

Erasmus MC

University Medical Center Rotterdam



How to Manage Biomedical Imaging Research

Gabriel P. Krestin MD, PhD

Erasmus MC

University Medical Center Rotterdam



Challenges in Biomedical Imaging Research

- Clinical work is prioritized over, and financially better rewarded than research.
- The deficiency in human resources makes it difficult to satisfy clinical service, teaching, and research missions.
- Imaging used in clinical trials without involvement of radiologists.
- Fundamental research with imaging claimed by many.
- Limited funding for specific imaging research.
- Funded research does not cover true costs; policy of fund-matching limits growth.
- Few multidisciplinary research groups.

Moreover...

Many clinicians lack:

- Adequate research training.
- Protected time to:
 - perform feasibility studies
 - write (and rewrite) grant applications
 - conduct research
- Culture that values research.

Don't Forget that...

Research:

- Is hard work (not a leisure activity)
- Needs investment (nothing is for free)
- Is business (generates financial incomes & prestige)
- Needs focus (has to achieve goals)
- Has to generate output (publications, scientific presentations)
- Is a process (has to be managed)

Researcher's Annual Appraisal



Case Study

Medical Imaging Research @ Erasmus MC

Erasmus MC in Perspective

The Netherlands

population: 16,730,000

Rotterdam: harbour city

population: 616,000

Erasmus MC:

employees: 13,000



Dutch Healthcare: Facts & Figures

Total number of Hospitals:	68
general	60
university medical center	7



Erasmus MC =

Largest University
Medical Center in
the Netherlands

Erasmus MC

University Medical Center Rotterdam



from bench to bedside - from patient to population

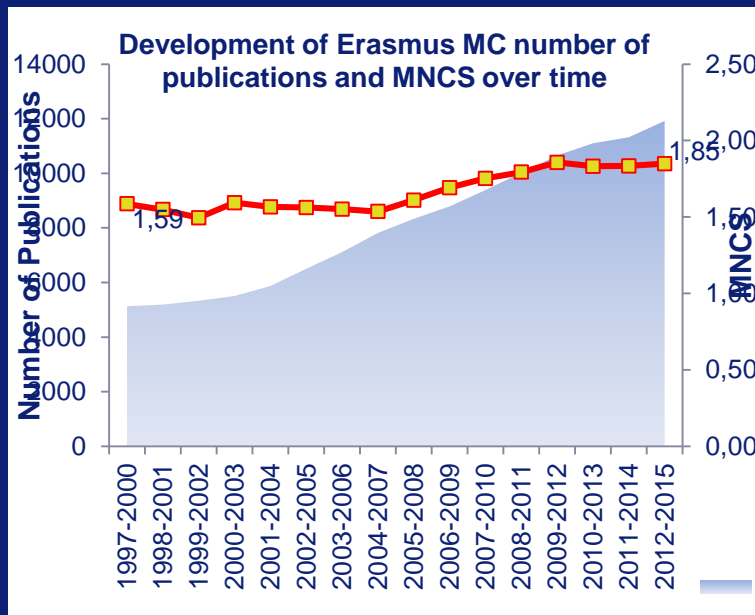
Erasmus MC: Facts & Figures

Employees	13,000
Medical and Scientific Staff	1,800
Nursing personnel	2,800
Students	2,950
Medicine	2,400
Health Policy and Management	550
Medical specialist educational programs	28
Total budget	€ 1,192,608,000
Beds	1,320
Outdoor patients annually	525,000

Core Activity: Research

Table 1b: Bibliometric statistics of Dutch academic medical centers, 2010-2014/2015

	P	TCS	MCS	MNCS	MNJS	PP(top 10%)	PP(uncited)	%Self Cit	Int Cov
Erasmus MC	12491,50	185253,50	14,83	1,78	1,54	20%	9%	22%	90%
LU MC	8991,00	136921,75	15,23	1,66	1,50	19%	8%	22%	92%
Radboud UMC	10092,50	136411,00	13,52	1,66	1,46	19%	9%	22%	90%
UMC Maastricht	8754,00	112017,00	12,80	1,59	1,36	17%	11%	21%	88%
UMCG	9921,50	129897,75	13,09	1,60	1,50	18%	11%	22%	90%
UU UMC	10094,25	147344,50	14,60	1,69	1,55	20%	8%	21%	92%
UvA AMC	13371,25	181873,50	13,60	1,63	1,46	18%	10%	20%	90%
VUmc	10271,50	149090,75	14,51	1,73	1,42	19%	10%	21%	89%



Publications and Citation Scores of Top 20 European Medical Schools

Rank in Europe	Rank in world	Journal	Papers	Citations per paper	Citations
1	20	Erasmus University Rotterdam	7,108	166,015	23.36
2	25	University of Cambridge	4,795	107,088	22.33
3	26	University of Oxford	6,706	149,545	22.30
4	31	University of Glasgow	4,908	104,245	21.24
5	40	University of Helsinki	10,169	206,196	20.28
6	50	Imperial College London	7,550	145,914	19.33
7	59	University of Amsterdam	8,123	150,269	18.50
8	60	Karolinska Institute	12,787	236,174	18.47
9	61	Humboldt University of Berlin	6,097	112,420	18.44
10	62	Leiden University	8,150	149,851	18.39
11	68	University College London	16,761	302,182	18.03
12	77	Uppsala University	6,327	105,962	16.75
13	79	University of Milan	8,722	145,331	16.66
14	80	Utrecht University	8,418	137,602	16.35
15	81	Aarhus University	6,340	103,629	16.35
16	82	University of Vienna	8,579	140,063	16.33
17	84	King's College London	8,359	136,382	16.32
18	85	Maastricht University	6,247	100,910	16.15
19	88	University of Zurich	8,638	137,050	15.87
20	89	Lund University	8,041	127,533	15.86

