Illuminating science for transitions

102nd Dies Natalis lecture Wageningen University & Research

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Transitions

Over the last two decades, and certainly the last years, transition has become one of the more fashionable concepts in science and society. Calls for, and policies and practices on, an energy transition, a mobility transition, an agricultural/food transition, and an industrial transition are emerging regularly in the Netherlands and beyond. Transition then stands for a systemic change of an economic or societal sector, as that sector does no longer meet the sustainability goals and objectives. Such transitions stand in contrast to smooth incremental change. Science in general has very well understood the need to deliver new knowledge, insights and innovations to facilitate and enable such societal transitions. It is not by accident that our Strategic Plan[2] 2019-2022, *Finding Answers Together*, has put our contribution to societal transitions centre stage. There even exists a scientific field called Transition Science[3], which studies past societal transitions to provide insights on how to organize and manage systemic changes of societal sectors.

Today, during this Dies Natalis celebration, I would like to discuss two facets of the relation between Science and Transition. I will label them Science *in* Transition and Science *for* Transition. First, then, Science *in* Transition.

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[1] Rector Magnificus Wageningen University & Research. Thanks to Erik van der Linden, Arnold Bregt and Vincent Koperdraat for helpful comments on an earlier draft.

[2] Wageningen University & Research (2018), *Finding Answers Together. Strategic Plan 2019-2022*, Wageningen: Wageningen University & Research

[3] See for instance J. Grin, J. Rotmans & J. Schot (Eds)(2011), *Transitions to Sustainable Development. New Directions in the Study of Long Term Transformative Change*, London: Routledge

Science* in *Transition

In 2012 in San Francisco the so-called DORA declaration[4] was published, the San Francisco Declaration on Research Assessment. This declaration emphasized the need to improve the way in which output of scientific research is evaluated by funding agencies, academic institutions, and other parties. Or in other words: how can we better assess excellent research that deserves to be rewarded? The signing of the declaration started the co-called *Science in Transition* movement, a movement that called for a modernization of how we assess research, particularly focusing on research metrics such as Journal Impact Factors.

Last year, in the tradition of *Science in Transition,* the Association of Dutch Universities VSNU, together with NFU, NWO, ZonMW and KNAW, published a paper on changing the assessment of academics and research.[5] This paper of the Dutch universities calls for a transition towards a modernized system of recognition and rewards of academics and research. The idea to modernise the assessment system is to be welcomed and Wageningen University & Research has supported and endorsed it. Let me elaborate on the presented modernization and give you a few thoughts what these ideas mean for Wageningen.

First, in any redesigned assessment system our aim will remain excellence in science. The legitimate question is: what is and how to recognise excellence in science. Excellence is divers in dimensions, and diversity furthers better science. But it does not mean that 'anything goes', that every scientist can set his/her own goals and criteria for assessment. Nor should we completely reject current assessment metrics or our tenure track, as they remain helpful in recognising academic excellence. As for our tenue

[4] San Francisco Declaration on Research Assessment https://sfdora.org/read/
[5] VSNU, NFU, KNAW, NWO and ZonMw (2019), *Room for everyone's talent: towards a new balance in the recognition and rewards of academics*, The Hague: VSNU

track, it is best to paraphrase the US writer Mark Twain: "Reports of its death have been greatly exaggerated".[6]

Second, the University Association report stresses that in assessing academics education is as important as research. Wageningen has always valued the importance of education, more than many other universities. Education is financially well rewarded, is full part of annual Result & Development talks and of Tenure Track, and we have just launched an Education Career Path; and we are doing well in education.[7] Is this enough to put education on a par with research? Perhaps not. But we don't start here from scratch.

Third, excellence has many dimensions. Expecting excellence of our academics in research, education, impact, leadership as well as open & citizen science might end up in high workload and more stress. To prevent this some advocate for separated careers: researchers, lecturers, impact experts and leaders/managers. However, we should be careful with driving such career compartmentalization too far. Wageningen has always celebrated the close relation and cross-fertilization between research, education and value creation. A solution for matching excellence with manageable workloads might lie in teamwork, my fourth point.

Fourth, science stands on the shoulder of predecessors and colleagues and is to a major extent teamwork; so assessments need to involve team performance. Sometimes team performance is assessed, for instance in the Standard Evaluation Protocol or in *Zwaartekracht* proposals. But personal grants, person-based metrics and individual prizes & rewards still dominate. To systematically combine team performance with individual assessment is as challenging as it is needed.

Fifth, Wageningen University & Research is part of a global science system. While we decide of course on our own assessment standards and

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[6] Mark Twain in the *New York Journal* of 2 June 1897, following reports announcing his death: "The report of my death was an exaggeration".

[7] Also for 2020 Wageningen University has been listed (for the 15th time in a row now!) as the best Dutch university for education (L. van Leeuwen, N. van der Elst, E. Heijne (2019), *Keuzegids universiteiten 202*0, Den Haag: Keuzegids B.V).

practices, we have to take into account how other academic institutions act, in the Netherlands and globally. Indifference to others may influence successes in our recruitment of international staff, our success at (international) funding agencies, our position on national and international rankings, our attractiveness to national and international students, and so on. The current coordination of the transition in recognition and rewards of academics in the Netherlands is welcomed; but yet little is done internationally.

