenever a publication is collaboration ‘Within’ or ‘Outside’ it must be in the set of papers with international collaboration. Also any paper in the set of international collaboration must be in at least one of the two other sets. Having these relation between the three types of collaboration one might expect that the RCR score of international collaboration would be the average of the RCR values of the two other sets. As shown in table 47, this is not the case. Instead of a RCR value for the international collaboration papers that is in between the two subsets, the RCR value is clearly below the values of both subsets.
The only reasonable explanation for this effect is that a selection of papers with high values on the RCR is present in both sets (Within and Outside Europe). The addresses mentioned on these papers contain at least three different countries (two in Europe, one outside). This hypothesis has to be tested.

Instead of using the two types – ‘Within’ and ‘Outside’ of collaboration, papers will be divided into different mutually exclusive classes that allow to assess the role of each type of collaboration.

An example of such a set of mutually exclusive classes could be

- Only Within Europe Collaboration
- Both Within and Outside Europe Collaboration
- Only Outside Europe Collaboration.

Within each of these classes RCR values will be calculated and ANOVA or non-parametric tests will be used to test whether there are differences between these types of collaboration. By adding our classification scheme for institutions in eight different groups we can also test for interaction effects between research profile and types of collaboration.

### 3.2 Collaboration patterns

The results of the collaboration study seem to suggest that institutions tend to seek partnerships not with the most alike others but more with institution that can offer complementary competences. Many researchers in the fields of Organizational or Social Psychology (see Curseu, 2003 for an overview) have studies this at the level of interpersonal relations.

According to Jackson (1992) or Cherrington (1994) a team or group of collaborators is homogenous as its members are similar in one or several aspects. As a consequence, groups or teams are considered heterogeneous if the members differ on one or several aspects. It is clear that several dimensions or aspects can be identified while considering a team’s composition as being homogenous or heterogeneous.

For the scientific endeavour, which can be seen as an intellective and creative task involving problem solving and creative idea generation, aspects or dimensions related to member’s abilities, skills or competences are relevant. Jackson (1992) and Shaw (1981) showed that heterogeneous groups are more creative and effective than homogenous groups at solving complex problems. Volkema & Gorman (1998) showed that the composition of the team only plays a significant role in interaction with the formulation of the problem. The results by Devine (1999) on the other hand did not show any difference in performance between groups with diverse cognitive abilities and more homogenous ones.
In order to apply this paradigm to the assessment of the impact or influence of diversity in collaboration on research performance at institutional level several assumptions have to be made and tested.

Competences of a particular person/team or institution can be derived from the papers already published. These competences can be expressed by the research profile which indicates the level of specialisation.

In a more formalized research environment institutions or departments become the initiators of collaborative relations. These collaborative relations are based on the needs of the institution or departments as a whole.

Both assumptions then allow to test the hypotheses that institutions tend to seek complementarity in their partnerships in order to enhance their research performance.
References