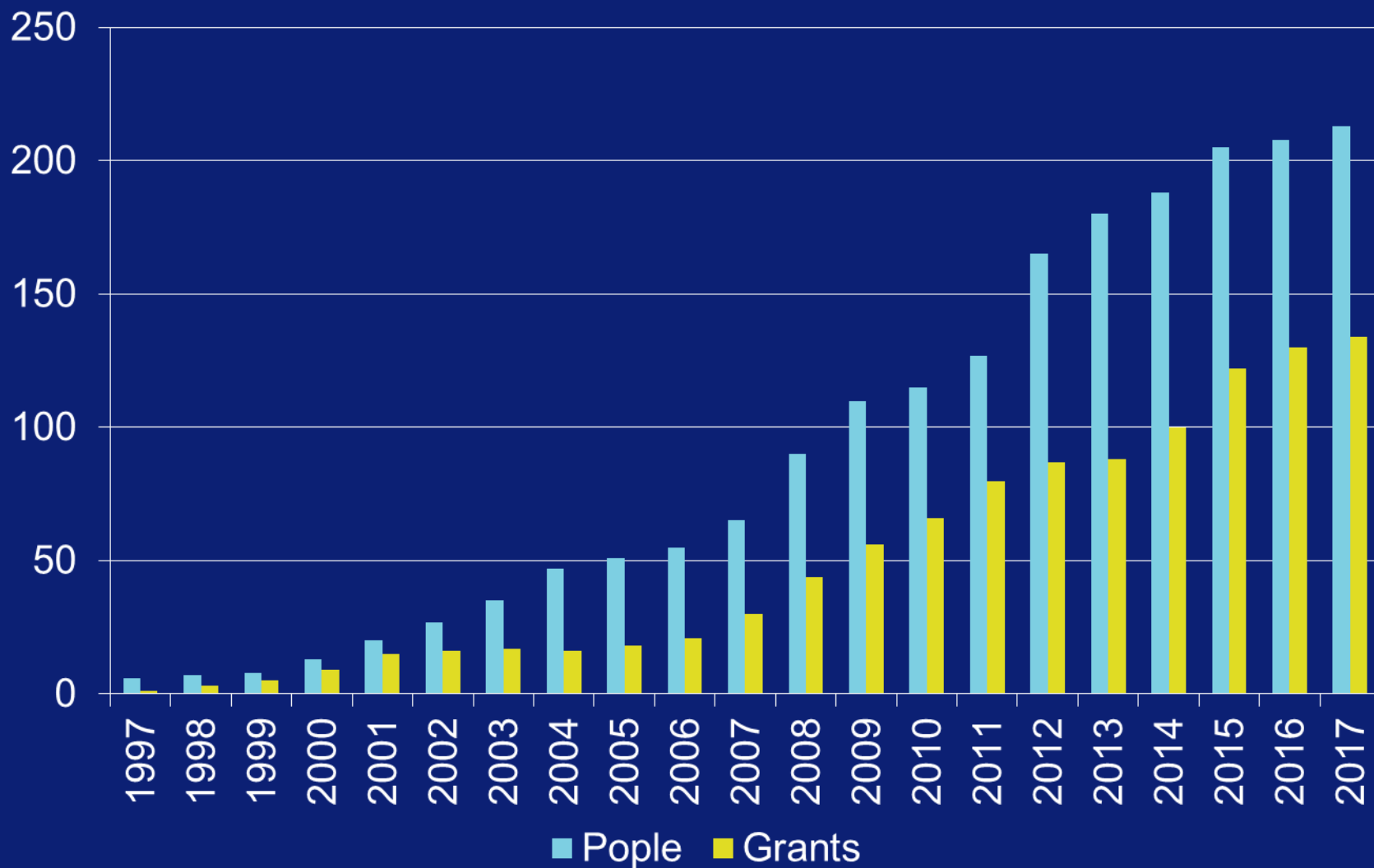
Medical Imaging Research @Erasmus MC: Fact Sheet (2017)

	People	Fte
Sr. researchers (Asst.-, Assoc.-, Full Profs)	37	15.1
Junior researchers & Post-docs	25	12.2
PhD students	99	56.2
Support		
grant facilitator, management, admin;	14	10.2
trial office, research techs;	25	12.2
instrumentation, graphic design, IT-support	12	5.7
TOTAL	212	111.6

Budget	Amount
University	1.652.000 €
Hospital	780.000 €
National/EU grants	2.950.000 €
Grants from charities	560.000 €
Industrial grants (cooperations)	1.950.000 €
Industrial grants (equipment)	150.000 €

