TOWARDS THE BEST A^{++} RATING

PRODUCTIVITY OF RESEARCH AND TEACHING IN FINNISH UNIVERSITIES

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INTRODUCTION

The expansion and massification of higher education may lead to an untenable combination of rising costs and lowering learning achievements both in Europe and the United States (See Pritchett 2009). The expanding higher education has generated a plethora of diverse educational institutions and study programmes they offer. Further diversification of higher education deepens the gap between teaching and research.

The relationships between the government and the universities are changing also in state-driven higher education systems. The development in the universities of OECD countries may be described as a transition from academic autonomy to accountable autonomy. Along with the government, other interest groups (different kinds of financiers, domestic and foreign organizations and companies, media and the wider audience) display an increasing interest towards universities. This can be seen, for instance, in the popularity of international university rankings, which, according to the advocates of rankings, stimulate fair competition between universities in their striving for excellence. However, first and foremost these rankings function as a tool with which to communicate the varying statuses of different universities to the wider audience within the international reputation market.

Online rankings by disciplines have practically become an industry of their own. The best known names in the business are Shanghai Ranking Consultancy Ltd (ARWU Top 100), Quacquarelli Symonds Ltd (QS Top 300) and Higher Education Evaluation and Accreditation Council of Taiwan (HEEACT Top 300).[1] When producing their annual listings by discipline for the international reputation market HEEACT, QS and ARWU operate on reasonably established metrics.

The emphasis of the online ranking services has shifted from one-dimensional assessments towards multidimensional analyses. The multidimensional analyses employ the same indicators and formulas as the one-dimensional ones, but offer the 'user' the opportunity to

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[1] The earlier – prior to 2010 – QS analyses are perhaps better known by the acronym THES (Times Higher Education Supplement).

choose the indicators and assign their weights suitable for users' particular needs – and possibly also preferences.

One of the inherent weaknesses of the rankings is the fact that they lean too much on expert opinions acquired by surveys; changing composition of the pool of experts causes uncontrolled variation in the estimations, which are even multiplied when moving further down in universities' ranking status from the most famous to the less known. The rankings alone are not enough to base an evidence-based policy on.

Within the three well known international rankings by scientific discipline (ARWU Top 100; QS Top 300; HEEACT Top 300) Finnish universities are qualified in twenty evaluation series annually. In medicine, all 5 Finnish units are evaluated as good enough to be ranked, in natural sciences 4 out of 8 units are good enough, in social sciences the numbers are 3 units of 9, in humanities 2 units of 8, in technical sciences 1 out of 7 units and additionally one of the two units in agriculture and forestry. Considering the rich background materials contained by ARWU, QS and HEEACT rankings, it is obvious that they offer valuable supplements alongside with productivity analyses based on the national database, as we will later show.

As concerns science and university policies in such state-driven university systems as in Scandinavia, the evidence base can be reinforced by applying appropriate productivity ratings. Ratings are commonly used to evaluate economic viability[2], securities and guarantees within the credit markets. A rising rating may serve as a signal of controlled 'risk taking', favouring new openings and innovations in the strategic sense. A lowering rating, on the other hand, may function as a warning sign of unpreventable reorganizations. As we shall later show, we have developed a four-step (A_0, A, A^+ and A^{++}) rating system suitable for the Finnish universities, which takes into account the productivity of both research and teaching by disciplines.

Distinguishing universities and other institutions of higher education is notoriously difficult. According to the World Higher Education Database, kept by the IAU, there are 9,500 universities and more than 20,000 other tertiary level institutions of education in the world.
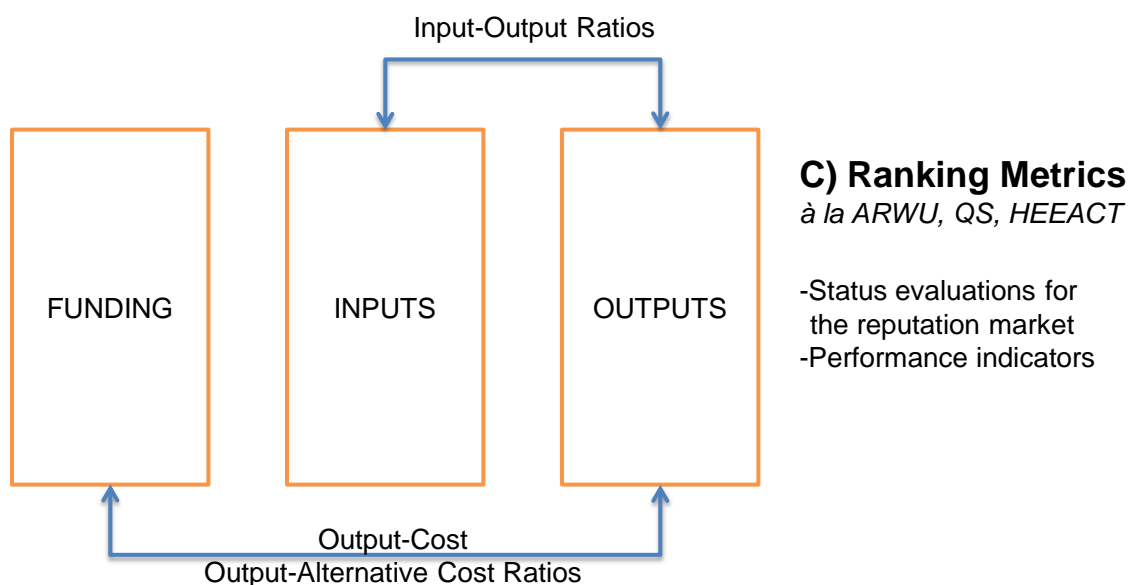
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[2] There are naturally both good and not so good rating systems in international credit markets. Understandably the bad ones have been in the headlines and everyday discussions recently, whereas the good ones serve their purpose without the high visibility.

Our framework leans on the traditional Humboldtian originated university model where by definition teaching must be grounded on the results of scientific research. Ratings based on analyses of productivity of research and teaching help in finding the most productive units, based on evidence, upon which the universities can build their future strategies. It is worth reminding, however, that even among the good research universities very few comprise entirely out of strong units. On the flip side of revealing the competent units, the rating naturally also helps to find the units which have for a longer period of time had difficulties in functioning productively.

For Figure 1 we have typified three applicable analysis methods for evaluating universities in their functions. All of these methods produce divergent results for divergent purposes.

A) Productivity Analyses *à la Kivinen et. al.*

- Productivity of research and teaching
- Ratings of universities by disciplines
- Facts for evidence-based university policy

Input-Output Ratios

FUNDING   INPUTS   OUTPUTS

C) Ranking Metrics
à la ARWU, QS, HEEACT

-Status evaluations for
 the reputation market
-Performance indicators

Output-Cost
Output-Alternative Cost Ratios

B) Cost Accounting *à la Neittaanmäki et. al.*

- Cost estimation for financial administration

Figure 1   Three approaches to evaluate universities: Productivity analyses (A), Cost accounting (B) and Ranking metrics (C)

Our productivity analyses, which we will elaborate on later in this report, focus on the inter-relations between output and input by disciplines. (See Kivinen, Hedman and Peltoniemi 2008; 2009). The productivity analyses yield such an evidence base upon which we have been able to develop our rating system, which in turn could work also in service of evidence-based policy, as we will demonstrate later in the report.

In cost accounting (à la Neittaanmäki) outlining the relations between output and costs is the main focus. The ultimate goal is to find out how much funds have been used to gain certain goals. Cost accounting yields cost estimations to aid the budgeting of various operations. The latest report concerning cost accounting in Finnish universities is by Neittaanmäki, Neittaanmäki, Tiihonen and Ärje (2010). The report does, however, to some extent resort to double-talk when it names the relation between output and costs as productivity, but actually deals with clear cost accounting. The relative unit costs and alternative costs estimated by cost accounting are typically employed when mapping for instance different calculation models for budgeting operations.

The ranking metrics measuring the statuses of universities in the reputation market do not as such have a direct conceptual or methodological relationship with either the productivity analyses or with cost accounting. In spite of the fact that all three methods illustrated in Table 1 yield their results for different purposes, we may still note that productive, cost effective and world-renowned university would indeed be something worth striving for, and there is no doubt that it would be hailed also throughout the spectrum of interest groups.

DATA AND RESEARCH METHOD

In our productivity analyses we lean on the KOTA database maintained by the Ministry of Education and Culture. All Finnish universities report their inputs and outputs into the KOTA database. The disciplines included in the study are those with the most significant input volumes and in which scientific research is practiced and taught in at least five universities. The nine disciplines selected for the study are humanities (in 8 universities), education (8), social sciences (9), psychology (6), nursing science (6), business administration (9), natural sciences (8), technical sciences (7) and medicine (5). In this study the agriculture and forestry are excluded from the natural sciences and dentistry, veterinary medicine and pharmacy from the medicine. Also law is excluded.

In this study, by units we mean combinations of a discipline and a university, for example "Medicine – University of Helsinki". In total, there are 66 units from nine disciplines included in this study. The period of our study covers the years 2005–2009 and therefore we will apply the statistical conventions used at that time. This means that in our study the unit which is now the Aalto University School of Science and Technology is signified as the Helsinki University of Technology (HUT), the Aalto University School of Economics as the Helsinki School of Economics (HSE).

Within every discipline the analyses are conducted in a manner which provides each of the 66 units two separate scores indicating productivity of research and teaching leaning on relational methodology and standardization methods. In short, we proceed by transforming inputs and outputs of a unit into percentages of total inputs and outputs of all units in the discipline. These percentages of inputs and outputs are then used in calculating input-output ratios. The productivity score for research in the analysis is based on 30 input-output ratios and the score for teaching is based on 10 ratios. Any unit receiving 50 scores or more in both research (Research +) and teaching (Teaching +) is a productive unit in its field and will be given the highest available productivity rating of A^{++}.

During the period of 2005–2009 the external funding within the disciplines studied here amounted to 1.33 billion euros when the corresponding amount for the entire university system was 1.7 billion euros. The volume of research and teaching in the disciplines under

study measured by professorial person-years is 9,560, when the corresponding figure for the entire university system is 11,367. Other teaching (tenures + part-time teaching) years for the disciplines under study has been marked as 20,892 when the volume for the entire university system is 27,655. As the figures above show, about a quarter of the teaching and research volume within the university system is left outside our study.

When it comes to the output volumes of the disciplines analyzed here, the volume of the research measured by funding from the Academy of Finland is 0.60 billion euros when the corresponding figure for the entire university system is 0.72 billion euros. The output volume for the discipline studied for this period is: 6,735 doctoral degrees, 51,842 international refereed scientific articles and 62,962 master's level degrees. The corresponding figures for the entire university system are: 7,526 doctoral degrees, 60,212 international refereed scientific articles and 72,292 master's level degrees. Hence, what is left outside our study is less than a fifth of the research and teaching volume of the entire university system when measured by outputs. It is noteworthy that the nine disciplines under scrutiny here make up four fifth of the outputs with an input of three quarters.

We analyse the productivity of research by two input measures and three output measures. The input measures in question are professorial person-years and external research funding. The output measures are international refereed scientific articles, the doctoral degrees resulting from the research training and the funding received from the Academy of Finland. Professorial person-years is a valid input when evaluating the productivity of research and teaching, as it is — by definition — the responsibility of a professor to do scientific research, supervise doctoral training and guarantee that the scientific level of the teaching meets the criteria. External research funding is a valid research input, because in practice research work is done largely with funds other than those channelled through the Ministry of Education and Culture, and based on the Government budget. External funding may come from either a public or a private source.

Refereed articles published in international scientific journals are unequivocally the key output measure when evaluating the productivity of scientific work. Doctoral degrees are an essential output of both teaching and research work, as the continuity of scientific work is based on research training. Funding received from the Academy of Finland is an apt measure of output when evaluating the productivity of scientific work, because the application process

submits both the applications and the applicants to peer review for verifying scientific merits. Citations or any figures derived from them, however, are not included in the KOTA database, and are not utilized in this study. It could be said that researchers and units which in general publish internationally a lot tend to receive more citations while those researchers and units which publish very little tend to receive very few.

