Chapter 2
Composition and Performance of Research Training Groups

Birgit Pferdmenges, Kerstin Pull, and Uschi Backes-Gellner

2.1 Introduction

In the early 1990s, a new, more competitive oriented form of governance for PhD education in Germany was established: the so-called Graduiertenkollegs (Research Training Groups – RTGs). RTGs were introduced by the German Research Foundation (Deutsche Forschungsgemeinschaft) as a major intermediary in the governance of research in Germany. They are run by a group of cooperating researchers and include a study programme covering a set of doctoral and postdoctoral projects. The study programme is compulsory for the RTG students and is held to provide them with methodological skills and specialised knowledge in a particular field of research. The German Research Foundation grants fellowships to the RTG students as well as funds for travel expenses and equipment. Until March 2003, a grant consisted of an initial funding for a period of three years that could be renewed twice; since April 2003, a grant has consisted of a funding for 4.5 years, and this period can only be renewed once. At present, about 240 Research Training Groups are funded by the German Research Foundation (see DFG 2010; Unger et al. 2010).

Among the most prominent governance mechanisms used to steer the RTGs is the explicit call for interdisciplinarity and internationality by the German Research

B. Pferdmenges (✉)
University of Applied Sciences, Saarbruecken, Germany
e-mail: birgit.pferdmenges@htwsaar.de

K. Pull
Tübingen University, Tübingen, Germany
e-mail: kerstin.pull@uni-tuebingen.de

U. Backes-Gellner
Zurich University, Zurich, Switzerland
e-mail: backes-gellner@business.uzh.ch

D. Jansen, I. Pruisken (eds.), *The Changing Governance of Higher Education and Research*, Higher Education Dynamics 43,
DOI 10.1007/978-3-319-09677-3_2

Foundation (see DFG 2008). While apparently hoping for positive effects of interdisciplinarity and internationality (with the call for interdisiplinarity being closely linked to the discussion on the increasing relevance of mode 2 research; see e.g. Jansen et al. and Laredo in this volume), surprisingly little is known on the outcomes of this kind of input-oriented external governance pushing in the direction of more interdisciplinarity and internationality which is further being promoted by an increasingly competitive model of PhD education (cf. Bonaccorsi in this volume) fostered by the introduction of RTGs: Will more interdisciplinarity and internationality among RTG students in fact increase RTG performance or not? In what follows we will shortly review the literature and then present first empirical evidence on the question.

2.2 State of Research

The impact of RTG composition on RTG performance has not been analysed as yet. In the light of the fact that the scientific environment proves to be increasingly important for knowledge production (see Carayol and Matt 2004; Stephan 1996), this would indeed seem surprising. The trend towards more collaboration in scientific work manifests itself – among others – in a well-documented increase in co-publications (see e.g. Rigby and Edler 2005: 785; Adams et al. 2005) and in authors increasingly acknowledging the help of others in their own work (Giles and Councill 2004: 17603 f.). Hence, we regard RTGs as shaping the relevant or at least one relevant scientific environment for RTG students, and in what follows refer to the general literature on (research) team composition and performance even though the performance of an RTG (as measured by the doctoral completion rate and by the scientific visibility of its students, see below) might not in general be regarded as being the outcome of a true team production process.

As far as studies on the relationship between research team composition and team performance are concerned, these are also few and far between and, moreover, they lead to contradictory results. E.g. Porac et al. (2004) study research cooperations on the analysis of ecosystems on the one hand and cooperations in the field of astrophysics on the other. While for the former, they detect a positive effect of interdisciplinarity on research output, for the latter they identify a negative one. The latter result is in line with the work by Jansen (2007) highlighting the potential problems of interdisciplinary research. Hollingsworth (2002), however, presents empirical evidence for a hump-shaped relationship between interdisciplinarity of research groups and their innovativeness. In light of the inconsistency of empirical findings, Porac et al. (2004: 675) conclude that "much more research is necessary" concerning research cooperations and alliances in order to better understand the relationship between research team configurations and performance (see Bell and Kravitz 2008: 301 for a similar claim).

Furthermore, what is true for research teams in particular is also true for the general question of team composition on team performance – in spite of a vast and

growing body of literature. Accordingly, Harrison and Klein (2007: 1199) conclude their recent review on the subject, stating that findings on the relationship between team composition and team performance have been "weak, inconsistent or both".