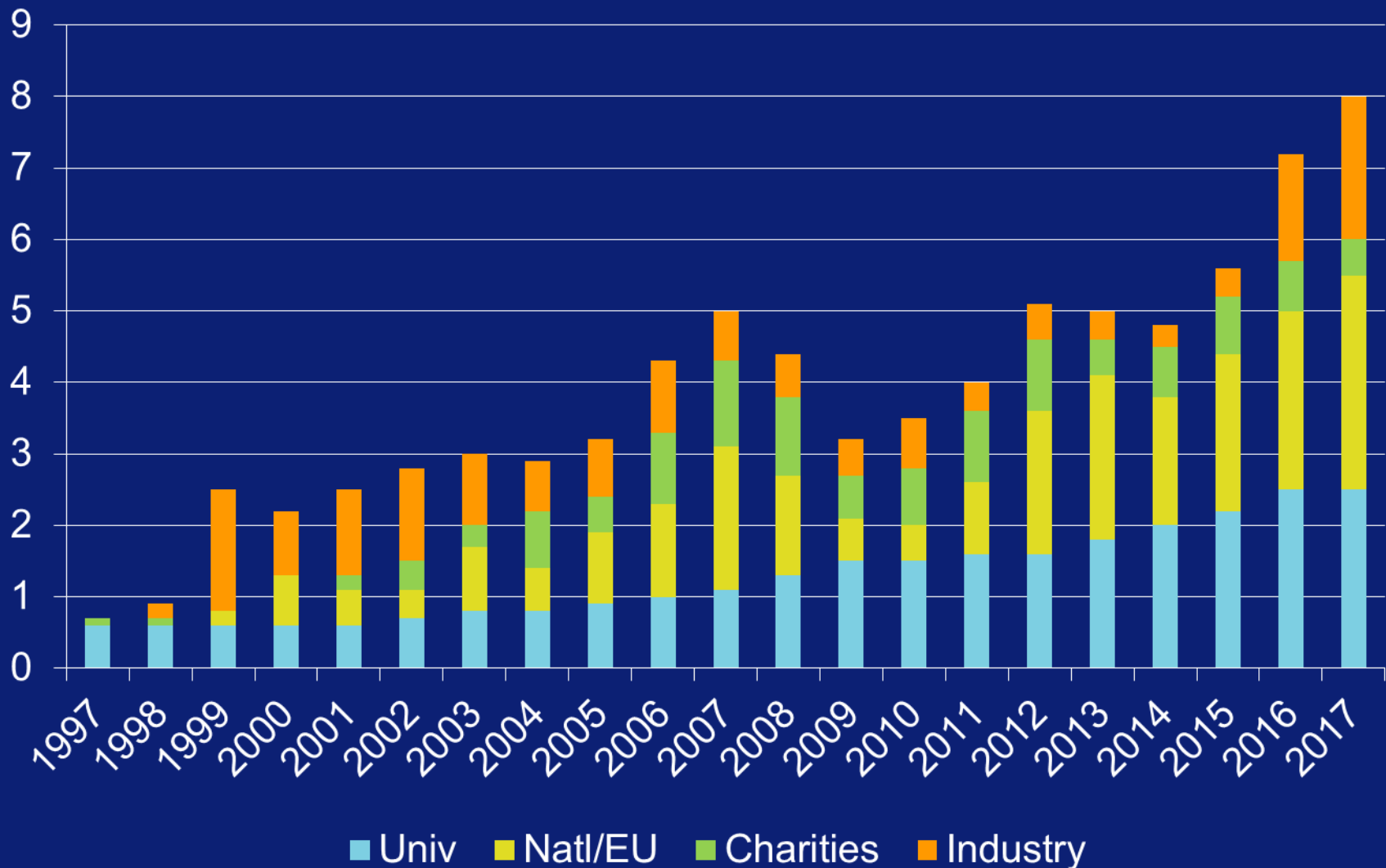
Research Input 1997-2017

(people, grants)



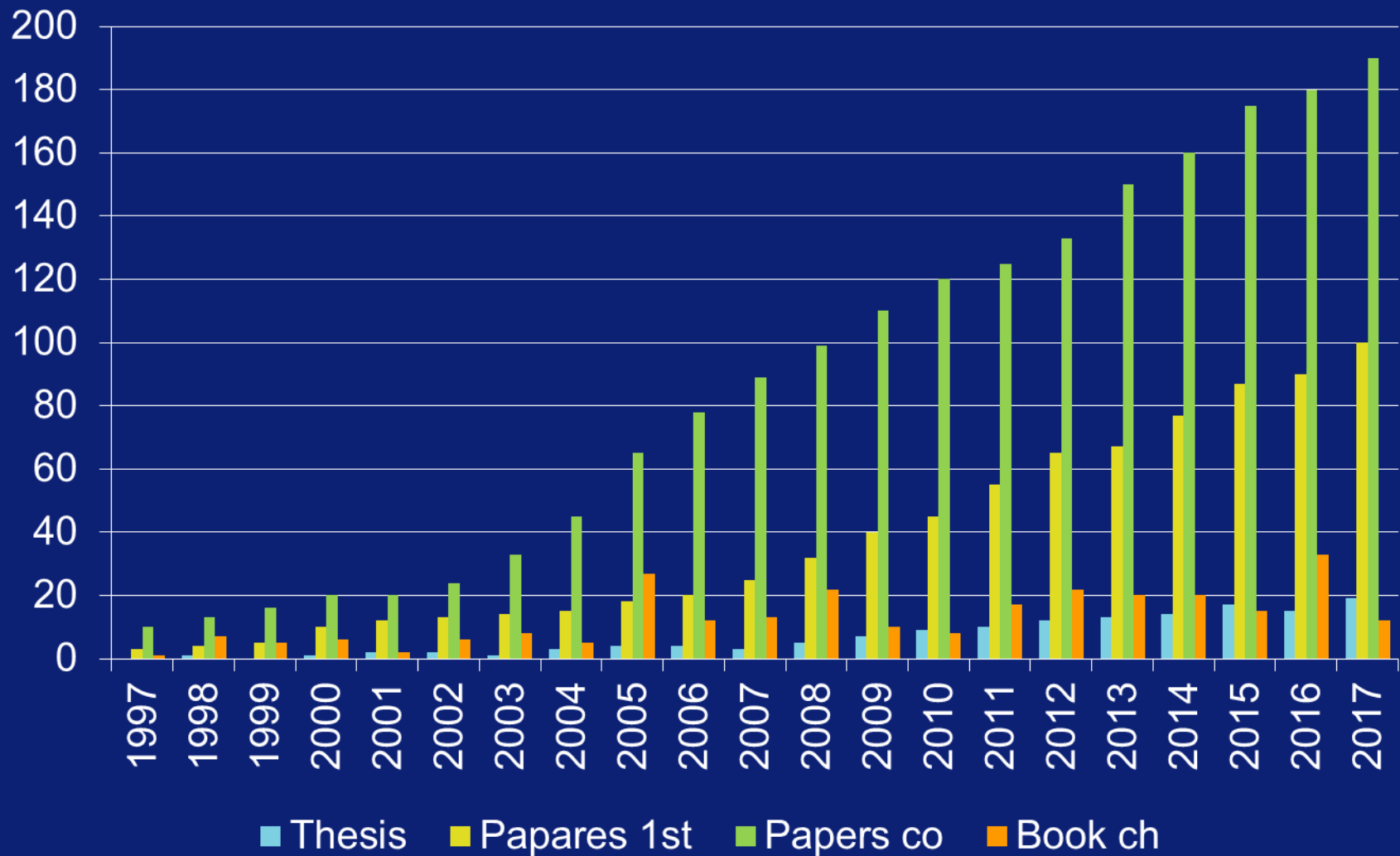
Research Input 1997-2017

(Euros x 10⁶)



Research Output 1997-2017

(Euros x 10⁶)



Metrics / KPIs

- Papers / researcher : $280 / 161 = 1.74$
- Papers / FTE : $280 / 83.5 = 3.35$
- Costs / Paper : $8,042,000 \text{ €} / 280 = 28,721 \text{ €}$
- Thesis / PhD ; $19 / 99 = 0,19$