INPUTS   OUTPUTS

Professorial person-years

- Psyc. 2%
- Nurs. 2%
- Educ. 7%
- Bus. 11%
- Nat. 18%
- Med. 14%
- Soc. 11%
- Tech. 23%
- Hum. 13%

International refereed articles

- Educ. 2%
- Bus. 5%
- Psyc. 3%
- Nurs. 3%
- Soc. 4%
- Hum. 3%
- Nat. 27%
- Med. 34%
- Tech. 19%

External research funding

- Educ. 2%
- Bus. 7%
- Psyc. 1%
- Nurs. 2%
- Soc. 5%
- Hum. 2%
- Nat. 18%
- Med. 16%
- Tech. 47%

Doctoral degrees

- Bus. 7%
- Psyc. 2%
- Nurs. 4%
- Educ. 6%
- Soc. 8%
- Nat. 24%
- Med. 18%
- Hum. 9%
- Tech. 22%

Acad. of Finland funding

- Bus. 3%
- Psyc. 3%
- Nurs. 1%
- Educ. 2%
- Soc. 11%
- Hum. 9%
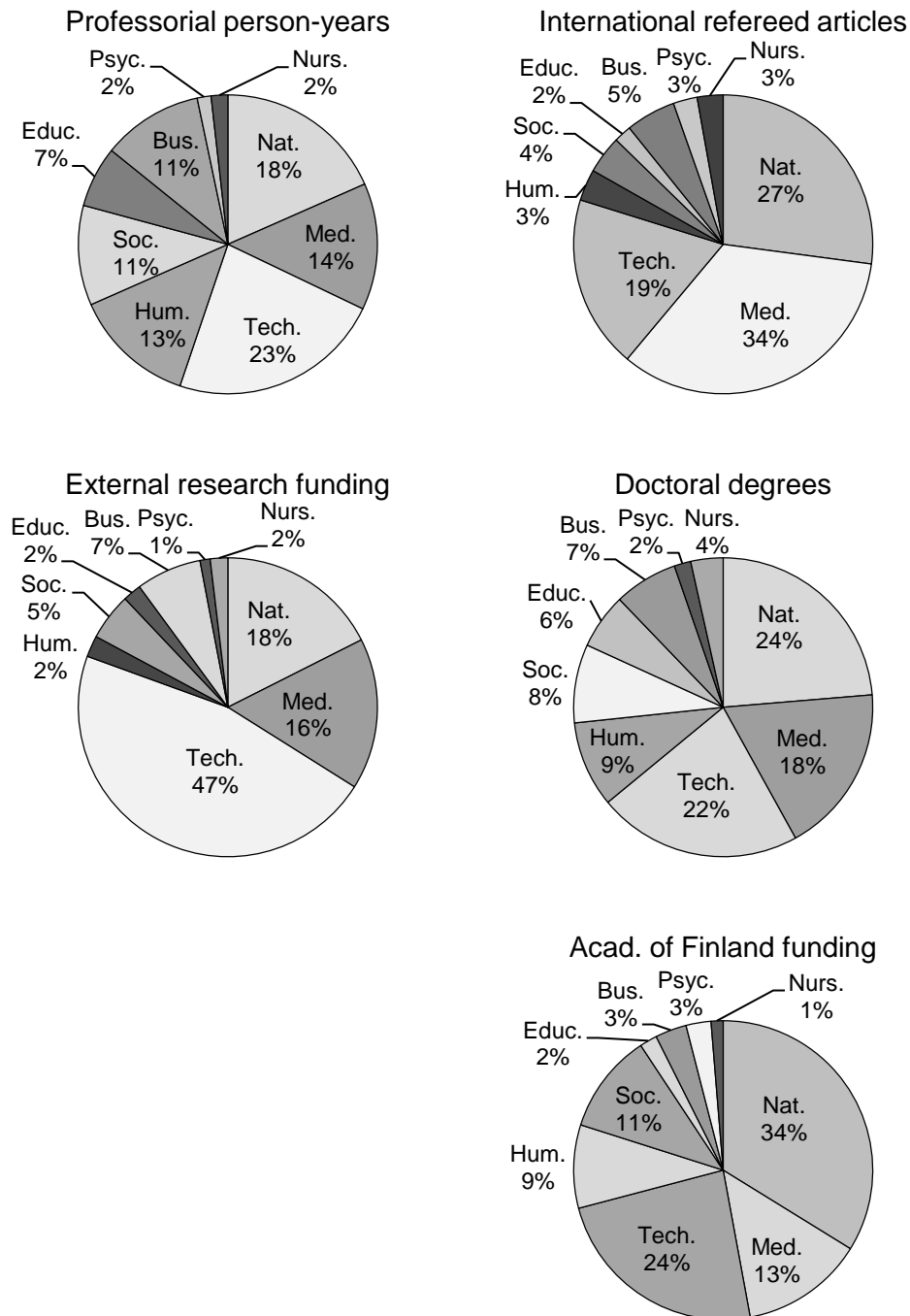- Nat. 34%
- Med. 13%
- Tech. 24%

Figure 2   Output and input shares of research by scientific disciplines 2005–2009

Figure 2 illustrates the distribution of inputs and output by disciplines during the period of 2005–2009. The "hard" sciences: technical science, medicine and natural sciences have clearly the largest inputs. Together these three utilize more than half of all inputs. When it comes to professorial person-years the share of technical sciences is 23 percent, while those of natural sciences and medicine are 18 and 14 percent respectively. The technical sciences alone receive nearly half (47%) of all external funding. The percentages of external funding of natural sciences (18%) and medicine (16%) are more or less corresponding with their shares of professorial person-years. In the case of technical sciences the proportions of outputs (international refereed articles 19%, doctoral degrees 22%, the Academy of Finland funding 24%) are closer to their share of professorial person-years than to their share of external funding. Natural sciences present output shares (27%, 24%, 34%) which are substantially larger than its input shares. The natural science units hold the largest share of both doctoral degrees and the Academy of Finland funding. The largest share of international refereed articles (34%) is held by medicine but its received share of the Academy of Finland funding (13%) is substantially smaller.
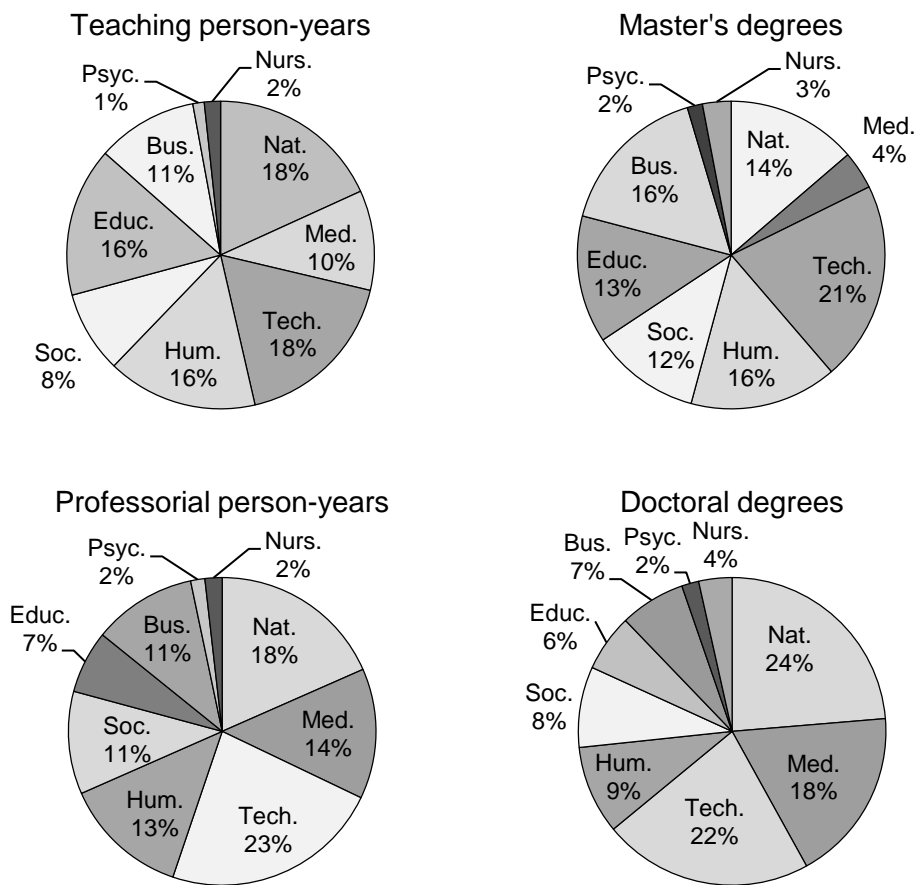
INPUTS   OUTPUTS

Teaching person-years

Master's degrees

Professorial person-years

Doctoral degrees

Figure 3   Output and input shares of teaching by disciplines 2005–2009

Figure 3 illustrates the shares of inputs and outputs of teaching by disciplines in the period of 2005–2009. The person-years of teaching staff are natural inputs to measure teaching by, and master's level degrees are a standard tool for measuring output of teaching in higher education. Natural and technical sciences both get 18 percent of teaching person-years. The corresponding figure for the humanities and education is 16 percent. The 10 percent share of medicine does not even match up to the share of business administration (11%). The output shares reveal that most master's degrees are completed under technical sciences (21%). Both the humanities and business administration produce a share of 16 percent, which is larger than the corresponding figure for the natural sciences (14%). When looking at the master's degrees, percentages produced by medicine, nursing science and psychology (4%, 3% and 2% respectively) are marginal. Considering the input distribution across these nine disciplines reveals that in Finland the disciplines receiving the greatest inputs are technical science, natural sciences and medicine, which together gather a share of nearly two thirds of the complete input.

Figure 4 The phase by phase illustration of the calculative principles of productivity scores

Each of the nine disciplines is analyzed as described in figure 4. In phase one, the units (66 altogether) are assigned with six input-output ratios for research (a^R, b^R, c^R, d^R, e^R, f^R) and two (a^T, b^T) for teaching per year (5 altogether) by relating unit's share of discipline's total output to unit's share of discipline's total input. This procedure yields 30 input-output ratios for research and 10 input-output ratios for teaching for each unit.

In phase two, we order the units according to their annual input-output ratios (for instance the doctoral degrees/professorial person-years ratio). The unit with the highest input-output ratio receives as its ranking point the value n (the total number of units), the unit with the second highest the value n-1 and the unit with the lowest value the n-(n-1)=1, which stands for one

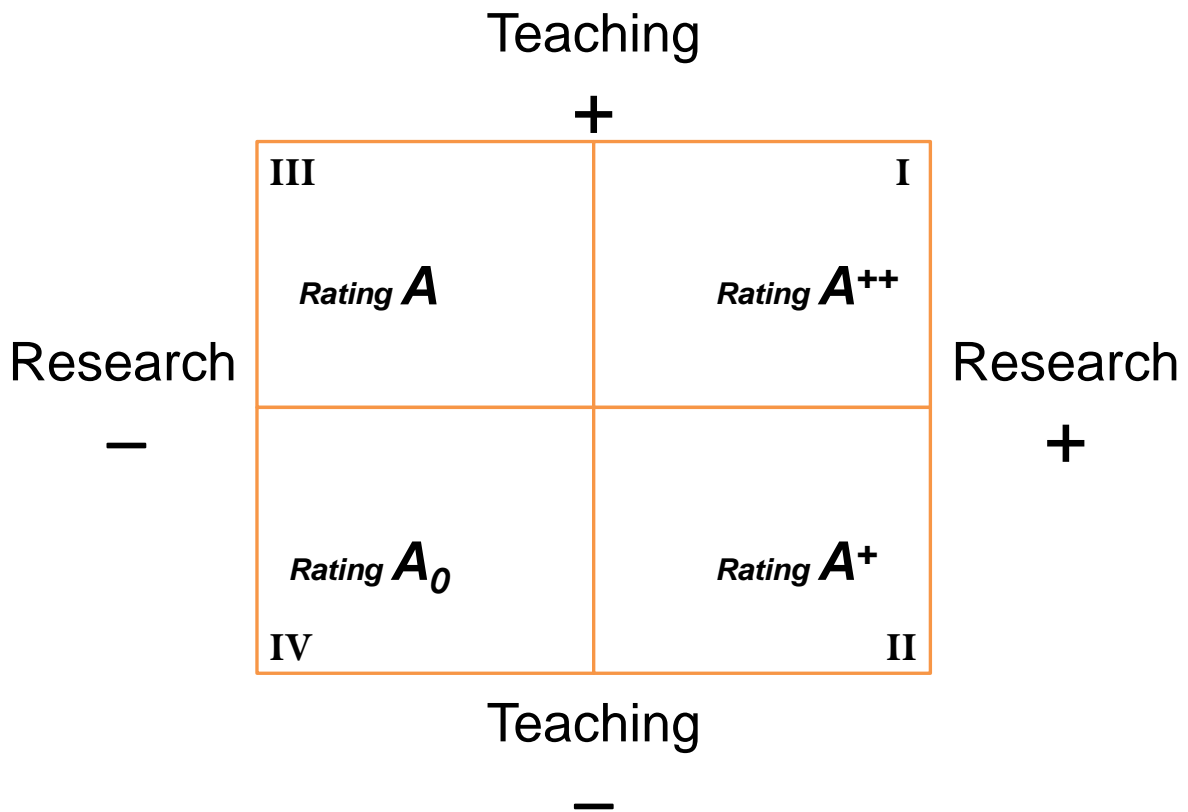point. It is possible to order the units by disciplines, or, as we have done, by including all 66 units. The order of the units in relation to one another is in both cases determined by the input-output ratios, and the ranking points do not alter the order of units.