From a theoretical perspective, these mixed empirical findings may be the result of two countervailing effects: (i) On the one hand and highlighted by the so-called resource perspective (see, e.g. Gruenfeld et al. 1996; Hambrick and Mason 1984; Jackson 1992; Thomas 1999), team heterogeneity may indeed have positive effects on team performance if team members possess distinct knowledge bases or abilities that are relevant for the production process. (ii) On the other hand, however, team heterogeneity may also negatively affect team performance because the communication between team members is endangered, conflicts arise and the group cohesion is reduced (so-called process perspective, see, e.g. Byrne 1971; McPherson et al. 2001; Pelled et al. 1999; Tajfel 1974, 1981; Turner 1975, 1987).

While the net effect of team composition on team performance hence remains unclear from a theoretical as well as from an empirical perspective, we hypothesise that it will (a) depend on the type of team heterogeneity (interdisciplinarity, internationality) and (b) on the disciplinary field (humanities and social sciences vs. natural and life sciences). While the latter hypothesis is motivated by our earlier study on the RTG performance in these two different disciplinary fields (see Unger et al. 2010), the former is based on an extensive body of literature concerning the potentially differing effects of functional as opposed to demographic heterogeneity: While internationality as a form of demographic heterogeneity is regularly argued to have a negative net impact on team performance, resulting from enhanced communication problems, the potential for conflicts and reduced group cohesion (see, e.g. Jehn et al. 1999; Pelled et al. 1999; Smith et al. 1994), the interdisciplinarity being part of the so-called functional heterogeneity is typically regarded as being net performance-enhancing at least as long as it is related to the team task. Moreover, functional heterogeneity is less likely to be linked to identity than demographic characteristics are and consequently less likely to cause social categorisation (see, e.g. Ancona and Caldwell 1992; Jehn et al. 1999; Pelled et al. 1999). Both theoretical claims, namely the potentially net performance-enhancing effect of functional heterogeneity as well as the potentially net performance-reducing effect of demographic heterogeneity are mirrored well in empirical studies (see, e.g. Hagedoorn et al. 2000; Cannella et al. 2008 for the former and Thomas et al. 1996 for the latter).

2.3 Data and Measures

Our empirical analysis is based on a data set of 86 RTGs funded by the German Research Foundation (DFG). It comprises all Research Training Groups from the humanities and social sciences and the natural and life sciences who are in their second funding period and who submitted an application for a third funding period to the German Research Foundation between October 2004 and October 2006 (see

Unger et al. 2010 for the details). 28 of the 86 RTGs in our data set belong to the humanities and social sciences, 58 RTGs belong to the natural and life sciences.

(a) *Dependent Variables: RTG Performance*
The performance of the Research Training Groups is measured by their scientific visibility (number of publications) and by the doctoral completion rate. Both are measured per funding year in order to control for varying RTG sizes and for varying degrees of student fluctuation among RTGs. While the doctoral completion rate is an obvious measure of the RTG performance, a measure of the scientific visibility is added in order to account for the fact that RTG students were established to train the next generation of researchers who should hence be introduced to the process of scholarly publication. When collecting the data, we counted all kinds of publications of RTG students: monographs, editorships, journal articles, book sections in edited books, conference proceedings, discussion papers, published abstracts, and reviews. We adjusted the publications according to the number of authors and allocated a fraction of 1/n to each author (see, e.g. Egghe et al. 2000: 146).[1] We decided to use all publications instead of just counting journal articles as an indicator for research performance for the following reasons: Firstly, the indicator "total publications" proves to be a good predictor of the German Research Foundation's decision to approve the application for a third funding period. As the decision to either approve or reject an RTG's application is based on the well-founded judgement of experts in the respective field, we are confident that the indicator "total publication" measures RTG performance. Secondly, by not only including journal articles we account for differing modes of publication (in the natural and life sciences, journals are the predominantly used publication outlet, whereas in the humanities and social sciences book sections represent the dominant mode of publication; see Unger et al. 2010). Finally, as we do not dispose of a comprehensive journal ranking including all the different journals from all the different subjects and subdisciplines covered in our data set, the main advantage of using an indicator of scientific visibility based on (appropriately weighted) journal articles only, was not an option.

