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Research Proposals by Junior Professors to the DFG: Submission and Success

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This analysis focuses on proposals submitted by junior professors to the Deutsche Forschungsgemeinschaft (German Research Foundation, DFG). It also looks at the question of whether, and to what extent, the success rate of the proposals differs relative to other applicants and between subjects. To introduce the survey, various statistical analyses on the junior professorship scheme, based on unpublished data collected by the German Federal Ministry of Education and Research (BMBF), are presented.

Introduction

Junior professorships were introduced in an attempt to promote the independence of young scientists and researchers and to make the route to qualification as a professor more flexible. The success of these young scientists in securing third-party funding is very important in this respect, since funding for independent research projects cannot usually be covered by the core support from universities. In most subjects the applicants' success at raising third-party funding is also a key factor in the assessment of their research performance, which plays a very important role when it comes to being appointed to tenured professorships. Whereas existing studies have focussed primarily on the current situation and career prospects of junior professors, information on the topic of third-party funding is only available for individual subjects or universities (see Rössel et al. 2003; Buch et al. 2004, BMBF/DLR 2004, Humboldt University 2004, DPG 2005).

This report looks at the proposals submitted to the DFG by junior professors. The DFG is one of the main research funding bodies in Germany. With a current annual budget of € 1.3 billion, the DFG primarily funds university research, and approximately 34 % of all third-party funding provided to German universities originates from the DFG (see DFG 2003: 34). By focussing on DFG-funded research this report thus covers a significant proportion of the funding and research activity at German universities.

This study addresses three key questions

- What proportion of proposals submitted to the DFG are submitted by junior professors?
- How successful are junior professors at obtaining research funding from the DFG?
- Are there significant differences in the success rates of junior professors, as compared to other applicants who submit funding proposals to the DFG?

The report begins with a brief description of the junior professorship programme and previously unpublished statistical data, which provide information on the demographic and subject-specific profile of the group addressed by the study.

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1 Junior professorships – programme information and basic statistical data

1.1 Junior professorships in the BMBF's special funding programme

Junior professorships were introduced in 2002 with the passing of the Fifth Amendment to the Framework Act for Higher Education. This was intended to enable young researchers and scientists to conduct independent research and teach by their early thirties.

Following the ruling of 27 July 2004, in which the Federal Constitutional Court declared that the framework legislation on junior professorships was unconstitutional and void, it became necessary to establish a new basis to secure junior professorships under federal law. A law to amend the regulations under civil service and labour law in higher education came into force on 31 December 2004 [2]. This law stipulated the following appointment requirements and specified the employment status of junior professors:

"In addition to the usual requirements for employment in academia, candidates for junior professorships also need to have:

1. a higher education degree,

2. an aptitude for teaching,

3. and a particular ability or talent for academic work, all of which are typically demonstrated by the outstanding quality of the candidate's doctorate. (...)

The law foresees a two-stage term of employment, which is intended to last not more than six years. The second stage can be extended permanently ('tenure') if the junior professor has demonstrated his or her ability as a university lecturer. If this is not the case, then the position can only be extended for one additional year at the most (Federal Law Gazette 2004: 3836)." (translated from the German original)

In 2002 the German Federal Ministry of Education and Research (BMBF) initiated a special funding programme (called "Vorgriffförderprogramm"), which makes universities that have appointed junior professors and – if the respective state has not passed appropriate legislation – young research group leaders, eligible to receive funding of € 75,000 (or € 60,000 from 2003 onwards) (see BLK 2003).

1.2 Announcement of posts and appointment of junior professors between 2002 and 2004

As part of the implementation of the special funding programme, the BMBF collected data on the number of posts announced and the applications received (including related applicant demographic data). The data, published here for the first time, refer to the period between 2002 and 2004. In these three years a total of 1,145 junior professorship posts were announced, attracting 11,113 applications from scientists in the early stages of their careers. A comparison by area of study, performed by the BMBF according to subject classifications defined by the Federal Statistical Office, shows a significant variation in the average number of applicants between different areas of study (see Table 1).