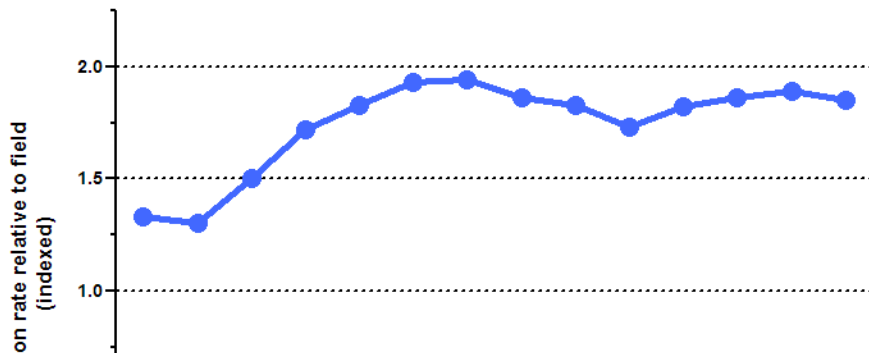
Research Impact 1997-2015

Erasmus MC

Erasmus

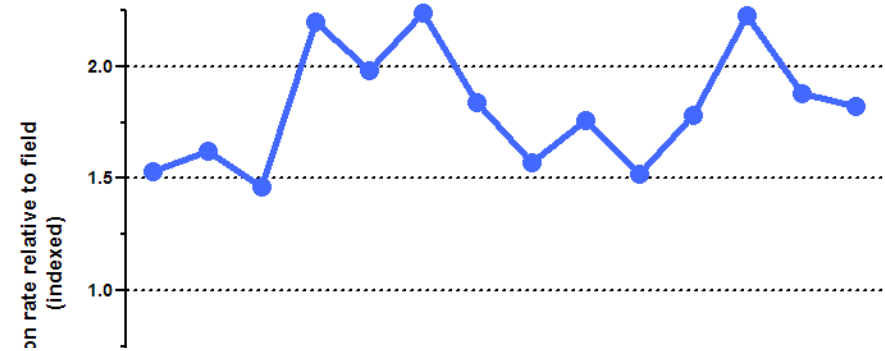
Radiology

Mean Normalized Citation Score (MNCS)



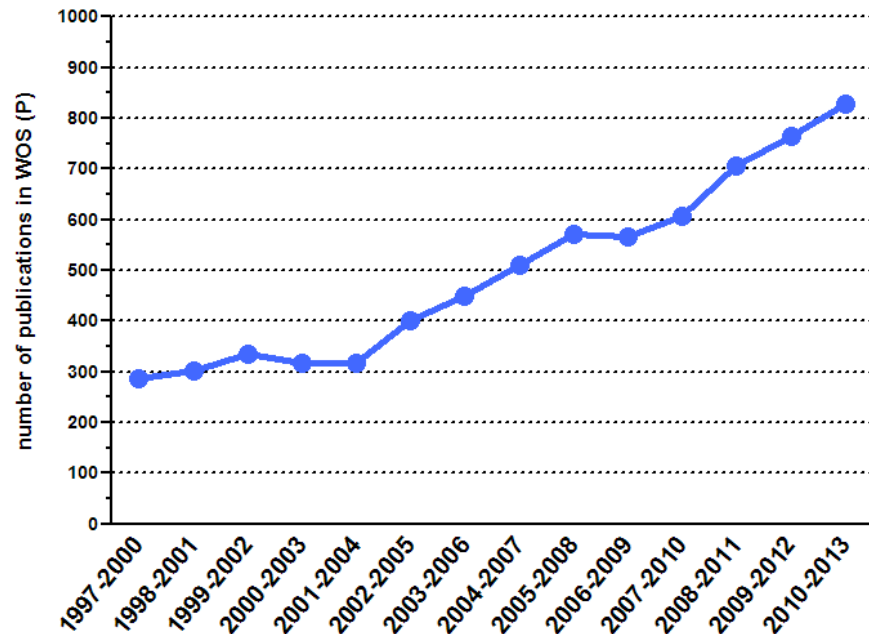
Nuclear Medicine

Mean Normalized Citation Score (MNCS)



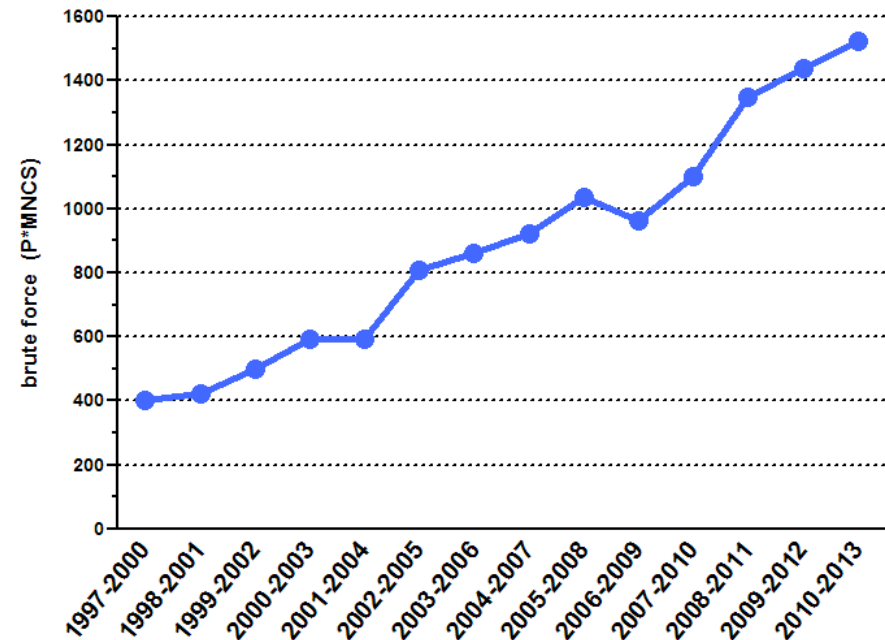
Radiology & Nuclear Medicine

Publications in Web of Science (P)



Radiology & Nuclear Medicine

Brute Force (P*MNCS)