(b) *Explanatory Variables: RTG Composition*
To capture heterogeneity, we calculate the widely used index of heterogeneity (Blau 1977). It is defined as

$$H = 1 - \sum_{i=1}^{n} s_i^2$$

with n representing the total number of categories of a variable, and s_i the fraction of team members falling into category i. We calculate Blau's index

[1] Whenever the number of co-authors was not specified in the research reports but the expression "et al." hinted at a joint production of publication outputs, we supplemented our data from the RTG research reports by information gathered from the internet.

concerning (i) the field of study and (ii) the nationality of the doctoral and postdoctoral students in an RTG. As fields of study we distinguish 22 different fields according to the ISCED; concerning the nationality of RTG students we distinguish nine cultural regions according to the classification by Huntington (1996). Afterwards the figures are normalised on the interval [0,1] (see Alexander et al. 1995: 1466).

2.4 Descriptives

As the descriptive statistics reveal, performance as well as heterogeneity vary considerably between the disciplinary fields and also between individual RTGs within one disciplinary field.

2.4.1 RTG Performance

Number of publications: Fig. 2.1 first displays the number of publications per funding year, both for the humanities and social sciences (left panel) and for the natural and life sciences (right panel). As can be clearly seen, in the RTGs from the humanities and social sciences the number of publications per funding year is on average considerably higher than in the RTGs from the natural and life sciences. This result is mainly explained by differences in co-authorships and the 1/n-count which reduces the publication count particularly for natural and life sciences with their traditionally long lists of co-authors.

Doctoral completion rate: Concerning the doctoral completion rate per funding year (Fig. 2.2), the picture is less clear: While the RTG with the highest doctoral completion rate per funding year belongs to the humanities and social sciences, the overall performance is higher in the natural and life sciences (with 20 out of 58

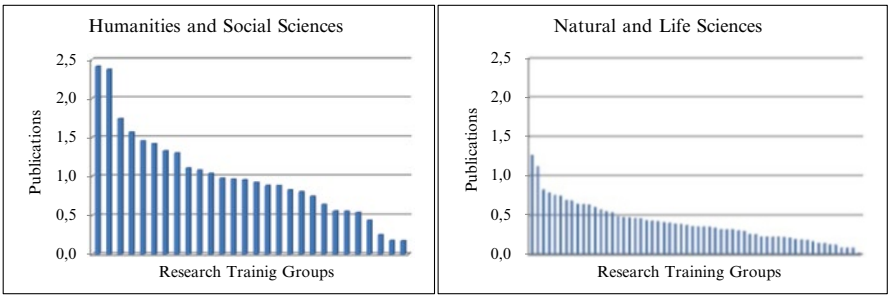

Fig. 2.1 No. of publications per funding year (Source: Own data)

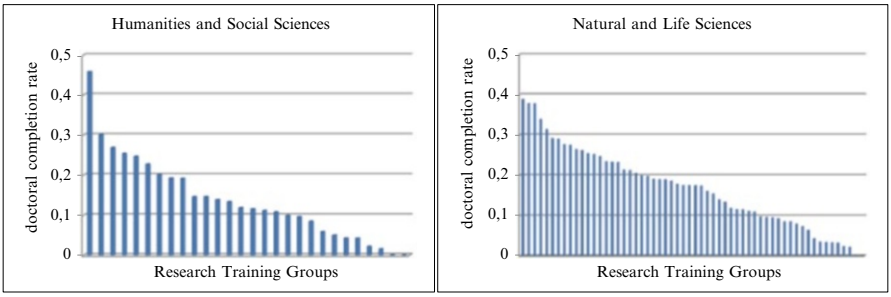

Fig. 2.2 Doctoral completion rate per funding year (Source: Own data)

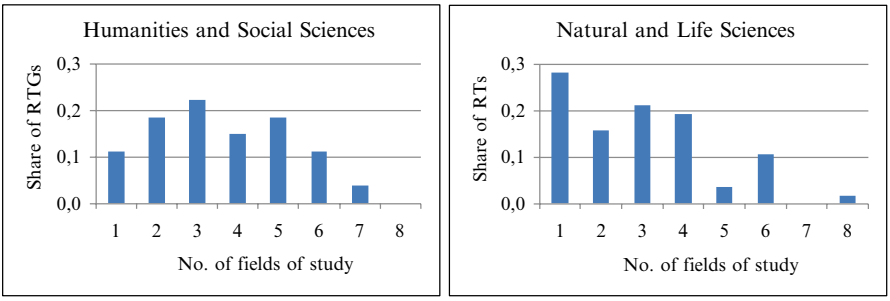

Fig. 2.3 Interdisciplinarity – no. of fields of study represented by the students in an RTG (Source: Own data)

RTGs having a doctoral completion rate per funding year of at least 20 %) and lower in the humanities and social sciences (with only seven out of 28 having a completion rate of more than 20 %).