Whereas the subjects within the languages and arts had an average of 21 applicants per post, there were just five and three applicants per post in engineering and in medicine respectively. An above-average number of applicants was also observed in art and art-related subjects (with 20 applicants per post) and in the legal, economic and social sciences (with 13 applicants per post). In mathematics and the natural sciences, and in agriculture, forestry and nutrition sciences, there were, on average, eight applications per post.

According to the BMBF's statistics, 786 junior professors had been appointed at 65 German universities throughout Germany by the end of 2004 [3].

2. See the information published online by the German Federal Ministry of Education and Research (BMBF) at http://www.bmbf.de/en/820.php

3. Please note that this figure differs significantly from the figures published by the Federal Statistical Office, which reports the appointment of 406 junior professors and "equivalent" (primarily "W1" posts) (see Federal Statistical Office, 2005: Table 1). This discrepancy arises primarily from the as yet unresolved status of junior professorships under certain state university laws and from the fact that the title of "junior professor" has not yet become firmly established amongst the parties concerned (see Buch et al. 2004: 17). The BMBF's statistics can, however, also not claim to be comprehensive or complete. They do not, for example, include junior professors appointed after the advance funding came to an end, and also fail to subtract those who have now gone on to be appointed as full professors.

Table 1: Junior professorship posts announced and applications (2002 - 2004)*

	Posts announced		Applications		
*Area of study***	*Number*	*Percent*	*Number*	*Average per post*	*Proportion of female applicants (%)*
Languages and arts (incl. sports)	158	13.8	3,283	20.8	29.9
Legal, economic and social sciences	185	16.2	2,482	13.4	31.9
Mathematics, natural sciences	400	34.9	3,040	7.6	16.8
Engineering	120	10.5	537	4.5	18.1
Medicine	181	15.8	545	3.0	25.7
Agriculture, forestry and nutrition sciences	14	1.2	111	7.9	22.5
Art	26	2.3	509	19.6	51.7
Other	61	5.3	606	9.9	35.3
Total	1.145	100.0	11.113	9.7	27.2

Source: BMBF statistics, own calculation

** As of 31 Dec. 2004; ** Based on the subject classification system used by the Federal Statistical Office (sports were assigned to languages and the arts)*

Comparing this figure for posts announced to that given in Table 1, there is a discrepancy of 359 posts, which, it has to be assumed, have remained vacant during the period covered by the data, corresponding to a discrepancy of around 31 %. As shown in Table 2, there is also a significant discrepancy between the different areas of study. Engineering had the highest proportion of unfilled positions (at 43 %), followed by legal, economic and social sciences (34 %), medicine (33 %), and mathematics and the natural sciences (31 %). Even in the area of study with the highest proportion of positions filled (agriculture, forestry and nutrition sciences), one post in seven remained vacant.

There is, as is to be expected, a close correlation between the number of applicants per post and how successfully these posts were filled. However, there are also exceptions: In the legal, economic and social sciences, for instance, a relatively high number of posts remained vacant despite a higher than average number of applicants, indicating that the junior professorship model encountered particular problems in this field.

If the number of junior professors appointed until the end of 2004 is compared to the total number of professors at German universities – according to a summary published by the Federal Statistical Office (2005: Table 1) this amounted to 21,257 in 2004 – then junior professors account for approximately four percent [4].

A comparison of the proportion of junior professors relative to full university professors by subject revealed that this programme has met with the greatest acceptance in mathematics and the natural sciences. As shown in Figure 1, more than 35 % of all junior professors are accounted for by this group, in compa-

4. International comparison is only possible to a very limited extent due to the differences in higher education systems and career structures. The proportion of junior professors relative to the total number of professors at German universities is, however, well below the proportion of "tenure track" scientific staff who have teaching responsibilities at American universities. At universities that are essentially comparable to German universities, they represented between 16 % and 24 % of all professors, depending on the particular type of university, in 1998 (see National Center for Educational Statistics (2001)).