Elsevier Ranking 2010-2014

Radiology, Nuclear Medicine and Imaging

1	Harvard University	United States	4680
2	Johns Hopkins University	United States	2087
3	University of Toronto	Canada	2058
4	University of Pennsylvania	United States	1783
5	Stanford University	United States	1582
6	University of Michigan	United States	1528
7	University of Texas M. D. Anderson Cancer Center	United States	1510
8	University of California at Los Angeles	United States	1483
9	Duke University	United States	1413
10	Mayo Clinic Rochester MN	United States	1364
11	University of Heidelberg	Germany	1359
12	University of Washington	United States	1323
13	University of California at San Francisco	United States	1296
14	University College London	United Kingdom	1214
15	Washington University St. Louis	United States	1207
16	Seoul National University	South Korea	1175
17	VA Medical Center	United States	1148
18	University of Wisconsin	United States	1129
19	University of Pittsburgh	United States	1003
20	Utrecht University	Netherlands	982
21	New York University	United States	960
22	University of British Columbia	Canada	958
23	Emory University	United States	949
24	University of Munich	Germany	926
25	Memorial Sloan-Kettering Cancer Center	United States	916
26	Columbia University	United States	882
27	Erasmus University Rotterdam	Netherlands	871
28	University of Zurich	Switzerland	865
29	Yonsei University	South Korea	860
30	Shanghai Jiaotong University	China	850
31	University of Erlangen-Nuremberg	Germany	846
32	Medical University of Vienna	Austria	822
33	University of Chicago	United States	813
34	INSERM	France	808
35	Technische Universitat Munchen	Germany	806
36	University of Ulsan	South Korea	782
37	Capital University of Medical Sciences	China	777
38	Cleveland Clinic Foundation	United States	772
39	Yale University	United States	768
40	Universidade de Sao Paulo	Brazil	756
41	University of Copenhagen	Denmark	753
42	General Electric	United States	753
43	Sungkyunkwan University	South Korea	747
44	Siemens	Germany	737
45	Charite - Universitatsmedizin Berlin	Germany	730
46	University of North Carolina	United States	724
47	Katholieke Universiteit Leuven	Belgium	722
48	University of Amsterdam	Netherlands	721
49	University of California at San Diego	United States	717
50	Northwestern University	United States	708

Number of Publications

1	Harvard University	United States	30826
2	University of Toronto	Canada	12274
3	Johns Hopkins University	United States	12210
4	University of Texas M. D. Anderson Cancer Center	United States	11554
5	Stanford University	United States	10942
6	Duke University	United States	10090
7	Mayo Clinic Rochester MN	United States	9986
8	University of California at Los Angeles	United States	9528
9	University of Wisconsin	United States	9521
10	University of Pennsylvania	United States	9466
11	University of Michigan	United States	9176
12	University of California at San Francisco	United States	8677
13	Memorial Sloan-Kettering Cancer Center	United States	8124
14	University College London	United Kingdom	7998
15	Washington University St. Louis	United States	7622
16	Erasmus University Rotterdam	Netherlands	7470
17	Utrecht University	Netherlands	7253
18	VA Medical Center	United States	6959
19	University of Heidelberg	Germany	6878
20	New York University	United States	6667
21	University of Pittsburgh	United States	6168
22	Columbia University	United States	6091
23	University of Erlangen-Nuremberg	Germany	6048
24	Cleveland Clinic Foundation	United States	5946
25	University of Zurich	Switzerland	5842
26	University of Washington	United States	5825
27	Technische Universitat Munchen	Germany	5808
28	University of Copenhagen	Denmark	5776
29	Medical University of Vienna	Austria	5696
30	University of California at San Diego	United States	5694
31	Seoul National University	South Korea	5682
32	University of Munich	Germany	5660
33	Siemens	Germany	5440
34	General Electric	United States	5428
35	Emory University	United States	5298
36	Katholieke Universiteit Leuven	Belgium	5204
37	University of British Columbia	Canada	5175
38	Yale University	United States	5092
39	University of North Carolina	United States	5028
40	University of Amsterdam	Netherlands	4947
41	University of Chicago	United States	4780
42	INSERM	France	4513
43	Charite - Universitatsmedizin Berlin	Germany	4336
44	Northwestern University	United States	4280
45	University of Ulsan	South Korea	4153
46	Yonsei University	South Korea	3630
47	Sungkyunkwan University	South Korea	3511
48	Universidade de Sao Paulo	Brazil	2679
49	Shanghai Jiaotong University	China	2078
50	Capital University of Medical Sciences	China	1608

Number of Citations

Elsevier Ranking 2010-2014

Radiology, Nuclear Medicine and Imaging

1	Memorial Sloan-Kettering Cancer Center	United States	8,9
2	Erasmus University Rotterdam	Netherlands	8,6
3	University of Wisconsin	United States	8,4
4	University of California at San Diego	United States	7,9
5	University of Texas M. D. Anderson Cancer Center	United States	7,7
6	Cleveland Clinic Foundation	United States	7,7
7	University of Copenhagen	Denmark	7,7
8	Utrecht University	Netherlands	7,4
9	Siemens	Germany	7,4
10	Mayo Clinic Rochester MN	United States	7,3
11	Technische Universitat Munchen	Germany	7,2
12	General Electric	United States	7,2
13	Katholieke Universiteit Leuven	Belgium	7,2
14	Duke University	United States	7,1
15	University of Erlangen-Nuremberg	Germany	7,1
16	Stanford University	United States	6,9
17	New York University	United States	6,9
18	Columbia University	United States	6,9
19	Medical University of Vienna	Austria	6,9
20	University of North Carolina	United States	6,9
21	University of Amsterdam	Netherlands	6,9
22	University of Zurich	Switzerland	6,8
23	University of California at San Francisco	United States	6,7
24	Harvard University	United States	6,6
25	University College London	United Kingdom	6,6
26	Yale University	United States	6,6
27	University of California at Los Angeles	United States	6,4
28	Washington University St. Louis	United States	6,3
29	VA Medical Center	United States	6,1
30	University of Pittsburgh	United States	6,1
31	University of Munich	Germany	6,1
32	University of Toronto	Canada	6
33	University of Michigan	United States	6
34	Northwestern University	United States	6
35	Johns Hopkins University	United States	5,9
36	University of Chicago	United States	5,9
37	Charite - Universitätsmedizin Berlin	Germany	5,9
38	Emory University	United States	5,6
39	INSERM	France	5,6
40	University of British Columbia	Canada	5,4
41	University of Pennsylvania	United States	5,3
42	University of Ulsan	South Korea	5,3
43	University of Heidelberg	Germany	5,1
44	Seoul National University	South Korea	4,8
45	Sungkyunkwan University	South Korea	4,7
46	University of Washington	United States	4,4
47	Yonsei University	South Korea	4,2
48	Universidade de Sao Paulo	Brazil	3,5
49	Shanghai Jiaotong University	China	2,4
50	Capital University of Medical Sciences	China	2,1