2.4.2 RTG Composition

Interdisciplinarity: Our first dimension of heterogeneity concerns the question in how far an RTG is characterised by interdisciplinarity of its students. Figure 2.3 displays the shares of RTGs in the humanities and social sciences (left panel) and in the natural and life sciences (right panel) concerning the number of different subjects studied by their doctoral and postdoctoral members. The share of RTGs in the humanities and social sciences characterised by all of its students coming from the same study field is 10 %, while in about 28 % of the RTGs in the natural and life sciences all of their students come from the same study field. The majority of RTGs in both disciplines comprises students from three or more different study fields. In light of the fact that the ISCED study field classification already represents a rather aggregate classification only distinguishing 22 different fields of study, this is indeed a striking result.

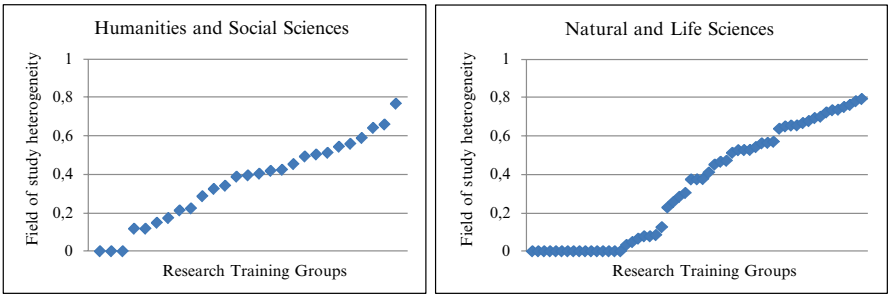

Fig. 2.4 Interdisciplinarity – Blau's index concerning the field of study (Source: Own data)

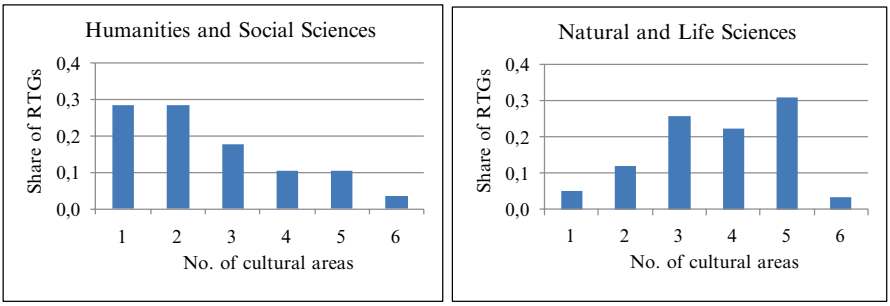

Fig. 2.5 Internationality – no. of cultural areas represented by students in an RTG (Source: Own data)

Figure 2.4 displays the index of heterogeneity according to the field of study of RTG students. As can be seen, no RTG achieves a degree of heterogeneity of 1.0. In both disciplinary fields, the maximum level of heterogeneity concerning the field of study is around 0.8.

Internationality: Our second heterogeneity dimension concerns the question in how far an RTG is characterised by the internationality of its students. Figure 2.5 displays the share of RTGs in the humanities and social sciences (left panel) and in the natural and life sciences (right panel) concerning the number of different cultural areas represented by their doctoral and postdoctoral members. As can be seen, the RTGs from the humanities and social sciences are on average less characterised by internationality than those from the natural and life sciences: In the latter, the majority of the RTGs comprises students from more than three different cultural areas whereas in the former, the majority of RTGs comprises students from at most two different cultural areas.

Figure 2.6 displays Blau's index of heterogeneity according to the cultural area an RTG student comes from. Again, no RTG achieves a degree of heterogeneity of 1.0. In both disciplines, the maximum level of heterogeneity is below 0.8.