Table 2: Appointments of junior professors (2002 - 2004)

	Posts filled				
*Area of study***	*Number of posts filled*	*Number of posts left vacant (%)*	*Proportion of posts filled from abroad*** (%)*	*Proportion by subject group (%)*	*Proportion of woman (%)*
Languages and the arts, sports	131	17.1	9.9	16.7	38.9
Legal, economic and social sciences	122	34.1	9.0	15.5	32.8
Mathematics, natural sciences	277	30.8	21.3	35.2	21.3
Engineering	68	43.3	5.9	8.7	19.1
Medicine	122	32.6	15.6	15.5	26.2
Agriculture, forestry and nutrition sciences	12	14.3	16.7	1.5	16.7
Art	21	19.2	9.5	2.7	47.6
Other	33	45.9	3.0	4.2	36.4
Total	786	31.4	14.1	100.0	27.9

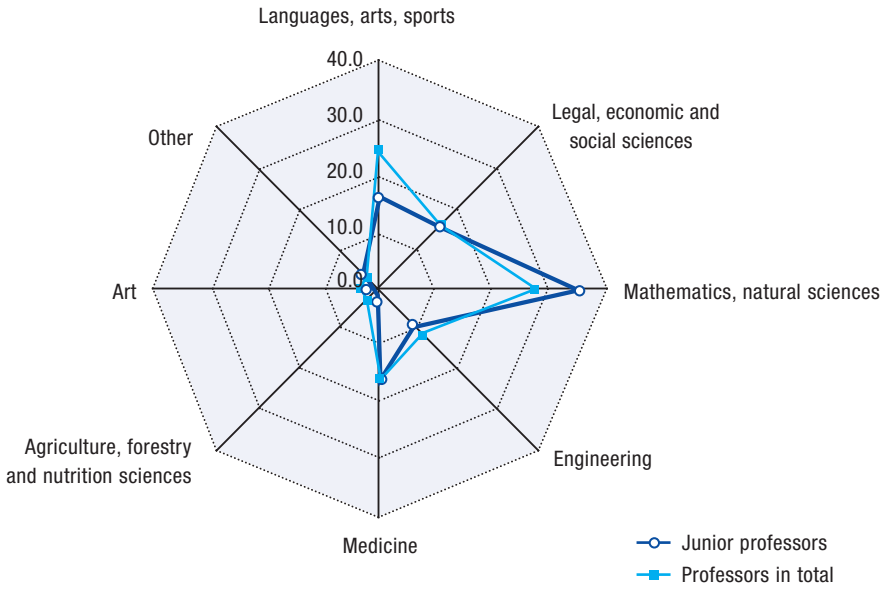
*Source: BMBF statistics, own calculation. * As of 31 Dec. 2004; ** Based on the subject classification system used by the Federal Statistical Office (sports were assigned to languages and the arts), *** Including German applicants from abroad*

rison to 27 % of professors overall. In contrast, the proportion in the languages and arts (including sports) is lower than the average; here the percentage of professors overall is 24 %, compared to just 17 % of all junior professors.

Table 2 also illustrates two other interesting findings relating to the filling of junior professorial posts: Firstly, it becomes evident that junior professorships have helped to motivate foreign scientists and German scientists who were working abroad at the time that they applied for a position[5] either to come or return to Germany, with some considerable degree of success. One post in seven was occupied by an applicant from abroad, and in mathematics and the natural sciences this figure rose to one in five. Secondly, junior professorships have a relatively high proportion of women (28 %) – with the typical large variation between the areas of study covered here. If additional data on the proportion of women at different levels of academia is drawn on for comparison, then the proportion of women amongst junior professors is almost twice as high as in other professorial posts in Germany (C2 and C3/W2 professors) or even three times as high (C4/W3 professors) (see Figure 2).