1	University College London	UK	2,36
2	Erasmus University Rotterdam	Netherlands	2,15
3	Utrecht University	Netherlands	1,97
4	Memorial Sloan-Kettering Cancer Center	United States	1,96
5	University of Copenhagen	Denmark	1,95
6	Siemens	Germany	1,9
7	Yale University	United States	1,85
8	University of Erlangen-Nuremberg	Germany	1,83
9	University of California at San Diego	United States	1,83
10	University of California at Los Angeles	United States	1,79
11	Columbia University	United States	1,78
12	Katholieke Universiteit Leuven	Belgium	1,77
13	University of Wisconsin	United States	1,76
14	Emory University	United States	1,74
15	Technische Universitat Munchen	Germany	1,74
16	Cleveland Clinic Foundation	United States	1,73
17	University of Zurich	Switzerland	1,71
18	General Electric	United States	1,7
19	Duke University	United States	1,69
20	Mayo Clinic Rochester MN	United States	1,69
21	University of Amsterdam	Netherlands	1,67
22	Charite - Universitätsmedizin Berlin	Germany	1,63
23	Harvard University	United States	1,62
24	Johns Hopkins University	United States	1,62
25	University of Pennsylvania	United States	1,61
26	Stanford University	United States	1,61
27	Northwestern University	United States	1,61
28	New York University	United States	1,6
29	University of Pittsburgh	United States	1,59
30	Medical University of Vienna	Austria	1,56
31	University of North Carolina	United States	1,56
32	University of California at San Francisco	United States	1,53
33	University of Munich	Germany	1,53
34	University of Texas M. D. Anderson Cancer Center	United States	1,51
35	Washington University St. Louis	United States	1,49
36	University of Michigan	United States	1,48
37	VA Medical Center	United States	1,47
38	University of Chicago	United States	1,44
39	University of Heidelberg	Germany	1,42
40	University of British Columbia	Canada	1,42
41	University of Toronto	Canada	1,38
42	INSERM	France	1,36
43	University of Washington	United States	1,18
44	Seoul National University	South Korea	1,14
45	University of Ulsan	South Korea	1,12
46	Sungkyunkwan University	South Korea	1,12
47	Universidade de Sao Paulo	Brazil	1,11
48	Yonsei University	South Korea	0,96
49	Shanghai Jiaotong University	China	0,63
50	Capital University of Medical Sciences	China	0,43

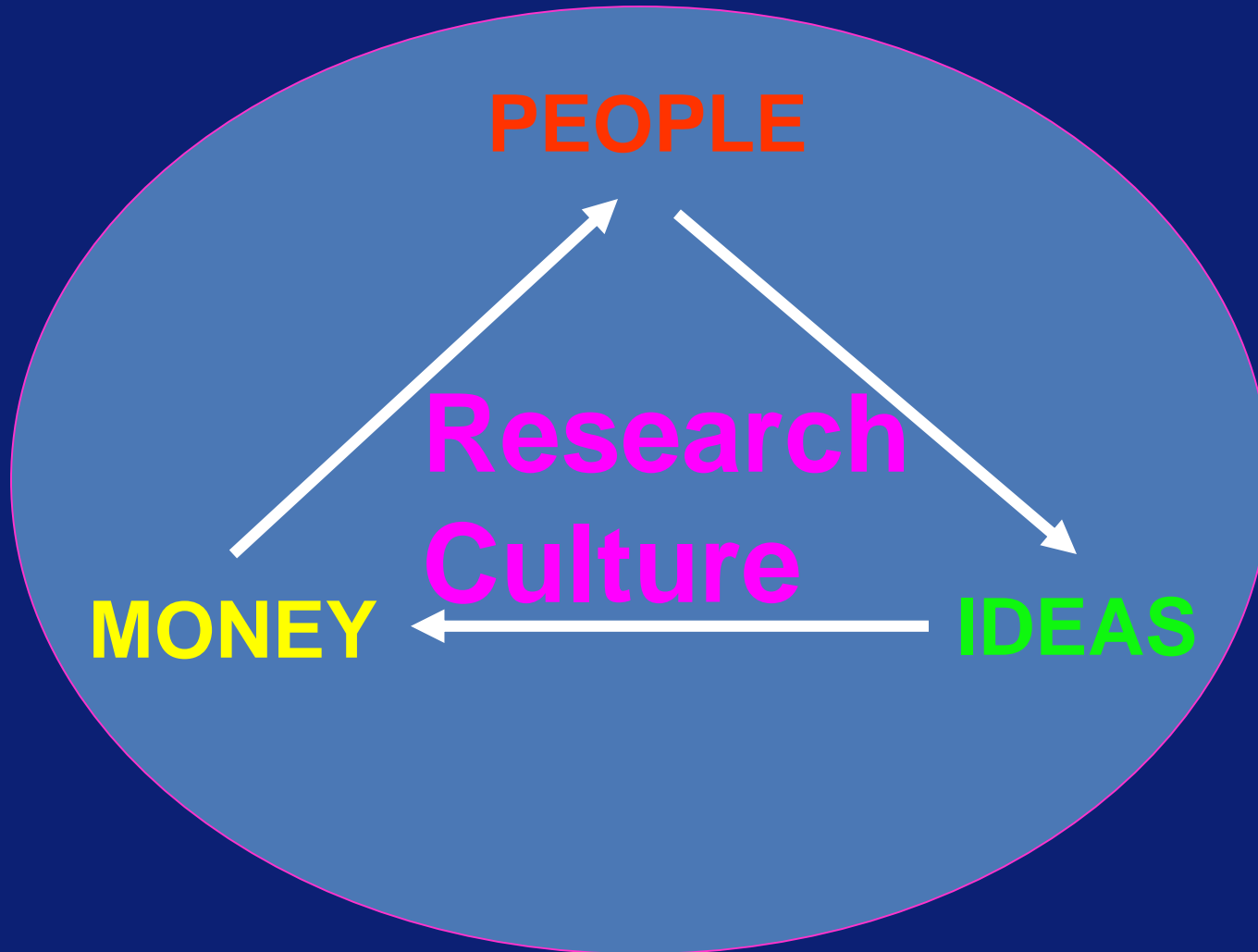
Citations / Publication

Field-Weighted Citation Impact

Key Elements to Consider

- Strategy
- Collaboration (internal, institutional, external)
- Diversity and focus
- Support/administration
- Infrastructure
- Monitoring performance

Research Needs:



Start Small

Why ?