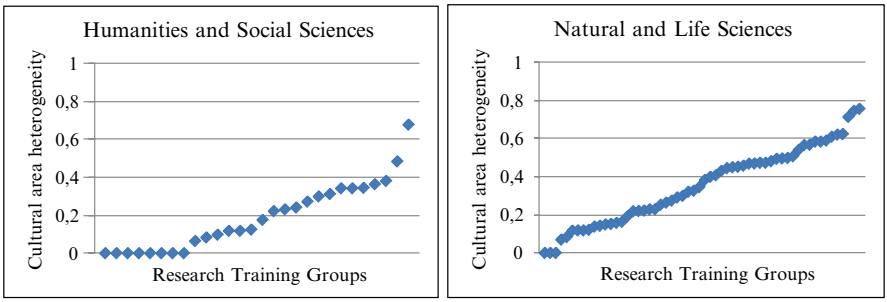

Fig. 2.6 Internationality – Blau's index of heterogeneity concerning cultural areas (Source: Own data)

2.5 Results

In order to analyse the effect of the RTG composition on the RTG performance as measured by the scientific visibility and the doctoral completion rate we employed the seemingly unrelated regressions (SUR). The seemingly unrelated regressions are an extension of the linear regression model and are used for analysing a system of multiple regressions with correlated error terms. As our estimations for scientific visibility and the doctoral completion rate use the same data set, the errors might well be correlated across the equations rendering the use of SUR adequately. In the light of our small data set, we ran separate regressions to test for the potential effects of interdisciplinarity and internationality and also had to abstain from using control variables. However, we estimated two different models in each case: One model tests for a linear relationship between the respective measure of heterogeneity (interdisciplinarity, internationality) and performance. The second model allows for a potentially non-linear relationship between the respective measure of heterogeneity and performance when a quadratic term of the respective heterogeneity measure is added.

2.5.1 RTGs in the Humanities and Social Sciences

Interdisciplinarity: For the humanities and social sciences, heterogeneity concerning the field of study is positively related with the RTG performance as far as scientific visibility, i.e. the publication output per funding year is concerned; there is no indication of the relationship being non-linear. Figure 2.7 visualises the corresponding relationship. It shows that the RTG performance with respect to the doctoral completion rate remains unaffected by the heterogeneity of the study field. In other words, the interdisciplinarity of RTG students has on average positive effects on the RTG performance in the humanities and social sciences.

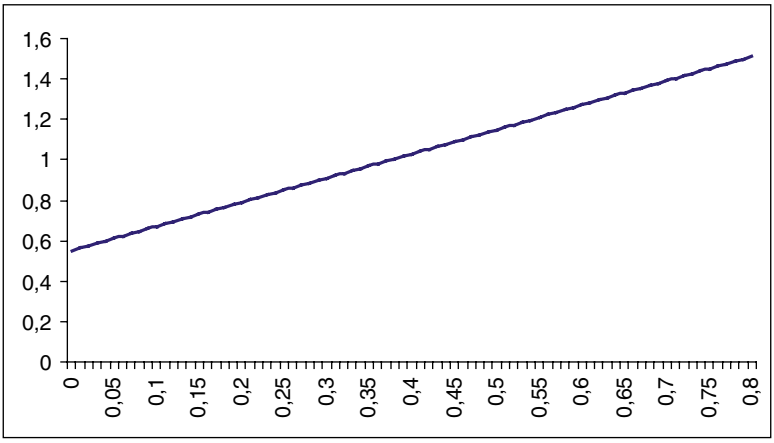

Fig. 2.7 Blau's index concerning the field of study (x-axis) and the no. of publications per funding year (y-axis) in the humanities and social sciences (Source: Own data)

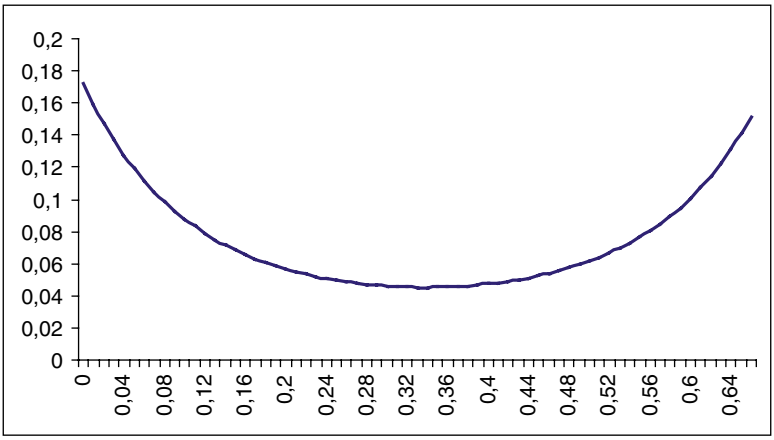

Fig. 2.8 Blau's index concerning the cultural area (x-axis) and the doctoral completion rate (y-axis) in the humanities and social sciences (Source: Own data)