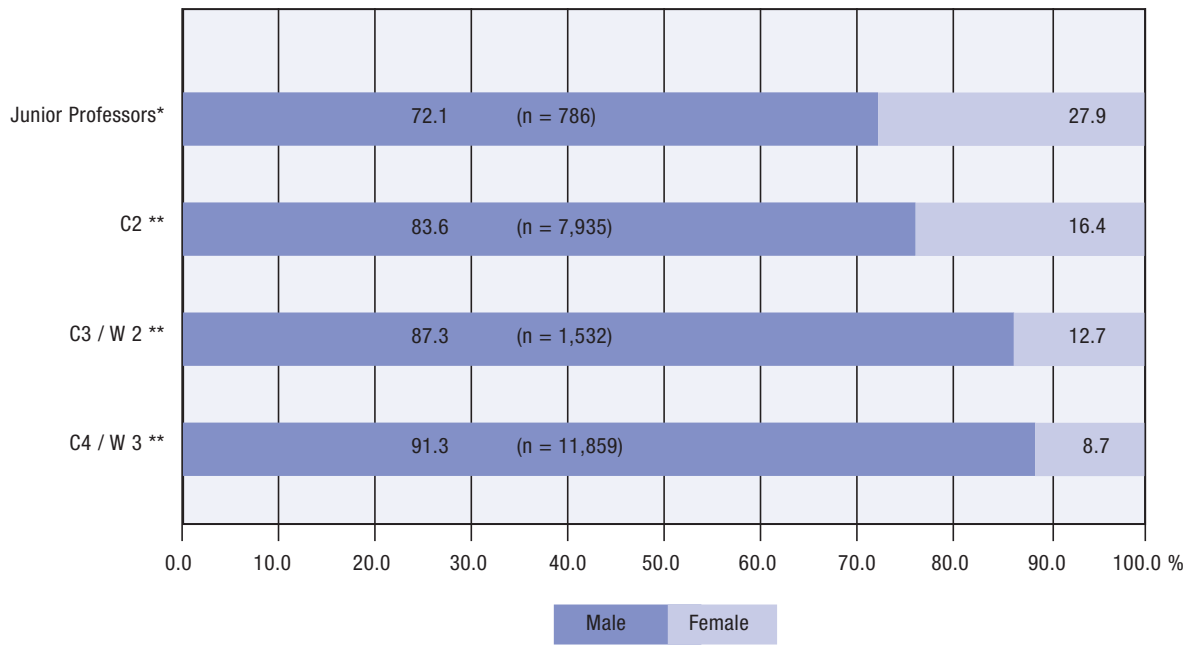
5. The data used for this analysis does not provide any information on the nationality of the applicant, but only on whether the applicant was residing in Germany or abroad.

Figure 1: Junior professors by area of study in comparison to professors overall (2004) (in %)



Source: Federal Statistical Office (2005): Personal nach Dienstbezeichnungen und Fächergruppen der fachlichen Zugehörigkeit (Staff by employment grade and area of study of their subject) (2004), own calculations

Figure 2: Proportion of women amongst university professors, by grade (2004) (in %)



*Source: * BMBF statistics, own calculation; ** Federal Statistical Office (2005): Personal nach Dienstbezeichnungen und Hochschularten (Staff by employment grade and type of university) (2004), own calculations.*

2 Junior professors as applicants for DFG funding

2.1 Data basis and methodology

This study on the number of proposals submitted to the DFG by junior professors was based on the names and addresses of 637 junior professors that appeared on a BMBF address list in February 2005. The BMBF provided this list to the DFG for use in this study, for comparison with the DFG's database of applicants, after data protection issues had been clarified.

The junior professors in the DFG's database of applicants were initially identified by automated name matching. Next a plausibility check was performed on the basis of the year of birth and the subject classification of the applicants. This procedure was adopted in order to avoid potential problems resulting from homonyms, i.e. where the same name is shared by different people. An additional test was performed to check for synonyms, in other words, where the same person is listed under different names in each of the sources. This was done by manually comparing all of the names that did not result in a 1:1 match during automatic matching with similar names contained in the database.

Using this method it was possible to identify 452 junior professors contained in the BMBF list in the DFG database, which contains over 120,000 names. According to this, 71 % of these junior professors have had some form of contact with the DFG's Head Office, either as an applicant or as a reviewer, with an application for travel expenses to attend a conference, as a co-applicant for a Research Training Group or as a project leader within a Collaborative Research Centre. This high proportion is an initial indication of the high significance accorded to the DFG, both as a funding body and with regard to its programmes, by junior professors as a whole.