As a result of the described operations, each of the 66 units gets the ranking points for productivity of research, as well as the ranking points for productivity of teaching. In phase three, we standardize the ranking points to the range of 1-100. The productivity score signifying the productivity of a unit's research is calculated as an average of 30 standardized ranking scores and the productivity score of a unit's teaching as an average of 10 standardized ranking scores. To reach the maximum value of 100, a unit must rank at the top every year and according to each of the input-output ratios. In the other end of the scope, a unit must rank at the bottom every year and according to each of the input-output ratios to score the value 1.

Unlike the sum-and-weight methods commonly used in university rankings, our input-output approach does not require any weights. For evidence-based policy in search of an objective factual basis, the sum-and-weight approach with its preconceived weights is problematic because it incorporates certain preconceptions within the calculations. This problematises the appropriateness of the produced evidence. (For more details see: Florian 2007; Kivinen and Hedman 2008; Billaut, Bouyssou and Vincke 2010; Dehon, McCAthie and Verardi 2010; Kroth and Daniel 2008; Van Raan 2005).

PRODUCTIVITY OF RESEARCH AND TEACHING BY DISCIPLINES

Our rating system based on the results of productivity analyses highlights the best units out of the total of 66 units studied. In units receiving the highest available rating of A^{++}, research and teaching form an integrated whole operating productively. As Figure 5 illustrates the units scoring 50 or higher for both productivity of research and teaching (Research +, Teaching +) place themselves in the quadrant I of the fourfold table with a rating of A^{++}. Units scoring 50 or more on research (Research +) but scoring less than 50 for teaching (Teaching −) place in the quadrant II with a rating of A^{+}. Units which score less than 50 for research (Research −), but score 50 or more for teaching (Teaching +) are placed in the quadrant III of the fourfold table with a rating of A. These units meet up with the requirements of the discipline in teaching, but should strengthen their research basis. Those units, which score less than 50 on both research and teaching (Research −, Teaching −) are placed in the quadrant IV of the fourfold table with a rating of A_0. These units show lesser evidence of productive research and teaching than other units. It is important to note, however, that even those units which receive a rating of A_0 have still managed to produce results verified by the scientific community, albeit on a smaller scale than the units within the other three quadrants.

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                        Teaching
                           +
       ┌──────────────────────┬──────────────────────┐
       │ III                  │                    I │
       │                      │                      │
       │      Rating A        │     Rating A++        │
Research│                     │                      │ Research
   −    ├──────────────────────┼──────────────────────┤    +
       │                      │                      │
       │     Rating A0        │     Rating A+        │
       │ IV                   │                   II │
       └──────────────────────┴──────────────────────┘
                        Teaching
                           −
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"Research +" = Productivity score for research ≥ 50

"Teaching +" = Productivity score for teaching ≥ 50

Figure 5   The fourfold table of ratings based on productivity of research and teaching

Various projects for grading and profiling research are ongoing around the world, the British RAE (Research Assessment Exercise) amongst the most famous. The system for evaluating research in Thailand developed by the Thailand Research Fund (TRF) is worth mentioning here. What makes this system interesting is that it also utilizes output indicators relative to inputs with classifications by disciplines. Adapting the logic of TRF's five-step rating system, we have created a four-step system well suited for Finland. In our system A^{++} marks the excellent international level, A^{+} the good international level, A the strong national level and A_0 means need for improvement.

We will put the success of Finnish universities in ARWU, QS and HEEACT rankings in proportion with the results of our own productivity analyses. We will examine the extent to which the Finnish units with differing productivity ratings are placed in international

rankings. All in all QS, ARWU and HEEACT offer 58 distinct evaluation series according to scientific disciplines for the years 2007, 2008, 2009 and 2010 (for more details see Appendix 1 and "Methodology" on the websites of all three service providers). The divisions into scientific disciplines do not, however, fully match those in the KOTA, and therefore we have on occasion had to settle for quite crude matches.

Altogether ARWU incorporates evaluations in five different disciplines: Life and Agriculture Sciences (LIFE), Engineering/Technology and Computer Sciences (TEC), Clinical Medicine and Pharmacy (MED), Natural Sciences and Mathematics (SCI), and Social Sciences (SOC). QS likewise incorporates five analyses according to scientific discipline: Life Sciences and Medicine (MED), Technology (TEC), Natural Sciences (SCI), Social Sciences and Management (SOC), Arts & Humanities (HUM). HEEACT includes the following six: Agriculture and Environment Sciences (AGR), Clinical Medicine (MED), Engineering, Computing and Technology (TEC), Life Sciences (LIFE), Natural Sciences (SCI) and Social Sciences (SOC). The ARWU and QS evaluations have been available since 2007 and HEEACT evaluations since 2008.

PRODUCTIVITY OF RESEARCH AND TEACHING IN MEDICINE

We have collected in Table 1 the productivity scores on both research and teaching from the medicine units of the five Finnish universities in period 2005–2009. The most productive in research is the University of Helsinki with 70 scores. The Universities of Oulu and Turku are side by side with 61 scores, and thus clearly over the landmark of 50 scores, whereas the Universities of Kuopio (41) and especially Tampere (27) fail to reach that. The highest productivity score for teaching (58) is as well scored by the University of Helsinki. Oulu (57), Tampere (54) and Kuopio (52) also pass the landmark of 50 scores in teaching in medicine, leaving only Turku under it with 42 scores.

Table 1   Productivity of universities in medicine in 2005–2009

University	Productivity score for research	Productivity score for teaching
University of Helsinki (UH)	70	58
University of Oulu (UO)	61	57
University of Turku (UTU)	61	42
University of Kuopio (UK)	41	52
University of Tampere (UTA)	27	54

Figure 6 illustrates the positions of the five medicine units on the research and teaching fourfold table based on their productivity scores. Units' productivity scores for research determine their positioning along the horizontal axis and the productivity scores for teaching along the vertical axis. The scales of 1 to 100 on both axes intersect at the score of 50. Both the Universities of Helsinki and Oulu place themselves in the quadrant I (Research + and Teaching +) and get the rating A[++]. Research in the University of Turku is productive (Research +) but teaching leaves room for improvement (Teaching −). Turku receives the rating A[+]. In Tampere and Kuopio teaching is productive (Teaching +) but research needs to strengthen (Research −). They both receive the rating A. It is worth noting that each of the five units in medicine is productive in research or in teaching, or in both.
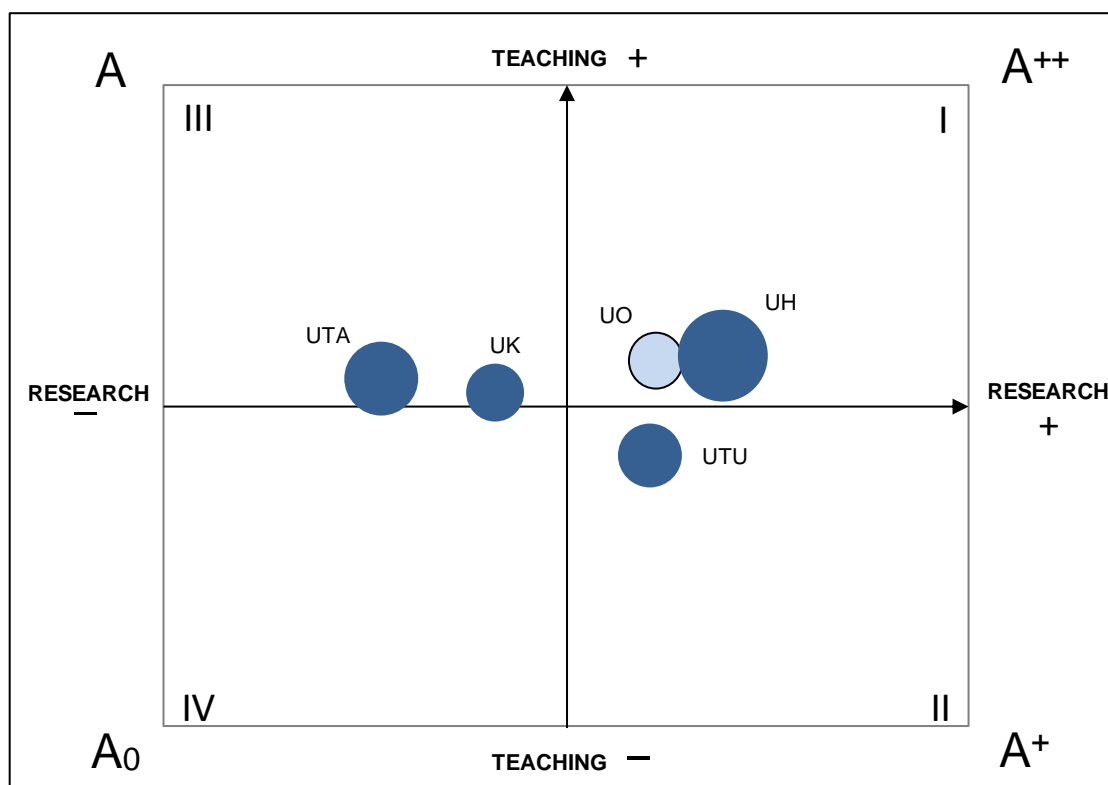
Figure 6   Productivity of research and teaching of the five units in medicine
in 2005–2009

In Figure 6, the size differences of the markers ('the circles') depict the size differences of the
inputs between the units, which may be interpreted as a difference in the critical mass. For
instance the notable critical mass of the unit of the University of Helsinki lets us to expect a
bit more productive future compared to the University of Oulu, despite the fact that both
place themselves in quadrant I and both receive the rating A^{++}. Reaching that level of
productivity with considerable inputs promises good international success in the future.

One strategically essential question in every discipline is the optimal number of units. The
differences between the five medicine units concern mainly productivity of research, because
the differences in the productivity of teaching between the units are quite small. In the
facility-intensive field of medicine, research often tends to override teaching. Adapting the
principles of for example the Thailand Research Fund the following strategic plan could be
articulated: secure a research capacity enabling the strive for excellent international quality
for the trio Helsinki (A^{++}), Oulu (A^{++}) and Turku (A^{+}) — with Helsinki as the forerunner.
Securing the strong national level capacity for Tampere and possibly Kuopio accompanied by

stronger teaching orientation could crystallize the division of labour within the discipline. The labour market signals indicate a shortage of physicians. This situation is more severe in rural areas than in the cities. It might be reasonable to increase the volume of education in medicine.

Next we will look at the placings of Finnish university units in international university rankings by discipline (ARWU, QS and HEEACT). Following a crude match, it is possible for a Finnish unit in the field of medicine to be ranked altogether in eighteen different evaluation series. The maximum placing frequency in medicine is thus 18/18 which gives the qualification coefficient of 1.00 (18/18). The placings and the qualification coefficients of medicine units are compiled in Table 2. As can be seen, the University of Helsinki is placed in every one of the 18 possible instances, which makes its placing frequency 18/18 and qualification coefficient 1.00. With the coefficient of 0.56 (10/18), the University of Turku is second. Oulu and Kuopio gain fewer placings and both receive the coefficient of 0.28. Tampere takes the last place in this comparison with the coefficient of 0.17.

Table 2   The placings received by Finnish units in medicine in ARWU, QS and HEEACT rankings 2007-2010 and the qualification coefficients

		UH	UTU	UO	UK	UTA
	Qualification coefficient	**1.00**	**0.56**	**0.28**	**0.28**	**0.17**
2010	"QS-top 300 in MED"	58	280			
	"ARWU-top 100 in MED"	76-100				
	"ARWU-top 100 in LIFE"	76-100				
	"HEEACT-top 300 MED"	52	202	239	188	205
	"HEEACT-top 300 in LIFE"	41	266	299	212	
2009	"QS-top 300 in MED"	72	216			
	"ARWU-top 100 in MED"	76-100				
	"ARWU-top 100 in LIFE"	76-100				
	"HEEACT-top 300 in MED"	50	198	223	179	179
	"HEEACT-top 300 in LIFE"	50	248		271	
2008	"QS-top 300 in MED"	71	167			
	"ARWU-top 100 in MED"	51-75				
	"ARWU-top 100 in LIFE"	76-100				
	"HEEACT-top 300 in MED"	45	180	221	192	195
	"HEEACT-top 300 in LIFE"	60	228			
2007	"QS-top 300 in MED"	89	197	288		
	"ARWU-top 100 in MED"	51-75				
	"ARWU-top 100 in LIFE"	51-75				

In conclusion it should be noted that the units receiving ratings A^{++} or A^+ for the productivity of research and teaching (Helsinki A^{++}, Oulu A^{++} and Turku A^+) fare better on the international reputation market compared with the units receiving the lower rating A (Tampere and Kuopio). This also indicates in part that in respect of medicine, the information included in the KOTA database gives a quite accurate image of the capabilities of units.