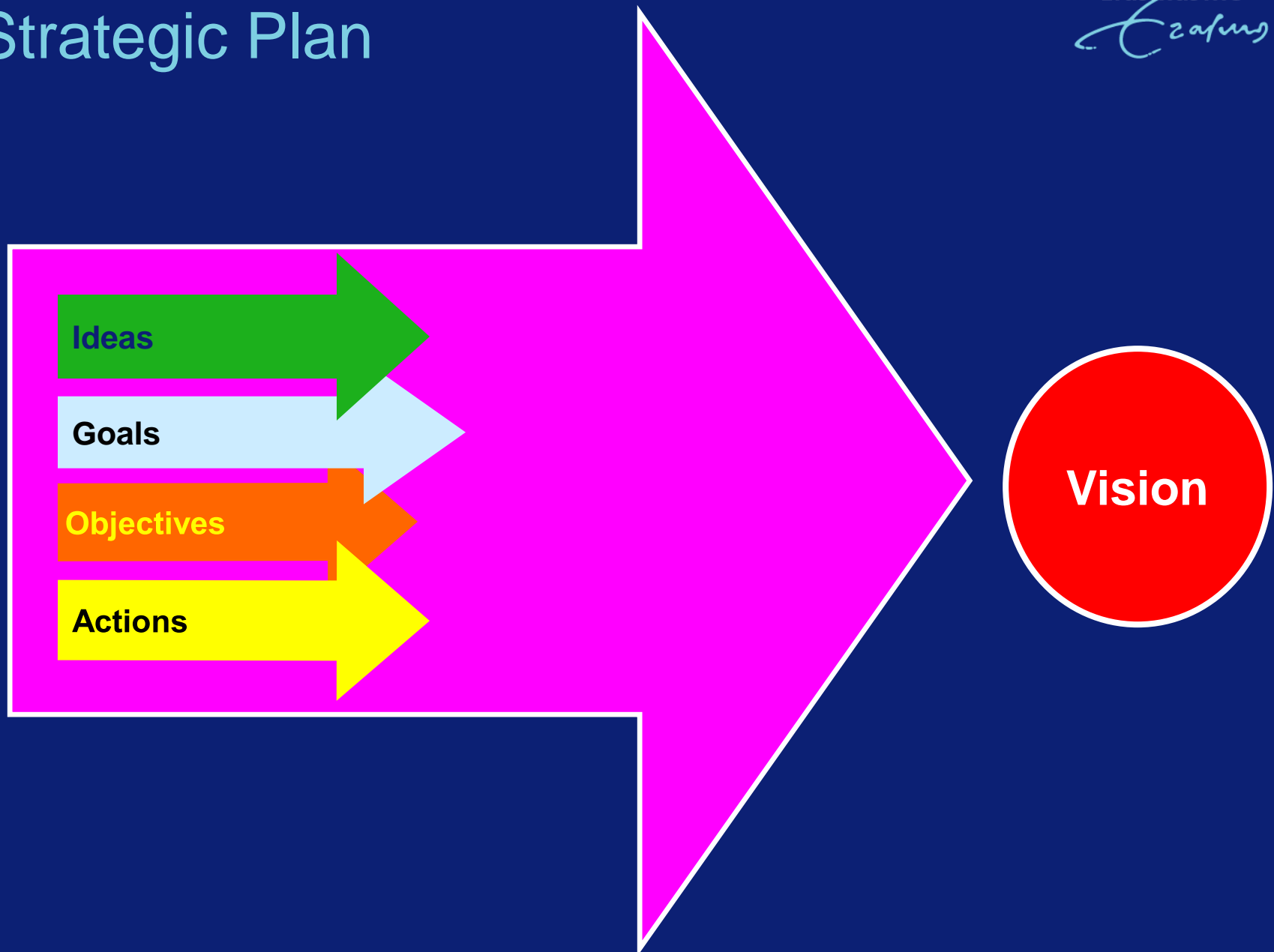
- If you start small, you still have the option to become BIG later
- Avoid temptation to conquer all frontiers – it could be too much
- Small means manageable and easy
- Small means flexible
- Can redirect goals and effort as times change
- Small grants are often a good start
- Small means fewer people to support
(fewer mouths to feed)
 - Smaller budget*
 - Less scary*
 - Sleep better at night*
- Small means FUN



