NORDIC FIVE TECH

Nordic Five Tech (N5T) is an alliance of the leading Nordic technical universities based on shared Nordic values - an entrepreneurial spirit, green environmental focus, student-oriented learning environments, societal responsibility. Together the N5T universities comprise approximately 100 000 students and produce c. 50 % of all the master-level engineering graduates in the Nordic countries.

Position Paper

by Nordic Five Tech universities

on

Public Funding of Engineering Education

1. Global university landscape

The global university landscape is going through a profound transition. Global competition is accelerating at an unprecedented pace. In particular, Asian universities and university systems are challenging the dominance of North American and West European institutions, and the academic world's center of gravity is moving eastwards. Academic investments, talent and ideas are, more and more, concentrating in Asian universities.

Importantly, the challenge does not equally affect all research and educational fields. Governments of the rising Asian economies focus investment on research and education in engineering fields and, to some extent, the underlying natural sciences, as can be seen clearly in Figure 1.

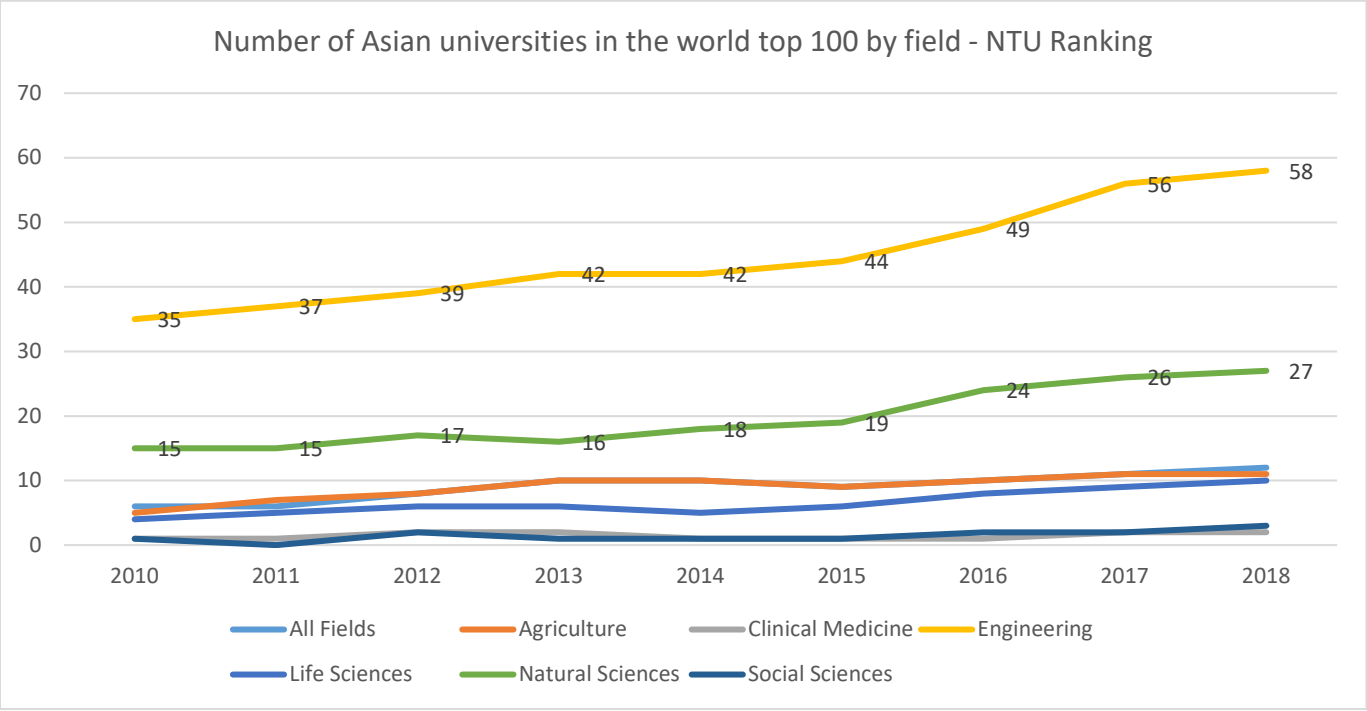


Figure 1: Number of Asian universities in the world top 100 by field of research in the National Taiwan University Ranking – Performance Ranking of Scientific Papers for World Universities 2010-2017

Asian policy makers understand that: (i) in modern innovation economies, economic growth, productivity and societal wellbeing are increasingly dependent on the innovative capacity of the society, (ii) the innovative capacity of a society is directly proportional to the quality and richness of its engineering research and education and, finally, (iii) fundamental engineering research and education is precisely the aspect of a nation's innovation system that public funding can support very effectively without causing market disturbances.