PRODUCTIVITY OF RESEARCH AND TEACHING IN NATURAL SCIENCES

The productivity scores received by the eight units in natural sciences for research and teaching are compiled in the Table 3. The highest score for productivity of research is received by Turku (69), with Helsinki and Åbo Akademi sharing the second place with 65 scores. Also Joensuu (59), Jyväskylä (57) and Oulu (56) reach the landmark of 50 scores, whereas Kuopio (40) and Tampere (32) fail to attain it. In productivity of teaching Helsinki receives the highest score (63), but Jyväskylä (62) and Åbo Akademi (61) are not far behind. Kuopio (54) also manages to pass 50 scores, whereas Oulu and Tampere (49), Joensuu (43) and Turku (40) fall short of it.

Table 3   Productivity of universities in natural sciences in 2005–2009

University	Productivity score for research	Productivity score for teaching
University of Turku (UTU)	69	40
University of Helsinki (UH)	65	63
Åbo Akademi (ÅA)	65	61
University of Joensuu (UJO)	59	43
University of Jyväskylä (UJY)	57	62
University of Oulu (UO)	56	49
University of Kuopio (UK)	40	54
University of Tampere (UTA)	32	49

In the fourfold table based on productivity scores for the units in natural sciences (Figure 7) Helsinki, Åbo Akademi and Jyväskylä are all placed in quadrant I (Research +, Teaching +) with the rating A^{++}. In quadrant II Turku, Joensuu and Oulu are productive in research (Research +) but their productivity of teaching is relatively modest (Teaching −). Hence the Universities of Turku, Joensuu and Oulu receive the rating A^+. The productivity scores of

Kuopio place the unit in quadrant III, because their teaching is productive (Teaching +) but research is not (Research −), and thus Kuopio receives the rating A. Tampere instead is placed on quadrant IV (Research − and Teaching −) with the rating A_0.
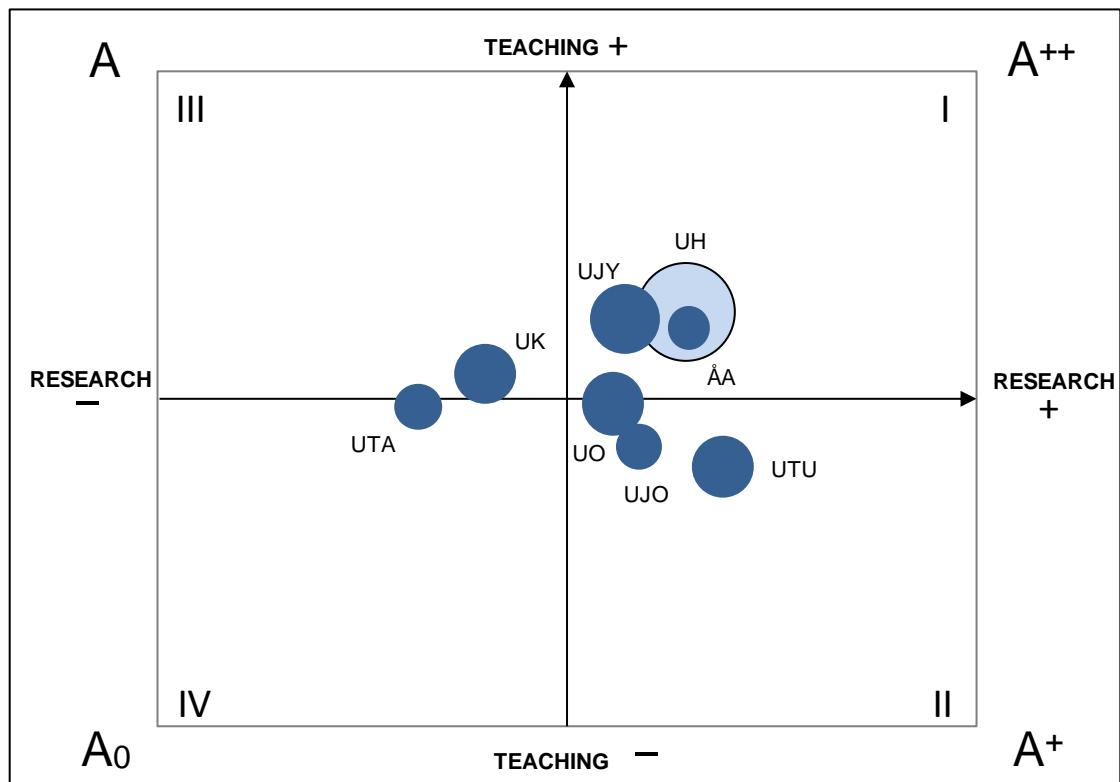

Figure 7   Productivity of research and teaching of the eight units in natural sciences in 2005−2009

As is the case with medicine, also in natural sciences the critical mass of the University of Helsinki sets it apart from Jyväskylä and Åbo Akademi, all of which receive the rating A^{++}. The differences in productivity of teaching in between the natural sciences units are quite small, and the differences in productivity are mainly originated in research. A crude strategy for the Natural Sciences could at a minimum include maintaining the international level research capacity for the three units with the A^{++} rating and the three units with the A^{+} rating. Helsinki is the forerunner in the natural sciences as well as in the medicine.

A Finnish unit in the field of natural sciences has possible placings in 21 series of international rankings. Helsinki is placed in all of the 21 series, ranking 15th in the world at best. This gives Helsinki the qualification coefficient of 1.00. Turku is the second most often

placed with 13 series and thus receives the coefficient of 0.62. The other Finnish units are placed less frequently: Kuopio in 5 series (coefficient 0.24), Jyväskylä in 3 (0.14) and Oulu in 2 (0.10). Tampere, Joensuu and Åbo Akademi go entirely without placings, this despite the fact that Åbo Akademi received the rating A^{++} and Joensuu A^{+} in our productivity analysis. This is due to our analysis giving credit also to smaller units utilizing their smaller inputs productively. On the other hand, in the international rankings the modest publicity received by a smallish university may leave even the productive units of that university into a blind spot.

Table 4 The placings received by the Finnish units in natural sciences in ARWU, QS and HEEACT rankings 2007–2010 and the qualification coefficients

		UH	UTU	UK	UJY	UO
	Qualification coefficient	**1.00**	**0.62**	**0.24**	**0.14**	**0.10**
2010	"QS-top 300 in MED"	58	280			
	"QS-top 300 in SCI"	108			268	
	"ARWU-top 100 in LIFE"	76-100				
	"HEEACT-top 300 in SCI"	95				
	"HEEACT-top 300 in AGR"	19	232	289		
	"HEEACT-top 300 in LIFE"	41	266	212		299
2009	"QS-top 300 in MED"	72	216			
	"QS-top 300 in SCI"	80	272		236	
	"ARWU-top 100 in LIFE"	76-100				
	"HEEACT-top 300 in SCI"	102				
	"HEEACT-top 300 in AGR"	17	174	231		
	"HEEACT-top 300 in LIFE"	50	248	271		
2008	"QS-top 300 in MED"	71	167			
	"QS-top 300 in SCI"	72	287		279	
	"ARWU-top 100 in LIFE"	76-100				
	"HEEACT-top 300 in SCI"	96				
	"HEEACT-top 300 in AGR"	15	135	258		
	"HEEACT-top 300 in LIFE"	60	228			
2007	"QS-top 300 in MED"	89	197			288
	"QS-top 300 in SCI"	92	260			
	"ARWU-top 100 in LIFE"	51-75				

In the case of natural sciences, the units with a productivity rating of A^{++} or A^{+} and a sufficient mass (Helsinki, Turku, Oulu and Jyväskylä) are also competitive in international rankings.

PRODUCTIVITY OF RESEARCH AND TEACHING IN TECHNICAL SCIENCES

In the field of technical sciences, there are units altogether in seven universities and their productivity scores for research and teaching are compiled in Table 5. For productivity of research the highest score received is by the Åbo Akademi (70) and the second highest by the Helsinki University of Technology (HUT) (66). All other units in the field score less than 50 for research. Following Turku (46), both Tampere and Oulu receive 39, Lappeenranta 32 and Vaasa 26. In productivity of teaching, the highest score, 68, is received by the HUT, now known as the Aalto University School of Science and Technology. Lappeenranta is the second in teaching with 62 scores and the Tampere University of Technology third with 52. The other four units score less than 50 in the following order: Åbo Akademi and Oulu (41), Turku (14) and Vaasa (4).

Table 5   Productivity of universities in technical sciences in 2005–2009

University	Productivity score for research	Productivity score for teaching
Åbo Akademi (ÅA)	70	41
Helsinki University of Technology (HUT)	66	68
University of Turku (UTU)	46	14
Tampere University of Technology (TUT)	39	52
University of Oulu (UO)	39	41
Lappeenranta University of Technology (LUT)	32	62
University of Vaasa (UV)	26	4

In the fourfold table of productivity scores for technical sciences (Figure 8) HUT is the only unit placed in quadrant I (Research + and Teaching +) and thus is the only one receiving the rating A^{++}. Åbo Akademi is the sole unit placed in quarter II (Research +, but Teaching −) and is given the rating A^{+}. Productivity scores of Lappeenranta and Tampere place them in quadrant III, meaning that teaching is productive (Teaching +) but research is not (Research −), which gives them the rating A. No fewer than three units in the field of technical sciences are placed in quadrant IV (Teaching − and Research −) and thus receiving the rating A_0.
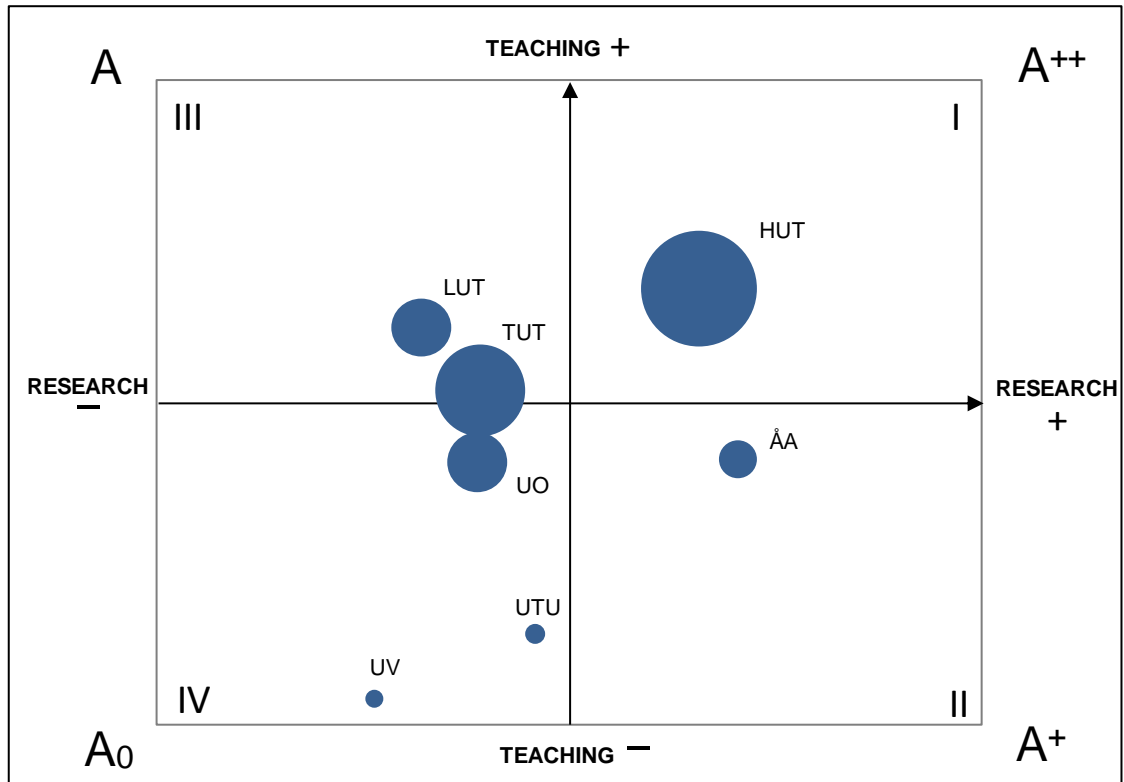
Figure 8   Productivity of research and teaching of the seven units in technical sciences in 2005–2009

As Figure 8 illustrates, the variance in productivity in the field of technical sciences is significant. HUT is set apart from the other units by its A^{++} rating and its critical mass, which indicates a good competence in answering to international challenges. The A^+ rating received by the Åbo Akademi suggests international potential, although their mass is not close to matching that of the HUT. The Technical Universities of Tampere and Lappeenranta receive the rating A, and Tampere also stands out with its substantial mass. Oulu, Turku and Vaasa receive the rating A_0; Turku and Vaasa possess rather insignificant numbers in terms of mass as well. The heterogeneous field of technical sciences needs strong actions in order to improve the productivity of research combined with solutions to radically reorganize the division of labour.