The analyses of the submission and success rates of proposals by junior professors begin in 2002, the first year in which junior professors were appointed, and end with the funding decisions made by the DFG in 2005. It should be noted that this period may include proposals on which a decision was reached either before an applicant was appointed as a junior professor, or after they were subsequently appointed as a full professor. Such cases will, however, presumably be rare and will not seriously affect the significance of these analyses in terms of the overall number and success of proposals submitted by junior professors.

The range of DFG funding programmes is very broad and encompasses means of support that are not limited to funding research projects, but also include scientific prizes, publication allowances and contributions towards travel expenses for attending international conferences. This study concentrates primarily on third-party funding for genuine research purposes. It therefore only takes funding proposals for the DFG's individual grants programme and pro-

Table 3: DFG funding proposals submitted by junior professors, by funding programme and role (2002 - 2005)

	Main applicant		*Co-applicant*		*Total*	
Programme	*No.*	*%*	*No.*	*%*	*No.*	*%*
Individual Grants	330	60.8	94	44.5	424	56.2
Research Units	25	4.6	20	9.5	45	6.0
Priority Programmes	83	15.3	27	12.8	110	14.6
Collaborative Research Centres	105	19.3	70	33.2	175	23.2
Total	543	100.0	211	100.0	754	100.0

ject proposals within its coordinated programmes (Priority Programmes, Collaborative Research Centres and Research Units) into consideration.

The DFG's proposal database includes decisions on a total of 754 funding proposals in which junior professors were involved, either as the main applicant or as co-applicant, in the period 2002 - 2005. A total of 56 % of these proposals were for the individual grants programme. Project proposals within Collaborative Research Centres came in second (23 %), with 15 % for Priority Programmes, and 6 % of the proposals under consideration here for Research Units (see Table 3).

2.2 Proposal submissions by junior professors

2.2.1 Proposals by discipline

Comparing the 754 proposals received by the DFG to the 637 junior professors appointed, we find the average number of proposals per person in the almost four-year period to be greater than one. In fact, as can be seen in Table 4, just over half of all junior professors were involved in funding proposals for the programmes considered here, either as the main applicant or as co-applicant. When looked at on a subject-by-subject basis, according to the four disciplines used in the DFG's subject classification system [6], junior professors from the life sciences (68 %) were the most active in submitting grant proposals, followed by the natural sciences (62 %) and engineering (59 %). Junior professors in the humanities and social sciences submitted grant proposals less frequently, with only one in three applying to the DFG in the period covered by the study.

In total, 23 % of all junior professors were involved in one proposal, 11 % in two and 14 % in between three and five proposals. Involvement in multiple funding proposals is particularly prevalent in the life sciences, the natural sciences and – to a lesser extent – engineering (see Table 3).