2. Nordic university reform

Alongside many European countries, the Nordic countries are currently renewing their university systems. University funding models must respond to the accelerating international competition and, particularly, the rise of Asian higher education challenge. For a successful response, an accurate assessment of the global landscape is needed; maintaining the competitiveness of engineering research and education is crucial. The Nordic countries must invest significantly more in engineering education to maintain its current level of competitiveness—and if the goal is to increase competitiveness, even more investment is called for.

3. Costs of high-quality engineering education are high

Engineering education is a challenge for university funding systems, as the costs of high-quality engineering education are extremely high in comparison to most fields. Competitive engineering education requires not only state-of-the-art research and education infrastructure, but also hands-on laboratory work in small groups: a competitive engineering graduate excels in theoretical engineering science as well as in the skill-based art of engineering. This makes the education of world-class engineers both a demanding and resource-intensive endeavor.

Thriving engineering education is an essential ingredient of a competitive innovation system and, by extension, a competitive economy. Renewed Nordic university funding models must not create incentives for universities to direct their educational efforts from resource-intensive engineering fields to less expensive fields; such a shift would have catastrophic consequences for the economy and, ultimately, citizens of the Nordic countries. Field-specific weights in the funding model, especially in teaching, can, thus, be mobilized.

For example, under the Commonwealth Grant Scheme, the Australian Government's contributions per student place (see Table 1 below) vary significantly between fields. The government subsidizes engineering education almost nine times as much per student than the least expensive fields.

Table 1: Total resourcing for a Commonwealth supported student place by discipline - Australia 2018[1]

Funding cluster	**Part of funding cluster**	**Maximum student contribution amounts (aus$)**	**Australian Government contribution (aus$)**	**Total Resourcing (aus$)**
Funding cluster 1 Law, accounting, commerce, economics, administration		10 754	2 120	12 874
Funding cluster 2 Humanities		6 444	5 896	12 340
Funding cluster 3 Mathematics, statistics, behavioural science, social studies, computing, built environment, other health	Mathematics, statistics, computing, built environment or other health	9 185	10 432	19 617
	Behavioural science or social studies	6 444		16 876
Funding cluster 4 Education		6 444	10 855	17 299
Funding cluster 5 Clinical psychology, allied health, foreign languages, visual and performing arts	Clinical psychology, foreign languages, or visual and performing arts	6 444	12 830	19 274

[1] Adapted from https://docs.education.gov.au/system/files/doc/other/2018_indexed_rates_2018_12_18.pdf via an unpublished discussion memo of the Finnish Ministry of Education and Culture.

	Allied health	9 185		22 015
Funding cluster 6 Nursing		6 444	14 324	20 768
Funding cluster 7 Engineering, science, surveying	Engineering, science, surveying	9 185	18 240	27 425
Funding cluster 8 Dentistry, medicine, veterinary science, agriculture	Dentistry, medicine or veterinary science	10 754	23 151	33 905
	Agriculture	9 185		32 336

The Australian model is by no means unique. The Swedish and Danish funding models have respected cost differences of different fields in a similar manner, although where Denmark[2] has wisely placed engineering (with laboratory-based sciences and medicine) in the highest rate group of DKK 92 500 per FTE student (plus a similarly field-specific completion bonus). From 2019, a new appropriation system will be introduced in Denmark and the rate for engineering reduced to DKK 66,400. This will partly be compensated by an increased basic appropriation the size of which is not yet known. In Sweden[3] the compensation level for engineering education lags behind the compensation level for medicine (SEK 51 753 (engineering) v. SEK 61 483 (medicine) for FTE students, and SEK 43 644 (engineering) v. SEK 74 786 (medicine) for FTE performance).

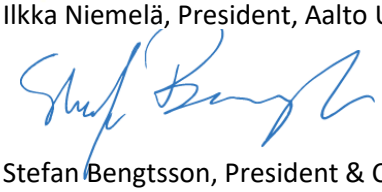
Other interesting benchmarks can be found e.g. in Austria and the UK. It is imperative that Nordic funding models include this kind of field-specificity in the future; teaching in different fields must have different price tags.

4. Conclusion

The Nordic countries must protect their excellent engineering research and engineering education as the backbone of Nordic innovation economies. This requires that governments recognize and respect field-specific requirements of engineering fields and the high costs of world-class engineering education. The compensation for teaching must have field-specific weighting that acknowledges the central importance of high-quality engineering education for Nordic countries' respective innovation systems and its considerable costs.

Signed in October, 2018

Ilkka Niemelä, President, Aalto University, Finland



Stefan Bengtsson, President & CEO, Chalmers University of Technology, Sweden

Anders Overgaard Bjarklev, President, Technical University of Denmark

Sigbritt Karlsson, President, KTH Royal Institute of Technology, Sweden

[2] https://ufm.dk/uddannelse/videregaende-uddannelse/universiteter/okonomi/uddannelsestilskud/bevillinger-til-universitetsuddannelse.

[3] http://www.uka.se/download/18.458252e315a188bd3e75c93/1488372286077/rapport-2017-03-01-uppfoljning-ersattningsbelopp.pdf, figures from 2015.