There are possible placings available in 14 series of international rankings for Finnish units in technical sciences. HUT is placed in all of them, granting it the qualification coefficient of 1.00. Turku and Oulu are placed rather sparsely (coefficients of 0.29 and 0.21 respectively). Tampere, Lappeenranta, Åbo Akademi and Vaasa are left completely without placings,

despite the fact that Åbo Akademi received the rating A$^+$ in our analysis. This again is explained by the fact that our analysis does justice to units working with small inputs, if their outputs match up to their inputs. As we have noted earlier, the smaller size of a university will often leave even the productive units in a blind spot.

Table 6   The placings received by the Finnish units in technical sciences in QS and HEEACT rankings 2007–2010 and the qualification coefficients

		HUT	UTU	UO
	Qualification coefficient	**1.00**	**0.29**	**0.21**
2010	"QS-top 300 in TEC"	140		289
	"QS-top 300 in SCI"	186		
	"HEEACT-top 300 in SCI"	300		
	"HEEACT-top 300 in TEC"	163		
2009	"QS-top 300 in TEC"	94		
	"QS-top 300 in SCI"	187	272	
	"HEEACT-top 300 in SCI"	235		
	"HEEACT-top 300 in TEC"	118		
2008	"QS-top 300 in TEC"	94		233
	"QS-top 300 in SCI"	175	287	
	"HEEACT-top 300 in SCI"	233		
	"HEEACT-top 300 in TEC"	101		
2007	"QS-top 300 in TEC"	72	296	276
	"QS-top 300 in SCI"	156	260	

Let us point out that in the field of technical sciences HUT is supreme over the other Finnish units in the international reputation market with the productivity rating A^{++} and its significant critical mass.

PRODUCTIVITY OF RESEARCH AND TEACHING IN SOCIAL SCIENCES

There are social sciences units in altogether nine universities and their productivity scores for research and teaching are compiled in the Table 7. The highest score for productivity of research is received by Jyväskylä (82), the second highest by Turku (75) and the third by Helsinki (68). All other units score less than 50: Tampere receives 49, Vaasa 46, Åbo Akademi 44, Joensuu 36 and the last place is shared by Kuopio and Lapland with 17 scores. The 75 received by Helsinki is the highest score in teaching. Jyväskylä (70) and Tampere

(69) also reach 50 scores. The rest of the units come in the following order: Turku and Kuopio (46), Åbo Akademi (34) with Joensuu, Lapland and Vaasa all receiving 26 scores.

Table 7   Productivity of universities in social sciences in 2005–2009

University	Productivity score for research	Productivity score for teaching
University of Jyväskylä (UJY)	82	70
University of Turku (UTU)	75	46
University of Helsinki (UH)	68	75
University of Tampere (UTA)	49	69
University of Vaasa (UV)	46	26
Åbo Akademi (ÅA)	44	34
University of Joensuu (UJO)	36	26
University of Kuopio (UK)	17	46
University of Lapland (UL)	17	26

In the fourfold table of productivity scores for social sciences (Figure 9) Helsinki and Jyväskylä are placed in quadrant I (Research +, Teaching +) with the rating A^{++}. Turku is placed in quadrant II (Research +, but Teaching −) with the rating A^{+}. Productivity scores of Tampere places it in quadrant III, where teaching is productive (Teaching +) but research is not (Research −), giving it the rating A. More than half − five of nine − of the units in social sciences are placed in quadrant IV (Teaching − and Research −) and thus receiving the rating A_0.
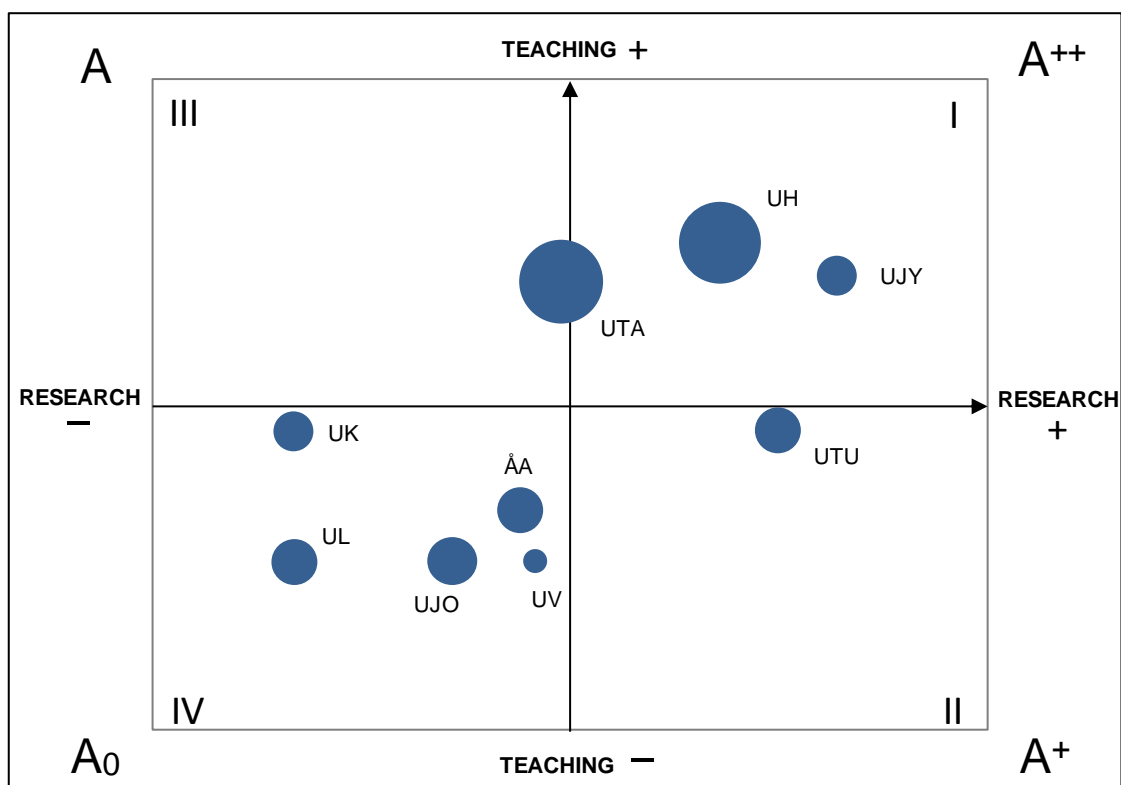
Figure 9 Productivity of research and teaching of the nine units in social sciences in 2005–2009

Figure 9 illustrates the heterogeneous field of social sciences. Helsinki and Tampere stand out from the rest by their critical mass. The difference between Helsinki and the other university with an A^{++}–rating, Jyväskylä, is significant. Turku receives the rating A^+, as it is productive in research but lacks productivity in teaching. Tampere is the only unit to receive the rating A. The units receiving the rating of A_0 are crudely of the same smallish scale, with Vaasa being the smallest. The reorganization of the division of labour within the fragmented field of social sciences aiming to improve the productivity of research can be foreseen.

A Finnish unit in the field of social sciences has possible placings in 18 series of international rankings by disciplines (Table 8). Helsinki is placed in all of them, granting it the qualification coefficient of 1.00. Tampere is placed quite often (coefficient of 0.67) as is Turku (0.56). Jyväskylä and Kuopio are placed rather infrequently (coefficients of 0.17 and 0.06 respectively). Four units are left entirely without placings: Åbo Akademi, Vaasa, Joensuu and Lapland. All of these are units which received the rating A_0 in our productivity analysis.

Table 8   The placings received by the Finnish units in social sciences in QS and HEEACT rankings 2007–2010 and the qualification coefficients

		UH	UTA	UTU	UJY	UK
	Qualification coefficient	**1.00**	**0.67**	**0.56**	**0.17**	**0.06**
2010	"QS-top 300 in HUM"	53				
	"QS-top 300 in TEC"	140				
	"QS-top 300 in SOC"	87	199	219		
	"HEEACT-top 300 in TEC"	299				
	"HEEACT-top 300 in SOC"	127	197		297	
2009	"QS-top 300 in HUM"	57	212	249		
	"QS-top 300 in TEC"	170				
	"QS-top 300 in SOC"	75	247	231		
	"HEEACT-top 300 in TEC"	190				
	"HEEACT-top 300 in SOC"	99	239	262	267	
2008	"QS-top 300 in HUM"	52	218	235		
	"QS-top 300 in TEC"	144	259			
	"QS-top 300 in SOC"	68	208	214		
	"HEEACT-top 300 in TEC"	185				
	"HEEACT-top 300 in SOC"	149	213	296	240	222
2007	"QS-top 300 in HUM"	73	204	275		
	"QS-top 300 in TEC"	188	244	296		
	"QS-top 300 in SOC"	74	212	251		

Helsinki stands out also here in social sciences with the rating A^{++} in productivity, as well as owing to its critical mass. Also the A^{++}–rated Jyväskylä and A^{+}–rated Turku gather placings in social sciences. Tampere receives a good qualification coefficient, despite the rating A.

PRODUCTIVITY OF RESEARCH AND TEACHING IN EDUCATION

There are education units in altogether eight universities, and their respective productivity scores for research and teaching in 2005–2009 are compiled in the Table 9. The highest score for productivity of research (73) is received by Jyväskylä with Turku (69) in the second place. Oulu (54), Helsinki and Tampere (52) also pass the landmark of 50 scores. Joensuu (34), Åbo Akademi (32) and Lapland (26) score significantly less than 50. The score of 85 received by The University of Lapland is the highest in teaching. Tampere is placed second with 79 scores. Turku (60) and Joensuu (55) also pass 50 scores. Helsinki (48), Jyväskylä (47) and Oulu (46) do not fall much short of it, but the margin to Åbo Akademi (33) is significantly larger.

Table 9   Productivity of universities in education in 2005–2009

University	Productivity score for research	Productivity score for teaching
University of Jyväskylä (UJY)	73	47
University of Turku (UTU)	69	60
University of Oulu (UO)	54	46
University of Tampere (UTA)	52	79
University of Helsinki (UH)	52	48
University of Joensuu (UJO)	34	55
Åbo Akademi (ÅA)	32	33
University of Lapland (UL)	26	85

In the fourfold table of productivity scores for education (Figure 10) both Turku and Tampere are placed in the quadrant I (Research + and Teaching +) and are given the rating A^{++}. Jyväskylä, Oulu and Helsinki are placed in quadrant II (Research +, but Teaching −) with the rating A^{+}. The productivity scores of Lapland and Joensuu places them in quadrant III, where teaching is productive (Teaching +) but research is not (Research −), which gives them the rating A. The only unit in the field of education placed in quadrant IV (Teaching − and Research −) and thus given the rating A_0 is Åbo Akademi.
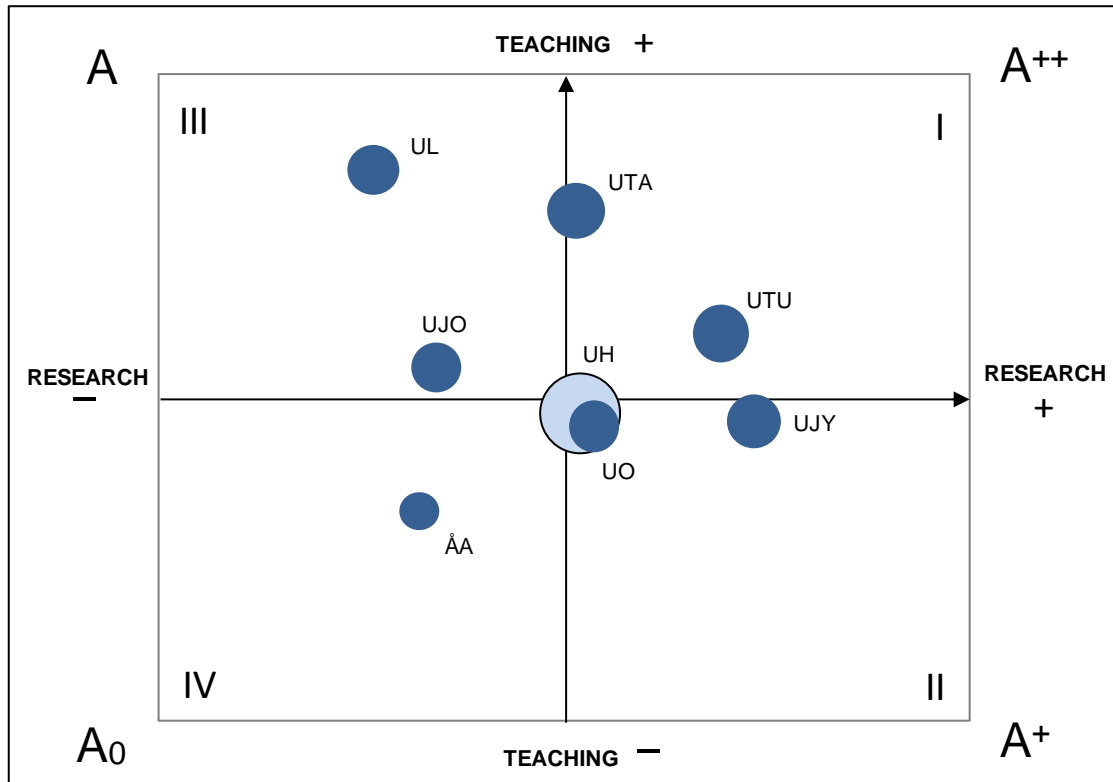
Figure 10   Productivity of research and teaching of the eight units in education in 2005–2009

As Figure 10 illustrates, the differences in inputs between the units in education are quite small. Only Helsinki stands apart in terms of mass from the other two units with the A^+–rating (Jyväskylä and Oulu). The education units located in small towns (ÅA in Vaasa, UL and UJO) seem to struggle with the productivity of research.