2.2.2 Proposals by gender

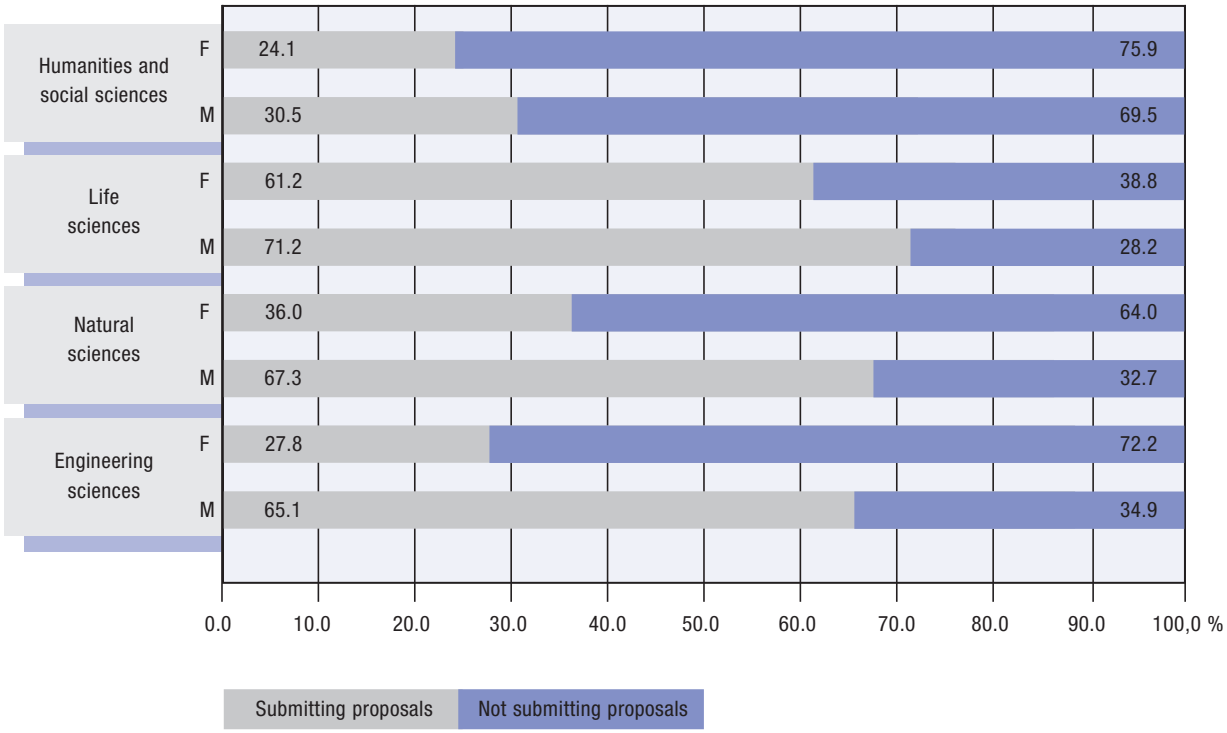
A comparison of the involvement in funding proposals by male and female junior professors revealed that, overall, women in all disciplines submitted funding proposals to the DFG less frequently than men. In the humanities and social sciences 24 % of all female junior professors were involved in submitting funding proposals, whereas in the natural sciences

Table 4: Number of proposals submitted by junior professors, by discipline (2002 - 2005)

	Humanities and social sciences		*Life sciences*		*Natural sciences*		*Engineering sciences*		*Total*	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
No proposals	159	66.8	52	32.5	50	36.2	46	45.5	307	48.2
1 proposal	45	18.9	43	26.9	33	23.9	25	24.8	146	22.9
2 proposals	13	5.5	25	15.6	14	10.1	15	14.9	67	10.5
3 - 5 proposals	8	3.4	31	19.4	30	21.7	17	16.8	86	13.5
More than 5 proposals	1	0.4	10	6.3	8	5.8	2	2.0	21	3.3
Total	238	100.0	160	100.0	138	100.0	101	100.0	637	100.0

6. The DFG's subject classification system is a hierarchic system with four levels: 48 Review Boards with 201 subjects, 14 research areas and 4 disciplines. More information on the subject classification system can be found on http://www.dfg.de/en/dfg_profile/index.html

Figure 3: Number of proposals submitted by junior professors (2002 - 2005) by discipline and gender (in %)



this figure rises to 36 %. The equivalent figures for men were 30 % and 67 %, respectively. In engineering (where the number of female junior professors overall is very low, meaning that statistical data can only be interpreted to a limited extent), 28 % of all female junior professors were involved in submitting funding proposals, compared to 65 % of the men. In the life sciences 61 % of the female junior professors were involved in submitting funding proposals. Although their proportion is slightly below that of their male colleagues, it is fairly high in comparison with other disciplines.

2.3 Junior professors' funding proposal success rate

The last aspect addressed by the study is the success rate of the funding proposals submitted by junior professors for DFG funding. Due to the fundamental differences in the review process[7] among various funding schemes, we consider only the success rate of proposals in the individual grants programme that were reviewed in writing. The analysis is based on the 330 funding proposals included in Table 3 on which a decision was made during the period covered. The decisions on the total of 38,470 funding proposals submitted between 2002 and 2005 in the individual grants programme are used for comparison.