Internationality: Concerning cultural heterogeneity, the picture is quite different: While the scientific visibility remains unaffected by the students' internationality, the doctoral completion rate is affected in the following way: an increasing degree of internationality at first is associated with a lower doctoral completion rate. Once a certain level of cultural heterogeneity is reached, a further increase in heterogeneity raises the doctoral completion rate (see Fig. 2.8). However, even at the highest level of international heterogeneity reached in the data set, the doctoral completion rate is below its value in a completely homogeneous RTG, which comprises only students from one cultural area. In other words, the internationality of RTG students seems to have on average negative effects on the RTG performance in the humanities and social sciences.

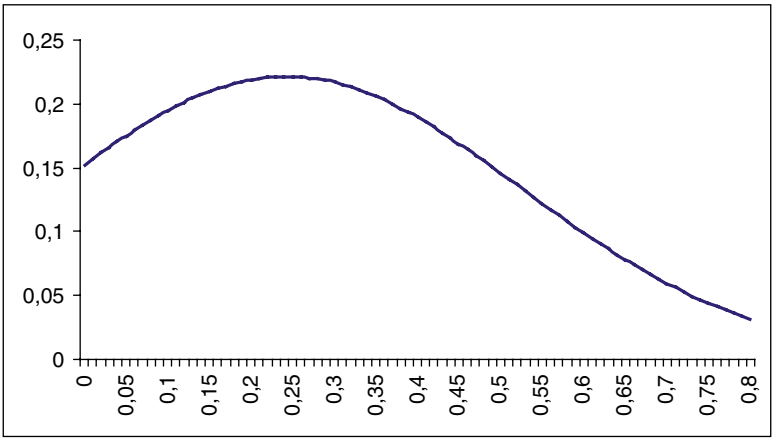

Fig. 2.9 Blau's index concerning the field of study (x-axis) and the doctoral completion rate (y-axis) in the natural and life sciences (Source: Own data)

2.5.2 RTGs in the Natural and Life Sciences

Interdisciplinarity: Using again the seemingly unrelated regressions, we find for the natural and life sciences that the relationship between the study field heterogeneity and the doctoral completion rate is hump-shaped: The regression model including the quadratic term shows that an increase in student interdisciplinarity at very low levels first increases the doctoral completion rate, but then very soon decreases it (Fig. 2.9). The RTG performance with respect to the indicator scientific visibility seemingly remains unaffected by the heterogeneity concerning the field of study.

Internationality: Concerning heterogeneity with respect to student nationality, there is no indication of a linear or non-linear relationship between heterogeneity and performance.

2.6 Conclusion

In this chapter we analysed how one particular governance mechanism affects the performance of research teams. The governance structure we look at is the requirement of interdisciplinarity and internationality of Research Training Groups (RTGs) uttered by the German Research Foundation. We study how the performance of RTGs is affected by the heterogeneity that is induced by an increasing number of study subjects and by an increasing number of cultural areas within a research group. From a theoretical perspective there may be two countervailing effects: according to the resource perspective, team performance should rise with increasing team heterogeneity because the team as a whole has access to a larger set of intellectual resources. However, from a sociopsychological process perspective, team

performance might also be endangered by an increase in team heterogeneity because communication between team members may suffer due to different (study field and national) languages, increased conflicts and reduced group cohesion. We expect that the size of both effects depends on the type of research in an RTG and analyse how the overall effect is shaped in the humanities and social sciences as compared to the natural and life sciences.

Using seemingly unrelated regressions, we find for the humanities and social sciences that heterogeneity has significant effects on research performance with study field heterogeneity enhancing scientific visibility, and internationality being inversely hump-shaped related with the doctoral completion rate. In contrast, for the natural and life sciences, we only find a significant effect for the doctoral completion rate exhibiting a hump-shaped relationship with study field heterogeneity.