There are possible placings available in 11 series of international rankings for Finnish units in education. Helsinki is placed in all of them, granting it the qualification coefficient of 1.00. Also the A^{++}–rated Tampere and Turku receive a large number of placings (coefficients 0.91 and 0.82 respectively). The coefficient received by Jyväskylä is quite low (0.27) and the one received by Oulu even lower (0.18). In the field of education, Joensuu, Lapland and Åbo Akademi stay entirely without placings. Of these three units, in our productivity analysis Joensuu and Lapland receive the rating of A and Åbo Akademi the rating A_0.

Table 10   The placings received by the Finnish units in education in QS and HEEACT rankings 2007–2010 and the qualification coefficients

		UH	UTA	UTU	UJY	UO
	Qualification coefficient	**1.00**	**0.91**	**0.82**	**0.27**	**0.18**
2010	"QS-top 300 in HUM"	53				
	"QS-top 300 in SOC"	87	199	219		
	"HEEACT-top 300 in SOC"	127	197		297	
2009	"QS-top 300 in HUM"	57	212	249		
	"QS-top 300 in SOC"	75	247	231		
	"HEEACT-top 300 in SOC"	99	239	262	267	283
2008	"QS-top 300 in HUM"	52	218	235		
	"QS-top 300 in SOC"	68	208	214		
	"HEEACT-top 300 in SOC"	149	213	296	240	277
2007	"QS-top 300 in HUM"	73	204	275		
	"QS-top 300 in SOC"	74	212	251		

It holds true for education that the units with a productivity rating of A^{++} or A^{+} (Helsinki, Turku, Tampere and Jyväskylä) fare better on the international reputation market than other units in the field.

PRODUCTIVITY OF RESEARCH AND TEACHING IN BUSINESS ADMINISTRATION

There are business administration units in altogether nine universities and their respective productivity scores for research and teaching in 2005–2009 have been compiled in Table 11. The highest score for research (66) is received by Åbo Akademi with Jyväskylä (61) in the second place. The other units scoring more than 50 are the Lappeenranta University of Technology (LUT) and the Helsinki School of Economics (HSE) (53) with Oulu and the Hanken School of Economics (SHH) (52). Of the rest Vaasa scores 49 whereas Tampere and Turku School of Economics (TSE) gain 39. The highest score for the productivity of teaching (88) is received by Lappeenranta. Also Jyväskylä (65), Vaasa (63), Åbo Akademi and Tampere (both 60) as well as Oulu (52) succeed in productivity of teaching. HSE and SHH both score 47 leaving TSE in the last place with 21.

Table 11   Productivity of universities in business administration in 2005–2009

University	Productivity score for research	Productivity score for teaching
Åbo Akademi (ÅA)	66	60
University of Jyväskylä (UJY)	61	65
Lappeenranta University of Technology (LUT)	53	88
Helsinki School of Economics (HSE)	53	47
University of Oulu (UO)	52	52
Hanken School of Economics (SHH)	52	47
University of Vaasa (UV)	49	63
University of Tampere (UTA)	39	60
Turku School of Economics (TSE)	39	21

In the fourfold table of productivity scores for the units in business administration (Figure 11) Jyväskylä, Åbo Akademi, Lappeenranta and Oulu all place in the quadrant I (Research +, Teaching +) with the rating A^{++}. HSE and SHH are placed in quadrant II (Research +, but Teaching –) with the rating A^{+}. Productivity scores of Tampere and Vaasa place them in quadrant III, where teaching is productive (Teaching +) but research is not (Research –), and thus give them the rating A. TSE is the only unit in the field of business administration which places in quadrant IV and thus receives the rating A_0.
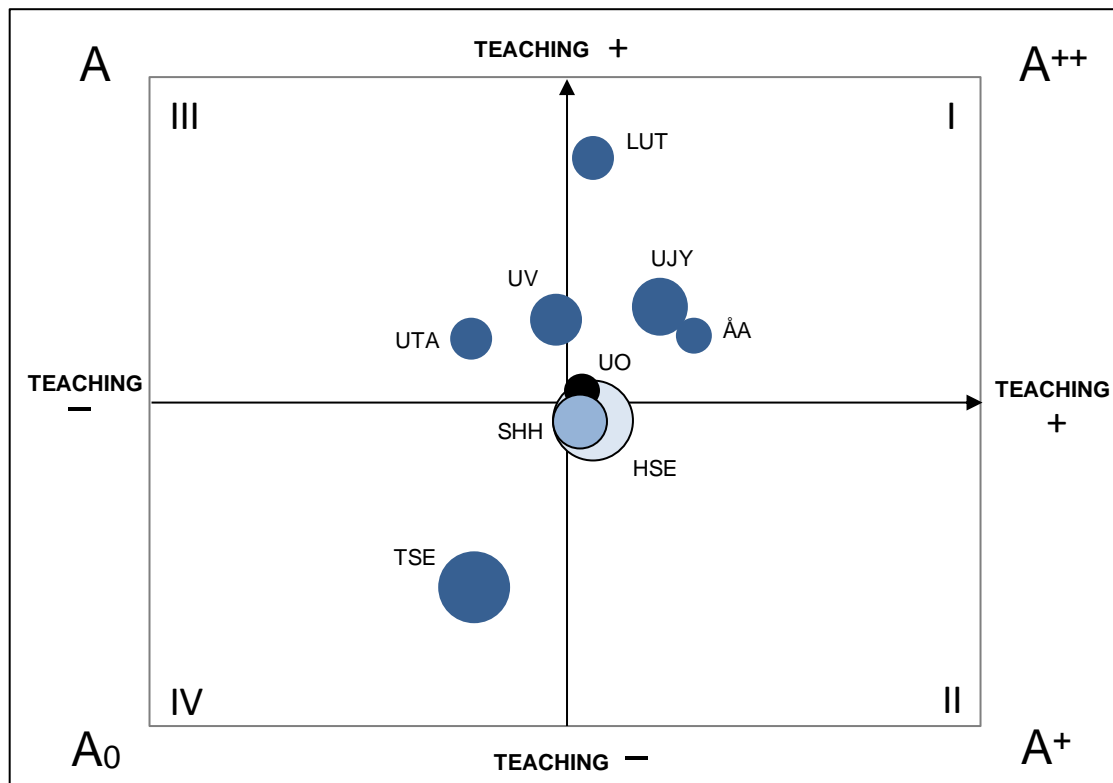
Figure 11   Productivity of research and teaching of the nine units in business
                 administration in 2005–2009

Figure 11 illustrates how Jyväskylä stands out from the other three A^{++}–rated units (LUT, ÅA
and UO) by its slightly larger mass. Similarly, the A^{+}–rated HSE distinguishes itself from the
SHH by its inputs. Tampere and Vaasa receive the rating A. Despite its notable mass, the
TSE is the only unit rated A_0. It remains to be seen whether its conjoinment with the
University of Turku will improve its productivity in the future.

A Finnish unit in the field of business administration has possible placings in 11 series of
international rankings. Tampere is the unit with most placings (9 of 11) and receives the
qualification coefficient of 0.82. Oulu (0.45) and Jyväskylä (0.28) are placed less frequently.
Of the specialized institutions of business administration the HSE is the only one placed, yet
infrequently (coefficient 0.09). There are as many as five units, which are not placed even
once: TSE, SHH, Lappeenranta, Åbo Akademi and Vaasa. This is despite the fact that in our
productivity analysis Åbo Akademi and Lappeenranta received the rating A^{++} and SHH the
rating A^{+}. It is therefore safe to say that although our analysis makes justice even for the units

operating on small inputs, these smaller units are easily left on the blind side in the international rankings.

Table 12   The placings received by the Finnish units in business administration in QS and HEEACT rankings 2007–2010 and the qualification coefficients

		UTA	UO	UJY	HSE
	Qualification coefficient	**0.82**	**0.45**	**0.28**	**0.09**
2010	"QS-top 300 in TEC"		289		
	"QS-top 300 in SOC"	199			241
	"HEEACT-top 300 in SOC"	197		297	
2009	"QS-top 300 in TEC"				
	"QS-top 300 in SOC"	247			
	"HEEACT-top 300 in SOC"	239	283	267	
2008	"QS-top 300 in TEC"	259	233		
	"QS-top 300 in SOC"	208			
	"HEEACT-top 300 in SOC"	213	277	240	
2007	"QS-top 300 in TEC"	244	276		
	"QS-top 300 in SOC"	212			

It can be said that in the field of business administration, productivity of teaching and research does not go hand in hand with the rankings within the international reputation market. A better international visibility could be expected especially of the HSE (now the Aalto University School of Economics) with its A^+–rating and large mass. Being a teaching-oriented discipline, improving productivity of teaching can be seen as an essential goal in improving ranking visibility of a unit.

PRODUCTIVITY OF RESEARCH AND TEACHING IN HUMANITIES

There are humanities units in altogether eight universities, and their respective productivity scores for research and teaching in 2005–2009 are compiled in the Table 13. The highest score for research (70) is received by Oulu with Tampere (60) in the second place. Jyväskylä (59) and Joensuu (58) also reach the milestone of 50 scores, and Helsinki scores exactly 50. Turku (48), Vaasa (46) and Åbo Akademi (42) fail to reach the 50 scores. For productivity of teaching the highest score (82) is received by the University of Jyväskylä, with Oulu gaining 72 and Helsinki 58. The other five units that receive less than 50 scores are Tampere (49), Vaasa (46), Åbo Akademi (43), Joensuu (31), and Turku (29).