Finally, a modernization of the assessment system is not a one-time Executive Board decision. It has to be an institution-wide cultural *norm-bildung* process. We have to do this together because we always do that in Wageningen. And because all academics assess fellow academics: in appointment advisory committees, in Tenure Track committees, in Result and Development talks, in research proposal assessments, and as peers.

To underline this togetherness I have installed a committee, chaired by our Dean of Education prof. Arnold Bregt, to develop - in close interaction with the wider Wageningen academic community - workable Wageningen principles and practices on recognition and rewards.

Science* for *Transition

Let me now move to the second relation between science and transition: science *for* transition. At least throughout Europe, but also beyond, universities, research institutions and funding agencies have put the 17 Sustainable Development Goals centre stage. Figure 1 gives relative data of WUR SDG publications. By doing so, the scientific community has shown its commitment to contribute to transitions, to systemic change, in energy, food, mobility, poverty alleviation, water and other areas. This of course strongly legitimizes public and private funding of research and education.

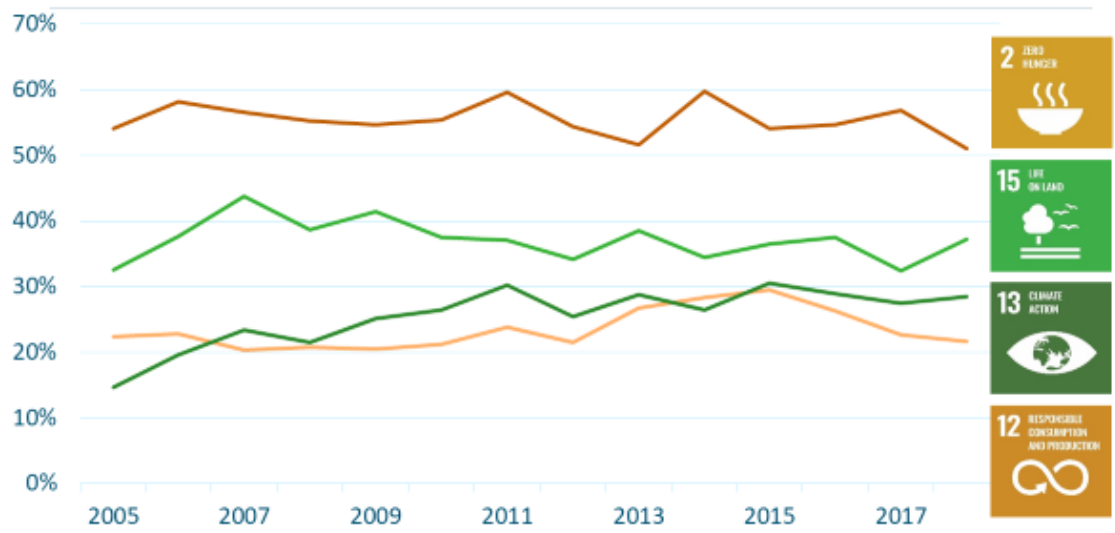

Figure 1: Contribution of WUR to SDG publications in the Netherlands (in %)

This commitment to societal challenges is reflected in research, education and strategic plans at universities, in the research programs and plans of research institutes, in calls at funding agencies (such as NWO and the European Commission), and in governmental research and education policies such as the National Science Agenda NWA. But this emphasis on transitions may (and arguably does) advance a particular form of scientific research. Pasteur's Quadrant (Figure 2; Stokes, 1997)[8] gives an informed distinction in types of research along two dimensions: fundamental understanding and consideration of use. The attention given in academic research to SDGs, missions and related transitions favors support and finances for use-inspired and applied research. And it jeopardizes attention, endorsement and support for what is here called pure basic research. This is also the conclusion of a recent – and much debated – Royal Academy of Arts and Sciences report that assessed funding in our national science system: increased funding in strategic research over the past years has come with stagnation in so-called unfettered (basic) research.[9]

[8] D.E. Stokes (1997), *Pasteur's Quadrant: Basic Science and Technological Innovation*, Washington D.C.: Brookings Institution Press

[9] See KNAW (2020), *Evenwicht in het Wetenschapssysteem. De verhouding tussen ongebonden en strategisch onderzoek*. Amsterdam: KNAW, pp. 32-33. See on decreasing finances for free