We conclude that the effectiveness of a particular governance mechanism varies substantially from discipline to discipline. The observed differences may be rooted in profound disciplinary characteristics. Following Becher (1994), Bonarccorsi (2008) and Whitley (2000), knowledge production in the natural sciences – in comparison to the humanities and social sciences – is characterized by a higher functional dependence (i.e. a higher degree to which a scientist needs other human or technical resources as an input for his or her work), by more specialized research topics and standardized operational procedures, by the existence of clear criteria for knowledge verification and by a consensus on the most relevant questions in the research field. To the contrary, research in the humanities and social sciences is characterized by a greater uncertainty, more theoretic diversity, less control on research goals and value-driven results. While research in the natural sciences aims at discovering and explaining, in the humanities and social sciences, understanding and interpretation are in the focus (See Becher and Trowler 2001; Becher 1994; Bonarccorsi 2008; Whitley 2000). That is: While the humanities and social sciences are non-paradigmatic in nature and offer a plurality of well accepted theories and methodologies endowing their students with a more general education, the natural and life sciences represent so-called "paradigmatic sciences" that generally do not allow for different scientific approaches and leave less scope for interpretation. As a consequence, the production processes in the two disciplinary fields are severely different from each other (see e.g. Unger 2010) – a fact that has to be taken into account when designing adequate governance mechanisms.

As theoretically argued and empirically shown, the effects of input oriented governance vary between the scientific fields. What may work well in one disciplinary field may have just the opposite effect in the other. An increasing degree of interdisciplinarity in the humanities and social sciences positively affects the research performance. At the same time, when increasing the degree of interdisciplinarity in the natural and life sciences, positive effects on research performance can only be observed up to a certain point, but not if interdisciplinarity is driven to the extreme. Therefore, it seems reasonable to conclude that in governing research groups, all kinds of external governance should be either precisely engineered to the concerning disciplinary field and its specificities. Alternatively, a menu of options should be offered that allows research teams to choose a structure that is most effective given the specificities of its disciplinary field and the specific research requirements.

References

Adams, J. D., Black, G. C., Clemmons, J. R., & Stephan, P. E. (2005). Scientific teams and institutional collaborations: Evidence from U.S. universities, 1981–1999. *Research Policy, 34*(3), 259–285.

Alexander, J., Nuchols, B., Bloom, J., & Lee, S.-Y. D. (1995). Organizational demography and turnover: An examination of multiform and nonlinear heterogeneity. *Human Relations, 48*(12), 1455–1480.

Ancona, D. G., & Caldwell, D. F. (1992). Demography and design: Predictors of new product team performance. *Organizational Science, 3*(3), 321–341.

Becher, T. (1994). The significance of disciplinary differences. *Studies in Higher Education, 19*(2), 1151–161.

Becher, T., & Trowler, P. R. (2001). *Academic tribes and territories*. Maidenhead/Berkshire: SRHE/Open University Press.

Bell, M. P., & Kravitz, D. A. (2008). From the guest Co-editors: What do we know and need to learn about diversity education and training? *Academy of Management Learning & Education, 7*(3), 301–308.

Blau, P. M. (1977). *Inequality and heterogeneity*. New York: Free Press.

Bonaccorsi, A. (2008). Search regimes and the industrial dynamics of science. *Minerva, 46*(3), 285–315.

Byrne, D. (1971). *The attraction paradigm*. New York: Academic.

Cannella, A. A., Jr., Park, J.-H., & Lee, H.-U. (2008). Top management team functional background diversity and firm performance: examining the roles of team member colocation and environmental uncertainty. *Academy of Management Journal, 51*(4), 768–784.

Carayol, N., & Matt, M. (2004). Does research organization influence academic production? Laboratory level evidence from a large European University. *Research Policy, 33*(8), 1081–1102.

Deutsche Forschungsgemeinschaft (DFG). (2008). Jahresbericht 2008. Aufgaben und Ergebnisse. http://www.dfg.de/jahresbericht/download/dfg_jb2008.pdf. Accessed 15 Oct 2009.

Deutsche Forschungsgemeinschaft (DFG). (2010). Homepage. http://www.dfg.de/foerderung/programme/listen/index.jsp?id=GRK. Accessed 20 Oct 2010.

Egghe, L., Rousseau, R., & van Hooydonk, G. (2000). Methods for accrediting publications to authors or countries: Consequences for evaluation studies. *Journal of the American Society for Information Science, 51*(2), 145–157.

Giles, C. L., & Councill, I. G. (2004). Who gets acknowledged: Measuring scientific contributions through automatic acknowledgment indexing. *Proceedings of the National Academy of Sciences, 101*(51), 17599–17604.

Gruenfeld, D. H., Mannix, E. A., Williams, K. Y., & Neale, M. A. (1996). Group composition and decision making: How member familiarity and information distribution affect process and performance. *Organizational Behavior and Human Decision Processes, 67*(1), 1–15.