Table 13   Productivity of universities in humanities in 2005–2009

University	Productivity score for research	Productivity score for teaching
University of Oulu (UO)	70	72
University of Tampere (UTA)	60	49
University of Jyväskylä (UJY)	59	82
University of Joensuu (UJO)	58	31
University of Helsinki (UH)	50	58
University of Turku (UTU)	48	29
University of Vaasa (UV)	46	46
Åbo Akademi (ÅA)	42	43

In the fourfold table of productivity scores for the units in humanities (Figure 12) Oulu and Jyväskylä are placed in quadrant I (Research +, Teaching +) with a clear margin and Helsinki only just. Each of these units receives the rating A^{++}. Along with Joensuu, Tampere finishes barely in quadrant II (Research +, but Teaching −) and both units receive the rating A^{+}. Three of the eight units (Turku, Vaasa and Åbo Akademi) are placed in quadrant IV (Research − and Teaching −) and receive the rating A_0.
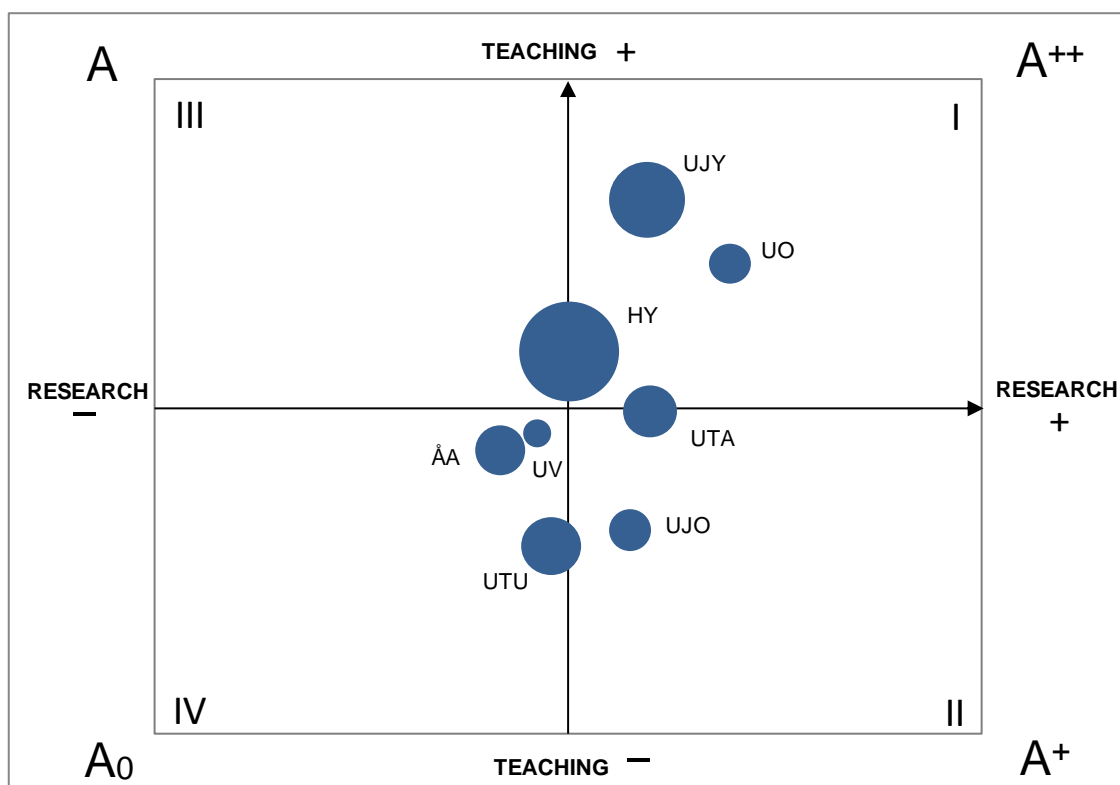
Figure 12   Productivity of research and teaching of the eight units in humanities in 2005–2009

Figure 12 illustrates how the University of Helsinki stands out from the other A^{++}–rated units (Jyväskylä and Oulu) by its critical mass. The rating A^+ received by Joensuu and Tampere separates them clearly from the three A_0–rated units (Turku, Vaasa and Åbo Akademi). Among these three, the larger mass of Turku plays slightly in its disadvantage.

For Finnish units in humanities, there are possible placings available in 11 series of international rankings. The University of Helsinki is placed in all of these, which provides it with the qualification coefficient of 1.00. The Universities of Tampere and Turku are also frequently placed with coefficients of 0.91 and 0.82 respectively. Jyväskylä is placed infrequently (0.27) and Oulu only rarely (0.18). Joensuu, Åbo Akademi and Vaasa are completely without placings, despite the fact that the University of Joensuu receives the rating A^+ in our analysis. This again goes to show that our analysis does justice to units working with small inputs, assuming that their outputs match up to their inputs.

Table 14 The placings received by the Finnish units in humanities in QS and HEEACT rankings 2007–2010 and the qualification coefficients

		UH	UTA	UTU	UJY	UO
	Qualification coefficient	**1.00**	**0.91**	**0.82**	**0.27**	**0.18**
2010	"QS-top 300 in HUM"	53				
	"QS-top 300 in SOC"	87	199	219		
	"HEEACT-top 300 in SOC"	127	197		297	
2009	"QS-top 300 in HUM"	57	212	249		
	"QS-top 300 in SOC"	75	247	231		
	"HEEACT-top 300 in SOC"	99	239	262	267	283
2008	"QS-top 300 in HUM"	52	218	235		
	"QS-top 300 in SOC"	68	208	214		
	"HEEACT-top 300 in SOC"	149	213	296	240	277
2007	"QS-top 300 in HUM"	73	204	275		
	"QS-top 300 in SOC"	74	212	251		

In humanities the University of Helsinki is competitive in international rankings with its critical mass and the rating A^{++}. Also the University of Tampere with the rating A^+ seems to do quite well in international rankings. The University of Turku receives the rating A_0 for productivity of research and teaching, which is less than ought to be expected given its high placing frequency (9/11).

PRODUCTIVITY OF RESEARCH AND TEACHING IN NURSING SCIENCE

We have collected in Table 15 the productivity scores on both research and teaching from the six nursing science units in 2005–2009. University of Turku gains the highest score for productivity of research (87) in the field of nursing science. The other units passing the landmark of 50 scores are Kuopio (57), Oulu (53) and Tampere (52). Jyväskylä (41) and Åbo Akademi (35) score less than 50. The highest productivity score for teaching is received also by the University of Turku by a small margin over Kuopio (74). Oulu receives 65 scores. Tampere (46), Åbo Akademi (29) and Jyväskylä (19) fail to reach 50 scores.

Table 15   Productivity of universities in nursing science in 2005–2009

University	Productivity score for research	Productivity score for teaching
University of Turku (UTU)	87	75
University of Kuopio (UK)	57	74
University of Oulu (UO)	53	65
University of Tampere (UTA)	52	46
University of Jyväskylä (UJY)	41	19
Åbo Akademi (ÅA)	35	29

In the fourfold table of productivity scores for the units in nursing science (Figure 13) Turku, Kuopio and Oulu are all placed in the quadrant I (Research +, Teaching +) with the rating A^{++}. Tampere is placed in quadrant II (Research +, but Teaching −) with the rating A^+. Two of the six units (Jyväskylä and Åbo Akademi) are placed in quadrant IV (Research − and Teaching −) and receive the rating A_0.
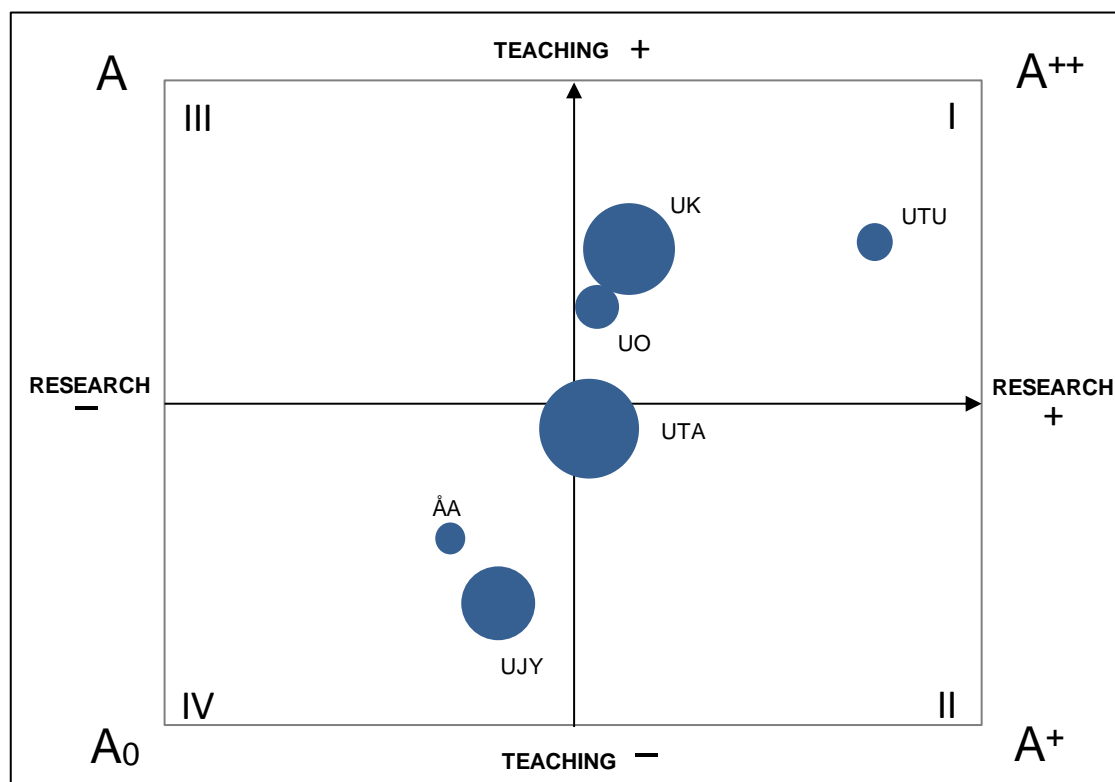

Figure 13   Productivity of research and teaching of the six units in nursing science in 2005–2009

As Figure 13 illustrates Kuopio is set apart from the other two A^{++}–rated units (Turku and Oulu) by its critical mass. The University of Tampere receives the rating A^+ with a mass quite similar to Kuopio. Of the two A_0 rated units, Jyväskylä is disadvantageously separated from Åbo Akademi by its larger mass.

Next we will look at the placings of Finnish units in the field of nursing science in ARWU, QS and HEEACT. According to a crude match, it is possible for a Finnish unit to be placed altogether in eighteen different evaluation series. These placings are collected in Table 16. As can be seen, the University of Turku is the most frequently placed Finnish unit with the qualification coefficient of 0.72. The frequencies of the other units are considerably lower with Tampere receiving the coefficient of 0.39 and Oulu the coefficient of 0.22. Jyväskylä and Kuopio are placed infrequently (coefficient 0.17). Åbo Akademi does not receive a single placing.

Table 16   The placings received by the Finnish units in nursing science in ARWU, QS and HEEACT rankings 2007–2010 and the qualification coefficients

		UTU	UTA	UO	UK	UJY
	Qualification coefficient	**0.72**	**0.39**	**0.22**	**0.17**	**0.17**
2010	"QS-top 300 in MED"	280				
	"QS-top 300 in SOC"	219	199			
	"ARWU-top 100 in LIFE"					
	"HEEACT-top 300 in SOC"		197			297
	"HEEACT-top 300 in LIFE"	266		299	212	
2009	"QS-top 300 in MED"	216				
	"QS-top 300 in SOC"	231	247			
	"ARWU-top 100 in LIFE"					
	"HEEACT-top 300 in SOC"	262	239	283		267
	"HEEACT-top 300 in LIFE"	248			271	
2008	"QS-top 300 in MED"	167				
	"QS-top 300 in SOC"	214	208			
	"ARWU-top 100 in LIFE"					
	"HEEACT-top 300 in SOC"	296	213	277	222	240
	"HEEACT-top 300 in LIFE"	228				
2007	"QS-top 300 in MED"	197		288		
	"QS-top 300 in SOC"	251	212			
	"ARWU-top 100 in LIFE"					

As we can conclude from the placing frequencies, the units with the rating A^{++} or the A^+ in nursing science (UTU, UK, UO, UTA) are also visible in the international rankings.

PRODUCTIVITY OF RESEARCH AND TEACHING IN PSYCHOLOGY

There are psychology units in six Finnish universities, and their respective productivity scores for research and teaching in 2005–2009 have been compiled into Table 17. The highest score for research (70) is received by Jyväskylä with Helsinki (63) in the second place. Åbo Akademi scores exactly 50. Three Psychology units leave under 50 scores: Turku gains 40, Tampere 36 and Joensuu 21. Also in the productivity of teaching the highest score (69) is received by the University of Jyväskylä. As with research, places two and three in teaching go to Helsinki (64) and Åbo Akademi (52). Three of the six units in the field of psychology fail to reach 50 scores for teaching. These units are Tampere (48), Turku (35) and Joensuu (13).