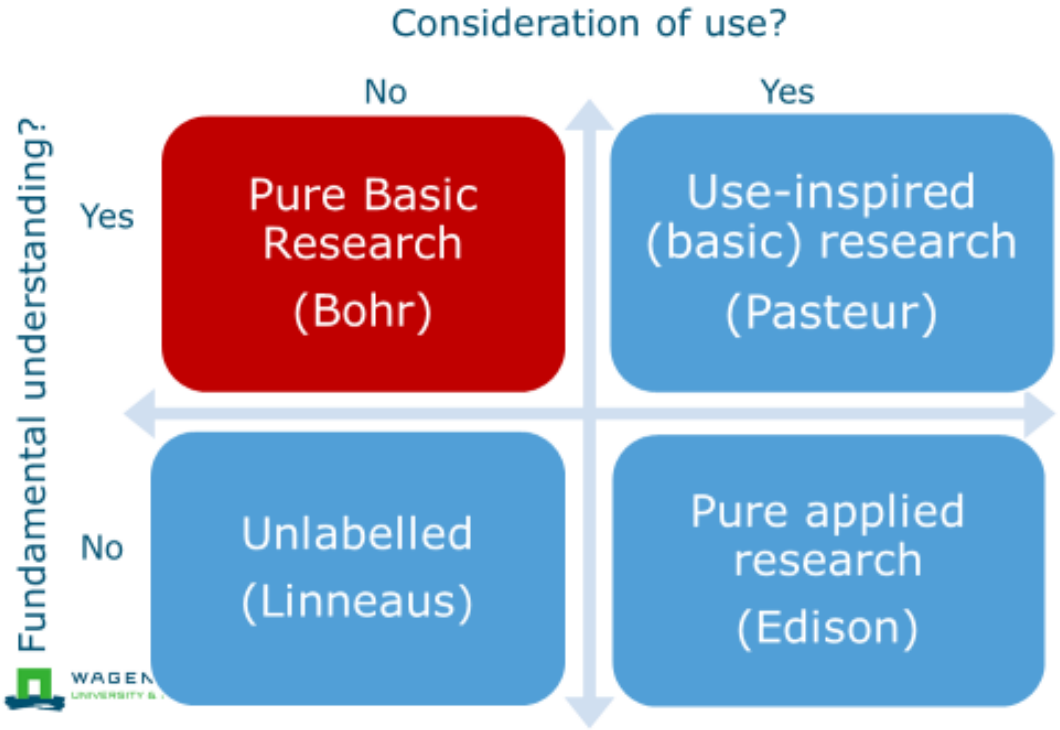

Figure 2: Pasteur's Quadrant (Stokes, 1997)

The relevance of basic curiosity-driven science in the upper left quadrant is not always immediately salient. It has high uncertainties regarding outcomes, the 'users' are often unknown and unheard, and applicability and pay-back time are usually decades rather than years. Hence this science tends to go unsung, unnoticed and insufficiently supported. By the same token, we know that pure basic research is essential for advancing systemic change of tomorrow.[10] Pure basic research furthers new scientific discoveries, which lead to new knowledge, which forms the basis of radical innovations for among others transitions. Evidence is easily found in history: many of the most impactful advancements in society such as the Internet and the accuracy of GPS[11] are founded in pure basic research carried out decades ago. And closer to the Wageningen domain: CRISP-Cas

fundamental research in the Netherlands over the past decade also KNAW (2015), *Ruimte voor ongebonden onderzoek. Signalen uit de Nederlandse wetenschap*, Amsterdam: KNAW.

[10] Pure basic research is also essential to remain excellent in science globally and to attract national and international academic talent.

[11] GPS accuracy is strongly based on Einstein's theories of special and general relativity; basic mathematical research into packet switching theory in the 1960s laid the foundation of the Internet

did not emerge from a purposeful research program to advance gene-editing technology, but mainly originated from basic, curiosity-driven microbiological research on how a bacterium's immune system works.

Hence, if we – as WUR in our strategic Plan, as the Netherlands' academic community, as governmental and non-governmental research funders – are serious about science *for* transitions we should acknowledge, appreciate and support curiosity-driven creative science that has no other immediate goal than unravelling fundamental physical, chemical, social and/or biological phenomena. And we should accept the long pay-back time and the uncertain societal and economic relevance; although this is not always easy for politicians, managers, funders and the model-builders of the Netherlands Bureau for Economic Policy Analysis CPB.[12] One word of caution: This call in favor of basic curiosity-driven research should not be understood as a call against or at the cost of strategic or applied research. The essential scientific vehicles for future transitions are innovation ecosystems where science from the different quadrants – as well as from different disciplines, but that is another story – interact and mutually strengthen each other. And you got the idea: that is exactly what we are constantly aiming for at our Wageningen campus ecosystem.

Photosynthesis and prof. Donald Ort

The beauty, inspiration and importance of basic, fundamental research is best explained through examples. An area where pure basic research is evidently important for future societal transitions is photosynthesis. I could now elaborate on the fascinating process of photosynthesis, how far we have come to understand it, wat are some of the major frontiers scientists are now working on, and why this all is not just fascinating for our

[12] In the national CPB models investments in scientific research emerge only as costs, while they do not include its (potential, long term) effects on economic growth and/or social welfare. CPB (2015), *Een macro-economische analyse van het rendement op publieke kennisinvesteringen*, Den Haag: CPB

understanding of life but also potentially relevant for addressing some of the major societal challenges. But it is far better to call upon an expert.

It is a great honour to introduce professor Donald Ort. He is the Robert Emerson Professor in Plant Biology and Crop Sciences at the University of Illinois at Urbana-Champaign. Professor Ort is one of the world's leading experts in photosynthesis, a field in which he has been working for more than 20 years. Professor Ort will illuminate the state of the art in photosynthesis research and its promises for the future.