SUMMARY

This dissertation presents a dynamic perspective on institutional research performance and a structural analysis of the research profiles of these institutions in order to enhance the comparability in research evaluation.

It starts with the observation that authorities and policy makers more and more appeal upon quantitative and qualitative evaluation mechanisms when judging the research performance of institutions receiving grants from these authorities. Since several decades a trend is visible where it seems that policy makers are requested to prove that the invested tax money in research can indeed create return for society. Apart from that there is also a growing need for an open and transparent system for the financing of research institutions which uses objective and measurable criteria. With these observations comes the ascertainment of the many problems tied to the evaluation of research performance. An extensive literature is already devoted to the description of these problems and link them to the differences in culture, behavior or paradigms used in different fields of science. As a result the comparability of research performance between institutions is compromised especially between those institutions active in other fields.

This dissertation offers a solution to the problem of incomparability by combining four principles and by clustering institutions based on the fields in which they are active.

The first part of this book touches the problems related to incomparability of results of research evaluation. As this dissertation concentrates on the quantitative part of evaluation, bibliometrics is introduced with a special focus on data sources, different types of indicators and last but not least to different applications of bibliometrics. These applications are divided along two axes, one concentrates on research evaluation and the other deals with mapping of the structure and evolution of science.

After this introduction the developed clustering and classification model are presented. Both are the core of my dissertation. The development of the model is described and references are made to publications which use this clustering and classification. Special attention goes to the validation of the clustering. In a next chapter the dynamic perspective is introduced. This perspective offers a methodology suitable to the evaluation of research by enhancing the comparability between institutions.

The last chapter of the first part features other applications of model. The classification can be used to study the evolution of research profiles of individual institutions. In a second application the effect of research profiles on institutional collaboration is investigated.
The second part of the dissertation contains the core research with five papers published in international peer reviewed journals or presented at international conferences.

The first paper presents a study on author self-citations and it is the first where this methodology is used to create groups of likewise institutions in order to enhance comparability. Based on their research profile institutions are assigned to one out of six different groups. These research profiles are vectors containing for sixteen different fields in science the share of each field in the total output of the institution. This methodology creates groups with institutions being active is more or less the same fields. This first paper concludes that author self-citations can in some cases lead to results that deviate from national or field standards. But, more important, it proves that by clustering institutions based on their research profile groups can be created with high internal consistency but also with high between group differences on citation indicators.

This clustering is elaborated in the second paper where a profound statistical basis is created. Different stopping rules are used to determine the best number of clusters and this results in a eight cluster solution with high stability and validity. Each of the clusters is labeled by the most typical field in which the member institutions are active. Of course activities of the institutions is not limited to the field mentioned by the label. These are the labels of the clusters: 1. Biology, 2. Agriculture, 3. Multidisciplinary Institutions, 4. Geo and Space Science, 5. Technical and Natural Sciences, 6. Chemistry, 7. General and Research Medicine, 8. Specialised Medical institutions. A discriminant analysis is used to create a classification model that can be applied to institutions not included in the clustering.

Besides the use of the model in research evaluation two other applications are presented in the paper. In the first one the model is used to investigate the dynamics in the research profiles of institutions by looking at shifts in classification over time. A second application is the study of collaboration between institutions.

The third paper concentrates on differences between the groups on thirteen distinct bibliometric indicators. On each of these indicators statistically significant differences between groups are found. In some cases an interaction between the grouping and country is observed but in all cases there is an independent main effect of the classification of institutions. In second part of the paper it is shown that these differences are not limited to the overall total output of institutions but also within specific fields and subfields. The case of ‘Chemistry’ is presented.

The dynamic perspective is introduced in the fourth paper in this dissertation with an application on five Israeli research institutions. This perspective is based on four principles: 1. Institutions are embedded in national situations, 2. Detection of trends and changes is crucial and can be done wit evolution data, 3. Multiple indicators and field differentiation is needed to capture the multifaceted nature of science, 4. Institutions can only be compared to likewise institutions being active
in the same fields or with similar profile. This dynamic perspective is applied to five Israeli institutions: Tel Aviv University, Hebrew University of Jerusalem, Technion Israel Institute of Technology, Ben Gurion University of the Negev and Weizmann Institute of Science.

The last paper concentrates on the application of the clustering on the study of interinstitutional collaboration and the effect of research profiles. The paper deals with seven questions. First is shown that there are strong differences between the eight groups on the shares of different types of collaboration. Not all groups tend to have an equal share of international collaboration. Next, three questions deal with the effect of collaboration on citation indicators. Sets of papers with international or extramural domestic collaboration tend to have higher values on these indicators than papers where no external partner is involved. Moreover, this effect of collaboration is not the same for each group. The last three questions study the patterns of collaboration. By using a similarity measure between research profiles it is shown that institutions that collaborate are more alike than those that do not collaborate. However, when a measure for the strength of the collaborative relation is introduced only a very small correlation is found between similarity and collaboration. Comparing an expected distribution of collaboration between groups with the observed distribution allows to conclude that specialised institutions prefer partnership with institutions from the multidisciplinary cluster of from their own cluster. This leads to the hypothesis that institutions tend to collaborate with institutions that have a complementary profile. This will be tested in future studies.

In the third and last part of the dissertation some themes for future research are presented. There is still some need for extending the validation of the clustering. The model will be applied to countries that were not in the initial data set and thus some validation is appropriate. The profiles used in this research project are all based on our subject classification scheme but other schemes are available or can be developed. Some validation with other subject classification schemes is needed as well. A second theme for future research is the application of the model on institutions from the USA. This allows a comparison between US and Europe on the institutional level. Additional data on funding and staff enables the study of effect of input variables on research performance with a differentiation on research profile of institutions. The last theme is an extension of the fifth paper in the second part where the hypothesis of complementarity between collaboration institutions will be tested.