For the individual grants programme the DFG regularly assesses the "funding and approval rates", which it publishes in various forms, for example in its annual reports and in summaries by discipline (see DFG 2005: 92). The funding rate shows the relationship between the number of approved proposals and the total number of proposals processed. The approval rate, on the other hand, shows the relation-

7. Information on the DFG's review process can be found at http://www.dfg.de/en/dfg_profile/structure/statutory_bodies/review_boards/index.html

ship between the amount of funding approved and the amount applied for.

Between 2002 and 2005 the funding rate was 47.7 % and the approval rate was 33.7 % (see Table 5). Almost half of all funding proposals submitted were thus approved, albeit with less funding than applied for in some cases. The funding rate ranged from 43.9 % for engineering to 51.3 % for the natural sciences. The range is even narrower when it comes to the approval rate, extending from 31.5 % (engineering) to 36.7 % (humanities and social sciences).

If the figures for the funding rate and the approval rate are compared for individual proposals submitted by junior professors, then this group of applicants is found to attain an above-average success rate. For the 330 proposals that were decided upon during the period covered, where the main applicant was a junior professor, we see a funding rate of 54.2 % and an approval rate of 38.5 %, thus making junior professors 6.5 percentage points more successful in terms of the funding rate and 4.8 % above average for the approval rate.

The total funding volume of the proposals within the individual grants programme on which this analysis is based amounts to € 1.8 billion. With 179 of the approved funding proposals submitted during the four-year period covered, junior professors received funding of € 18.5 million.

The data indicate, however, that the above-average success rate does not apply to all disciplines (see Table 5). Taking just the funding rate (the figures for the approval rate are comparable) into consideration, it is notable that junior professors in the natural sciences were particularly successful, with a difference of 16 percentage points between the funding rate for applicants overall and for junior professors. Similar differences are also seen in the life sciences (almost 14 %). In contrast, however, proposals in both engineering and the humanities and social sciences submitted by junior professors had funding rates of more than 10 % below average.

A total of 67 of the 330 proposals decided upon between 2002 and 2005 were submitted by women. This figure is too low in order to be able to make a

Table 5: Proposals submitted by junior professors, and by scientists and researchers in total, processed and approved by the DFG, by discipline (2002 - 2005)

	Proposals processed		*Proposals approved*			
	No.	*k €*	*No.*	*FR %*	*k €*	*AR %*
Humanities and social sciences	6,844	880,711	3,316	48.5	323,272	36.7
> by junior professors	52	7,396	20	38.5	1,929	26.1
Life sciences	14,905	2,158,493	6,998	47.0	719,340	33.3
> by junior professors	145	19,249	88	60.7	8,808	45.9
Natural sciences	9,401	1,091,458	4,821	51.3	376,859	34.5
> by junior professors	79	11,022	53	67.1	5,332	48.4
Engineering sciences	7,320	1,190,370	3,210	43.9	374,865	31.5
> by junior professors	54	10,374	18	33.3	2,406	23.2
Total	38,470	5,321,033	18,345	47.7	1,794,336	33.7
> by junior professors	330	48,041	179	54.2	18,475	38.5

FR = Funding rate (in relation to the quantity); AR = Approval rate (in relation to the amount)

statistically sound analysis by discipline (in the natural sciences, for example, only 7 proposals for funding in the individual grants programme were submitted by women, and in engineering just 6). It can, nevertheless, be noted that the likelihood of a funding proposal being approved does not vary significantly between male and female junior professors. The funding rate for both is 54 %, with only a minor difference in the approval rate (36 % for women and 39 % for men).

3 Conclusion

This report, based on previously unpublished data from the BMBF, first elaborated on the very different success rates of the establishment of junior professorships in the various subject areas. To do so it first looked at the average number of applications per junior professorship announced and then at the success with which the posts announced in the period covered by the report were occupied. Both of these indicators were indeed found to cover a considerable range, with a strong degree of correlation: high demand for such posts tends to result in a high success rate in filling them, and vice versa. Examples of this correlation are to be found in the languages and arts (including sports), where the highest number of applications per post and a well below-average number of unfilled posts were observed, and – at the opposite end of the scale – engineering, where few applicants (for comparatively few posts) went hand in hand with a very high proportion of vacancies.