Table 17   Productivity of universities in psychology in 2005–2009

University	Productivity score for research	Productivity score for teaching
University of Jyväskylä (UJY)	70	69
University of Helsinki (UH)	63	64
Åbo Akademi (ÅA)	50	52
University of Turku (UTU)	40	35
University of Tampere (UTA)	36	48
University of Joensuu (UJO)	21	13

In the fourfold table of productivity scores for the units in psychology (Figure 14) Helsinki, Åbo Akademi and Jyväskylä are all placed in quadrant I (Research +, Teaching +) with the rating A^{++}. Tampere, Turku and Joensuu are placed in quadrant IV (Research − and Teaching −) with the rating A_0.
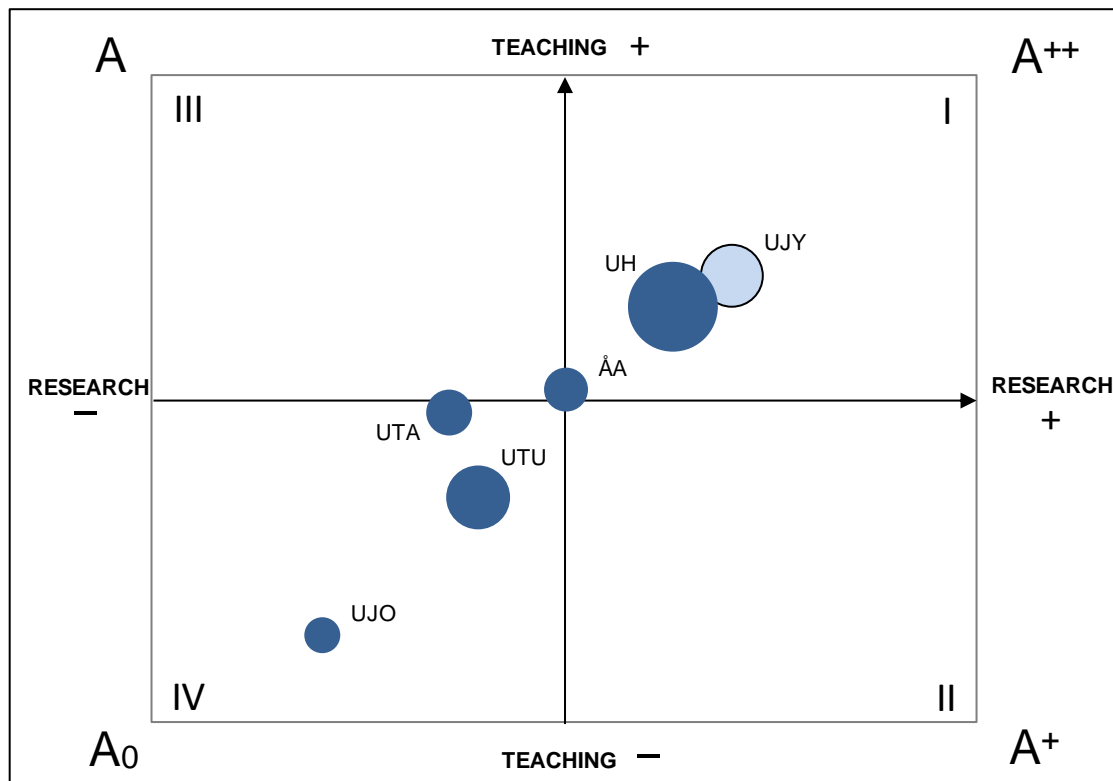
Figure 14   Productivity of research and teaching of the six units in psychology
in 2005–2009

Figure 14 illustrates how the University of Helsinki stands apart from the other two
A^{++}–rated units (Jyväskylä and Åbo Akademi) by its notable critical mass. Of the three A_0–
rated units, the mass of Turku separates it slightly from Joensuu and Tampere.

In the field of psychology, there are 14 possible international evaluation series for the Finnish
units. The University of Helsinki is placed in all of these, which provides it with the
qualification coefficient of 1.00. The Universities of Turku and Tampere gain placings quite
often with the respective coefficients of 0.57 and 0.50, with Jyväskylä being placed slightly
less frequently and given the coefficient of 0.43. Joensuu, Åbo Akademi and Vaasa are
completely without placings. This despite the fact that Åbo Akademi received the rating A^+
in our analysis. This again goes to show that our analysis does justice to units working with
small inputs, assuming that their outputs match up to their inputs.

Table 18   The placings received by the Finnish units in psychology in QS and HEEACT rankings 2007–2010 and the qualification coefficients

		UH	UTU	UTA	UJY
	Qualification coefficient	**1.00**	**0.57**	**0.50**	**0.43**
2010	”QS-top 300 in SCI”	108			268
	”QS-top 300 in SOC”	87	219	199	
	”HEEACT-top 300 in SCI”	95			
	”HEEACT-top 300 in SOC”	127		197	297
2009	”QS-top 300 in SCI”	80			236
	”QS-top 300 in SOC”	75	231	247	
	”HEEACT-top 300 in SCI”	102			
	”HEEACT-top 300 in SOC”	99	262	239	267
2008	”QS-top 300 in SCI”	72	287		279
	”QS-top 300 in SOC”	68	214	208	
	”HEEACT-top 300 in SCI”	96			
	”HEEACT-top 300 in SOC”	149	296	213	240
2007	”QS-top 300 in SCI”	92	260		
	”QS-top 300 in SOC”	74	251	212	

As we can conclude, in the field of psychology the University of Helsinki with notable critical mass and A^{++}–rating receives numerous placings in international rankings. The considerable number of placings Turku and Tampere receive does not match with the less impressive A_0–rating for productivity.

CONCLUSIONS

To conclude this study, we will sum up the results of our analysis for all 66 units in the nine scientific disciplines. In the end, the most important issue is certainly how to provide opportunities for successful research and teaching in different universities over the long run, guaranteeing at least to the most successful units an opportunity to be competitive in the world of expanding higher education and toughening international competition.

RATING	FREQUENTLY PLACED IN RANKINGS Coefficient ≥ 0.5	OFTEN PLACED IN RANKINGS $0.5 >$ Coeff. ≥ 0.2	INFREQUENTLY PLACED IN RANKINGS Coefficient < 0.2	WITHOUT PLACINGS IN RANKINGS Coefficient not defined
A^{++} EXCELLENT INTERNATIONAL LEVEL	UH-Med, UH-Nat, HUT-Tech, UH-Soc, UTA-Edu, UTU-Edu, UH-Hum, UTU-Nurs, UH-Psyc	UO-Med, UJY-Bus, UO-Bus, UJY-Hum, UO-Nurs, UJY-Psyc	UJY-Nat, UJY-Soc, UO-Hum, UK-Nurs	ÅA-Nat, LUT-Bus, ÅA-Bus, ÅA-Psyc
A^{+} GOOD INTERNATIONAL LEVEL	UTU-Med, UTU-Nat, UTU-Soc, UH-Edu, UTA-Hum	UJY-Edu, UTA-Nurs	UO-Nat, UO-Edu, HSE-Bus	UJO-Nat, ÅA-Tech, SHH-Bus, UJO-Hum
A STRONG NATIONAL LEVEL	UTA-Soc, UTA-Bus	UK-Med, UK-Nat	UTA-Med	LUT-Tech, TUT-Tech, UJO-Edu, ULA-Edu, UVA-Bus
A_0 NEEDS IMPROVEMENT	UTU-Hum, UTU-Psyc, UTA-Psyc	UO-Tech, UTU-Tech	UK-Soc, UJY-Nurs	UTA-Nat, UVA-Tech, TSE-Bus, ULA-Soc, UVA-Soc, ÅA-Soc, UJO-Soc, ÅA-Edu, ÅA-Hum, UVA-Hum, ÅA-Nurs, UJO-Psyc

Setup 1   The 66 units from nine disciplines organized according to productivity ratings of research and teaching (A^{++}, A^{+}, A and A_0) and qualification coefficients based on ARWU, QS and HEEACT rankings.

The best opportunity to be successful in changing field of higher education is naturally held by those Finnish units reaching the excellent international level (A^{++}). A notably high visibility in international university rankings may also emphasize the excellence. A high placing frequency may also encourage the units operating at the good international level (A^{+}) to even better performance.

The group with the highest potential for success are those 20 units in the three darkened cells (Setup 1). These units strongly moving "towards the best ratings" are:

Medical sciences in the University of Helsinki
Natural sciences in the University of Helsinki
Social sciences in the University of Helsinki
Humanities in the University of Helsinki
Psychology in the University of Helsinki
Education in the University of Helsinki

Education in the University of Turku
Nursing science in the University of Turku
Medical sciences in the University of Turku
Natural sciences in the University of Turku
Social sciences in the University of Turku

Medical sciences in the University of Oulu
Nursing science in the University of Oulu
Business administration in the University of Oulu

Business administration in the University of Jyväskylä
Humanities in the University of Jyväskylä
Psychology in the University of Jyväskylä

Education in the University of Tampere
Humanities in the University of Tampere

Technical sciences in the Helsinki University of Technology/the Aalto University

On the other hand, the units with the A_0–rating, signifying the need for improvement in the productivity of both research and teaching, are in a much more challenging position. In the Setup 1, there are altogether 19 units with the rating A_0 and twelve of these are even in the ranking blind spot.

We believe that our productivity rating system supplemented by information about ranking visibility provides tools for purposeful development in the areas of evidence-based university and science policies. In a strategic sense it is undoubtedly wise to secure the opportunities for the group of the best 20 units to operate in the international level. In addition, there is a question of the decisions concerning the future of the 'needs improvement' –group, all of which may not be easy ones to make.

REFERENCES

Billaut, J.C., Bouyssou, D. and Vincke, P. (2010) Should You Believe in the Shanghai Ranking? *Scientometrics* 84(1): 237–263.

Dehon, C., McCAthie, A. and Verardi, V. (2010) Uncovering Excellence in Academic Rankings: A Closer Look at the Shanghai Ranking. *Scientometrics* 83(2): 515–524

Florian, R.V. (2007) Irreproducibility of the Results of the Shanghai Academic Ranking of World Universities. *Scientometrics* 72(1): 25–32

Kivinen, O. and Hedman, J. (2008) World-wide University Rankings – A Scandinavian Approach. *Scientometrics* 74(3): 391–408.

Kivinen, O., Hedman, J. and Peltoniemi, K. (2008) *Productivity of research by disciplines in Finland in 2002-2006.* Research Unit for the Sociology of Education (RUSE), Research report 73. Turku : University of Turku.

Kivinen, O., Hedman, J. and Peltoniemi, K. (2009) *Suomen yliopistojen tieteellisen toiminnan tuloksellisuus vuosina 2004-2008.* Research Unit for the Sociology of Education (RUSE). Turku: University of Turku.

Kroth, A. and Daniel, H.D. (2008) International University Rankings - A Critical Review of the Methodology. *Zeitschrift fur Erziehungswissenschaft* 11(4): 542–558.

Neittaanmäki, P., Neittaanmäki, R., Tiihonen, T. and Ärje, J. (2010) *Yliopistojen tutkintokoulutuksen ja tutkimuksen rahoitus ja tulokset vuosina 2000-2004 ja 2005-2009.* Koulutuksen tutkimuslaitoksen tutkimusselosteita 40, University of Jyväskylä.

Pritchett, L. (2009) *Long Term Global Challenges in Education: Are There Feasible Steps Today?* Background Paper for Pardee Center Workshop Shaping Tomorrow Today March 17, 2009.

Van Raan, A.F.J. (2005) Fatal Attraction: Conceptual and Methodological Problems in the Ranking of Universities by Bibliometric Methods. *Scientometrics* 62(1): 133–143.

APPENDIX 1

Although ARWU, QS and HEEACT do utilize somewhat stabilized metrics, the selection of indicators alters from year to year. It is worth pondering, for instance, how well the indicators from the year 2009 rankings, collected in Appendix setup 1 function as a basis for evaluation. In any case, there are altogether 20 indicator values in 2009 rankings by disciplines, according to which a Finnish university can be placed on a ranking list. It is not possible for us to explain here in detail how these indicator sets are in reality transformed into ranking lists. We will simply state that the university rankings by disciplines made by ARWU, QS and HEEACT in the years 2007-2010 comprise in total 58 evaluation series, in which the placings of Finnish universities can be found.

INDICATOR	SOURCE
Alumni of an institution winning Nobel Prizes and Fields Medals	ARWU
Staff of an institution winning Nobel Prizes and Fields Medals	ARWU
Highly cited researchers in 21 broad subject categories	ARWU
Papers published in Nature and Science	ARWU
Articles Indexed in Science Citation Index-Expanded and Social Sciences Citation Index	ARWU
Per capita academic performance of an institution	ARWU
Academic Peer Review Composite score drawn from peer review survey (which is divided into five subject areas). 9,386 responses.	QS
Score based on responses to employer survey. 3,281 responses.	QS
Score based on student faculty ratio	QS
Score based on research performance factored against the size of the research body	QS
Score based on proportion of international faculty	QS
Score based on proportion of international students	QS
Number of articles of the last 11 years	HEEACT
Number of articles of the current year	HEEACT
Number of citations of the last 11 years	HEEACT
Number of citations of the last 2 years	HEEACT
Average number of citations of the last 11 years	HEEACT
H-index of the last 2 years	HEEACT
Number of Highly Cited Papers	HEEACT
Number of articles of the current year in high-impact journals	HEEACT

Appendix setup 1   The selection of indicators available in the year 2009 in ARWU, QS and HEEACT rankings