Hagedoorn, J., Link, A. N., & Vonortas, N. (2000). Research partnerships. *Research Policy, 29*(4/5), 567–586.

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review, 9*(2), 193–206.

Harrison, D. A., & Klein, K. J. (2007). What's the difference? Diversity constructs as separation, variety, or disparity in organizations. *Academy of Management Review, 32*(4), 1199–1228.

Hollingsworth, J. R. (2002). Research organizations and major discoveries in twentieth-century science: A case study of excellence in biomedical research. Wissenschaftszentrum Berlin für Sozialforschung GmbH (WZB). Discussion paper P 02–003.

Huntington, S. P. (1996). *The clash of civilizations and the remaking of world order*. New York: Simon & Schuster.

Jackson, S. E. (1992). Consequences of group composition for the interpersonal dynamics of strategic issue processing. In P. Shrivastava, A. S. Huff, & J. Dutton (Eds.), *Advances in strategic management* (Vol. 8, pp. 345–382). Greenwich: JAI Press.

Jansen, D. (2007). Governance of research – working towards interdisciplinary concepts. In D. Jansen (Ed.), *New forms of governance in research organizations: Disciplinary approaches, interfaces and integration* (pp. 105–129). Dordrecht: Springer.

Jehn, K. A., Northcraft, G. B., & Neale, M. A. (1999). Why differences make a difference: A field study of diversity, conflict, and performance in workgroups. *Administrative Science Quarterly, 44*(4), 741–763.

McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology, 27*(1), 415–444.

Pelled, L. H., Eisenhardt, K. M., & Xin, K. R. (1999). Exploring the black box: An analysis of work group diversity, conflict, and performance. *Administrative Science Quarterly, 44*(1), 1–28.

Porac, J. F., James, B. W., Fischer, H. M., Brown, J., Kanfer, A., & Bowker, G. (2004). Human capital heterogeneity, collaborative relationships, and publication patterns in a multidisciplinary scientific alliance: A comparative case study of two scientific teams. *Research Policy, 33*(4), 661–678.

Rigby, J., & Edler, J. (2005). Peering inside research networks: Some observations on the effect of the intensity of collaboration on the variability of research quality. *Research Policy, 34*(6), 784–794.

Smith, K. G., Smith, K. A., Olian, J. D., Sims, H. P., Jr., O'Bannon, D. P., & Scully, J. A. (1994). Top management team demography and process: The role of social integration and communication. *Administrative Science Quarterly, 39*(3), 412–438.

Stephan, P. E. (1996). The economics of science. *Journal of Economic Literature, 34*(3), 1199–1235.

Tajfel, H. (1974). Social identity and intergroup behaviour. *Social Science Information, 13*(2), 65–93.

Tajfel, H. (1981). *Human groups and social categories: Studies in social psychology*. Cambridge: Cambridge University Press.

Thomas, D. C. (1999). Cultural diversity and work group effectiveness: An experimental study. *Journal of Cross-Cultural Psychology, 30*(2), 242–263.

Thomas, D. C., Ravlin, E. C., & Wallace, A. W. (1996). Effect of cultural diversity in work groups. In P. A. Bamberger, M. Erez, & S. B. Bacharach (Eds.), *Research in the sociology of organizations* (Vol. 14, pp. 1–33). London: JAI Press.

Turner, J. C. (1975). Social comparison and social identity: Some comparisons for intergroup behavior. *European Journal of Social Psychology, 5*(1), 5–34.

Turner, J. C. (1987). *Rediscovering the social group: A social categorization theory*. Oxford: Blackwell.

Unger, B. (2010). *Heterogenität und Performance von Forschernachwuchsgruppen. Eine Untersuchung am Beispiel von DFG-geförderten Graduiertenkollegs*. München/Mering: Rainer Hampp.

Unger, B., Pull, K., & Backes-Gellner, U. (2010). The performance of German research training groups in different disciplinary fields: An empirical assessment. In D. Jansen (Ed.), *Governance and performance in the German public research sector. Disciplinary differences* (pp. 93–106). Dordrecht: Springer.

Whitley, R. (2000). *The intellectual and social organization of the sciences* (2nd ed.). Oxford: Oxford University Press.

http://www.springer.com/978-3-319-09676-6

The Changing Governance of Higher Education and Research
Multilevel Perspectives
Jansen, D.; Pruisken, I. (Eds.)
2015, XIV, 279 p. 15 illus., Hardcover
ISBN: 978-3-319-09676-6