The exception to the rule was seen in the legal, economic and social sciences, where an unsatisfactory proportion of posts were left vacant despite above-average numbers of applicants for the posts announced.

The mathematics and natural sciences are a success story in terms of junior professorships from several points of view. In terms of the numbers just mentioned they were not very noticeable (there was only a slight variation in the number of applications per post and the number of posts left unfilled), but this area of study stood out when it came to absolute figures, with 277 posts (of the 400 announced) successfully filled. The fact that this is not simply a factor of numbers – in terms of the number of professors working in the field, mathematics and natural sciences is the largest area of study of those under consideration – is apparent from a comparison of the number of junior professorship posts filled relative to the total number of professors working in the field. With a ratio of 1:20, this area of study represents the highest success rate in terms of the establishment of junior professorships.

Other indicators of success can be seen in terms of the factors analysed in the second part of the report, which deals with the number and success of funding proposals submitted to the DFG. Together with junior professors in the life sciences, those from the natural sciences demonstrated a particularly high affinity for the DFG as a funding body. Almost two-thirds of the total number of junior professors represented in the study, and who come from these disciplines, submitted funding proposals to the DFG during the period 2002-2005. And, even more, the young scientists in these two disciplines had significantly more than average success in convincing the peer reviewers that their ideas were worth funding – as can be seen from the well above average funding and approval rates.

The situation is different in engineering and the humanities and social sciences, where junior professors are not only below average in terms of the number of proposals submitted but also in terms of the below average success of their proposals. The comparatively low number of proposals from junior professors in the humanities and social sciences reflects to some extent the general reticence when it comes to third-party funding in this discipline (the figures are found to be similar if the statistics for the average amount of third-party funding per professor – both in total and from the DFG – are compared by subject (see DFG 2003: 44 pp.)). It fails to explain, however, why junior professors from this field who have decided to submit a funding proposal should

submit less convincing proposals. This is even more puzzling in light of the fact that – bearing in mind the above average number of applicants per post already reported – these applicants are prone to be subject to particularly stringent selection procedures and it can therefore be assumed that successful applicants in this field in particular should be especially well-qualified young scientists.

There is neither sufficient space nor opportunity to go into greater depth in interpreting the findings outlined here. The need for more in-depth surveys and analyses, looking in particular at the very different conditions under which junior professors (and other young scientists and researchers) teach and conduct research in the various subjects, in order to shed light on the details and draw more meaningful comparisons, is apparent. The results presented here only provide an initial indication of particular questions that should be investigated in depth. The situation for young female scientists would be a prime case in point: Although women are relatively well represented amongst junior professors, compared to other professorial levels, they account for a lower than average proportion of proposals than their male colleagues in all four of the disciplines differentiated by the DFG – only in the life sciences do they account for a more-or-less comparable number of proposals. Female junior professors thus submit funding proposals to the DFG less frequently than men. It would be interesting to find out whether the low demand for DFG funding amongst women is a result of special access to alternative sources of research funding, or due to lower interest in (third-party funded) research, or a consequence of specific demands (e.g. teaching load) made on female junior professors in comparison to their male counterparts.

In terms of the DFG there remain unanswered questions concerning the way in which junior professors can be included in the review process as time progresses: To what extent will they be called upon to give advice or to review project proposals submitted by their (usually older) peers? Looking beyond the DFG, it would also be of interest to assess whether, and to what extent, members of this young generation of scientists participate in teaching other young scientists.

Answering these and other unanswered questions will be the topic of a project that is currently being developed at the Institute for Research Information and Quality Assurance (IFQ) [8]. This study will not only include junior professors, but will also look at the Emmy Noether Programme and the leaders of independent junior research groups who are funded through other programmes. The study is intended to provide more precise information on the extent to which these programmes succeed at establishing successful research careers and what problems remain on the new carrier path to becoming a professor.

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