Chaos



Strategic Plan



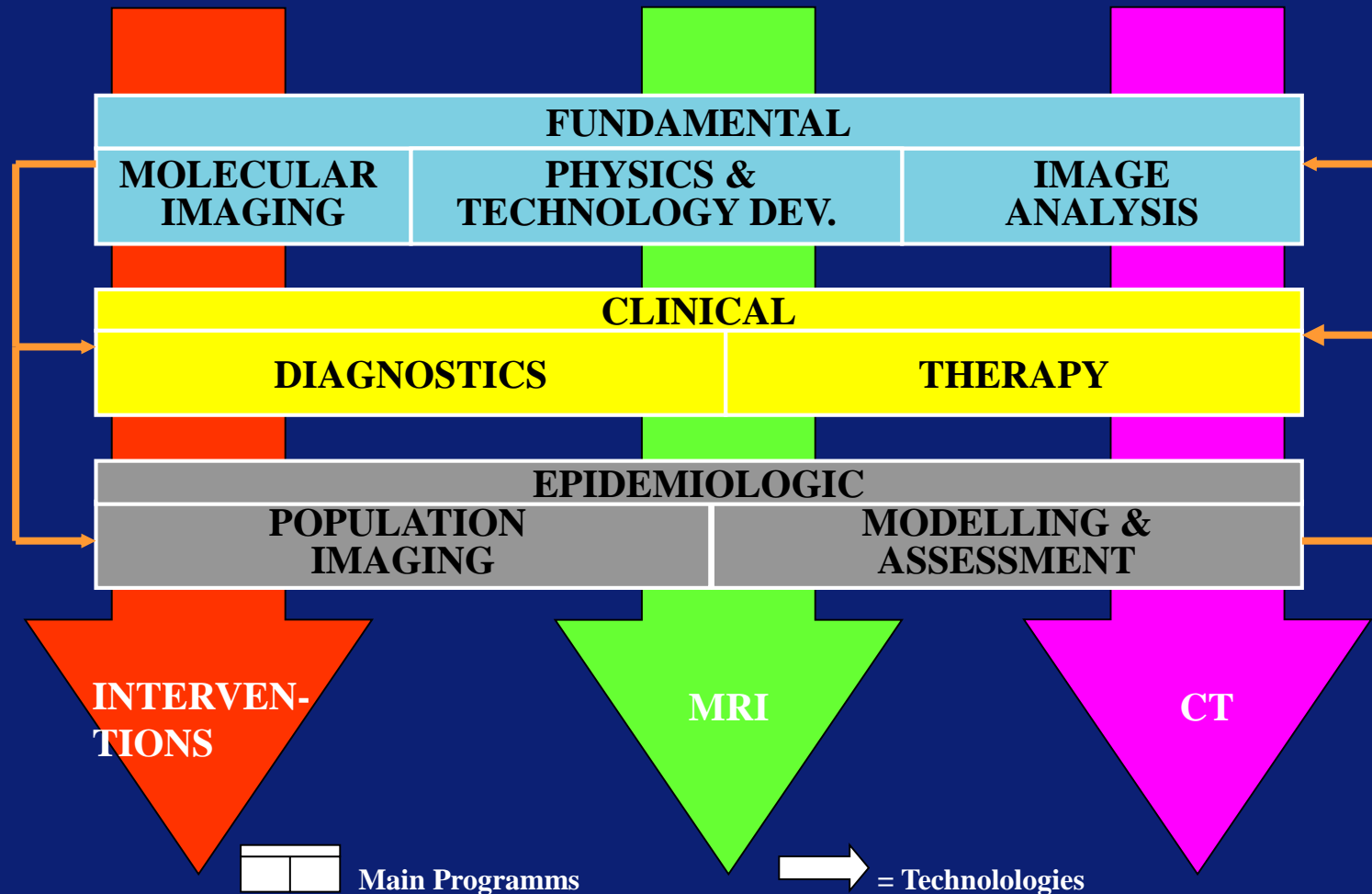
Strategic Planning



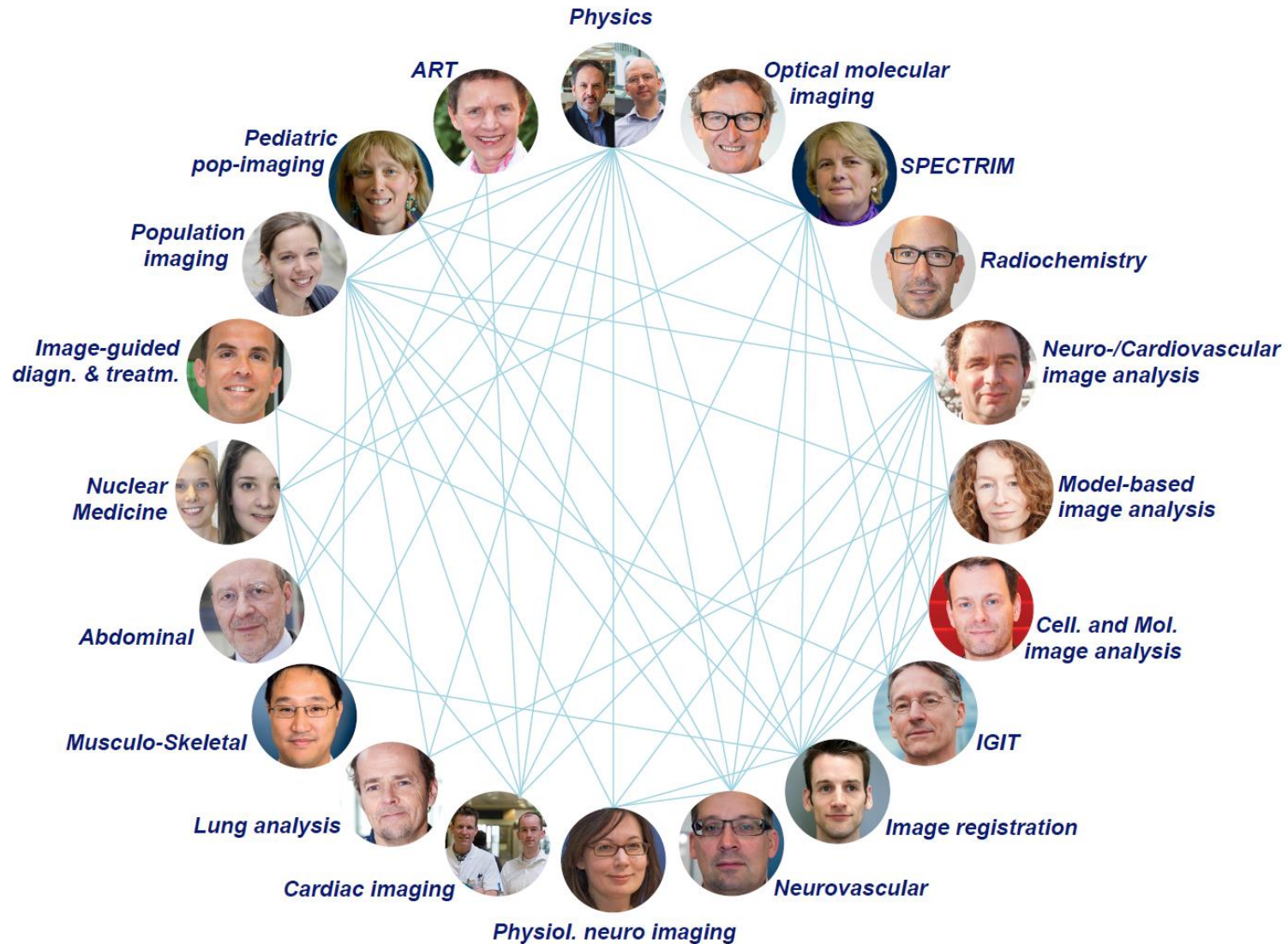
Monitoring the Research Process



Organizational Structure of Radiology Research at Erasmus MC



PIs in Rad & Nu.med



Research Infrastructure

- Equipment
- Space
- Support personnel
 - technicians (perform research exams, over standard knowledge)
 - trial nurses (perform clinical trials, interface with patients)
 - animal handlers
 - data manager, biostatistician (study design, data analysis)
 - “grant-hunter”
 - grant manager (accountant)
 - graphic designer
 - medical writer
- A research infrastructure not only facilitates research, but also contributes to the culture
- “Culture in which research is valued”

Research Management Solutions for Radiology Departments

- Create “culture in which research is valued”
- Start small
- Identify and support collaborations
- Provide research infrastructure
 - improve investigator efficiency
 - improve job satisfaction of investigator
- Develop a strategic plan
 - clearly define goals
 - create a structure
- Define and monitor processes
 - use input, throughput, and output metrics
 - use research MIS

And Then....?



S.A. Tartakower,
Russian chess master

“The mistakes are all there waiting to be made.”

**Thank You
for
Your Attention**



ERASMUS ROTTERDAMUS
1469-1536