No University without Diversity

The Dynamic Ecosystem of Scientific and Social Innovation

André Knottnerus

Introduction: the Dutch National Research Agenda

In 2015, a public and media-supported invitation to the Dutch community to submit questions to science was the start of a process to develop a national research agenda. The chosen approach was bold and innovative and drew a lot of attention, nationally and internationally. As has been described elsewhere in this volume, it turned out to be a successful approach, harvesting close to 12,000 questions from a broad range of highly motivated individuals and groups with various social backgrounds – citizens, consumers, professionals, businesses, policymakers – and also from researchers from the full spectrum of scientific disciplines.

After review, these specific questions were clustered in 140 more general questions covering key fields of scientific, social, and economic interest and related to existing institutional research and knowledge agendas and the EU grand challenges. In 2016, the implementation process started, and work is being done to further connect bottom-up initiatives with identified challenges and to make investment plans to facilitate corresponding research programmes.

A central aim of the Dutch National Research Agenda is to stimulate scientific creativity in the broadest sense and to harness this creativity to meet important scientific and societal challenges. The objective is to establish an adaptive, resilient, and dynamic research system that on the one hand is connected to science-driven research agendas but at the same time can be sensitive and responsive to important developments in society.

In this essay I shall explore how characteristics of the Dutch National Research Agenda relate to international developments taking place in the world of research and innovation. In doing so I shall use the agenda as cause and point of reference for some reflections on how to create a more dynamic ecosystem for science and innovation, allowing me to assess the relevance and timeliness of the agenda.

The importance of diversity and connectivity

To be effective and productive, given the fast and complex scientific and societal developments, a research agenda must have connective power and be able to promote collaboration across disciplines and sectors. In this context, the following insights are paramount.

New ideas and insights emerge best in a multiform and diverse multidisciplinary landscape in social interaction with external peers (Blackwell et al., 2010; Hasan and Koning, 2015a; Hasan and Koning, 2015b). Original and unexpected approaches and solutions of a problem have a higher chance to occur at the interplay of different disciplines which might not even have collaborated before on that problem. Such "bottom-up" creativity is facilitated in a scientific community bringing together a broad range of expertise. At the same time, "top-down" approaches to address grand scientific and societal challenges in innovative ways cannot be achieved without a broad input of creativity. In other words, also for this purpose diversity and the presence of multiple disciplines and research approaches are a precondition.

Moreover, innovation is facilitated by opportunities for direct face-to-face communication. Even in an era of increasing internet connectivity and new possibilities for real-time worldwide communication, 'physical connectivity' within short geographical distance remains important. It is a key requirement for creative brainstorming and serendipity, knowledge circulation, and productive collaboration (WRR, 2013; Rosenman, 2001). For this reason, processes of innovation are accelerated in urban regions ('smart cities') and advanced universities comprising a comprehensive diversity or 'multiversity' of disciplines and talents (NAS, 2012; Ter Weel et al., 2010).

Successfully realising innovative ideas at the interplay of different disciplines – i.e. interdisciplinary research – requires specific conditions to be met, both in research and research policy (Grensverleggend, 2015). It requires bridging divides not only between top-down and bottom-up research programming and between untied research and research focusing on societal challenges, but also between public and private funding of research, and between the academic world and the general public. This can be achieved if we leave the world of walls and separations and agree to be players in one dynamic ecosystem of research and innovation.

The formulation of the Dutch National Research Agenda fits these patterns and responds to this emerging ecosystem in that it involves the public and societal actors in setting the agenda and connects players across the entire knowledge and innovation landscape.

Integrating top-down and bottom-up approaches

Building on the previous section, we must recognise that in discussions on how research and innovation should be promoted, there are two perspectives that are both old and still very much alive. First, there is the perspective of the autonomy and freedom of research, as a *conditio sine qua non* for continuous progress and development, especially in the long term. This is also the perspective of bottom-up initiatives, science-driven governance, and self-regulation of research, leading to a multiform spectrum of largely unpredictable scientific creativity.

The second perspective is the one of research being motivated or stimulated by policies to meet grand challenges for science and society. In the context of this second perspective, clustering of research capacity in larger themes, programmes, or centres has become common practice in order to combine critical mass with focus to address the defined challenges with available resources.

While each of these two perspectives represents a strong case in itself, it is a continuous challenge to connect them in one and the same comprehensive research strategy. While there are still researchers and policymakers who believe that these perspectives are incompatible, the Dutch National Research Agenda seeks to overcome this distinction by presenting a framework that allows room for both approaches and integrates them. In doing so it builds on an international trend of linking bottom-up creativity with top-down programming. Examples of this trend are worldwide scientific collaborations such as the Human Genome Project and regional geographic concentrations to serve scientific and economic progress. The latter has been demonstrated in the NASA space research programmes, the CERN collaboration in Geneva, Silicon Valley in California, and the Eindhoven Brainport area. These successes were by and large the result of combining public and private efforts from academia, government, and industry. Public and private initiatives and extensive funding programmes – integrating basic, strategic, applied, and practice-related expertise – have also enabled Wageningen University to be a world leader in food and malaria research. In all these cases, concerted collaboration guided by common goals has shown to be a determinant of creative and interdisciplinary development.

The Dutch policy to promote economic top sectors is another case in point. In these top sectors, which are both publicly and privately financed, government, science, and industry work together to create innovative products and services to address major societal challenges and to increase the earning

power of the Dutch economy (Adviesraad voor Wetenschap, 2014). The Dutch National Research Agenda embraces and builds on the experience of this approach, but is wider in scope, seeking a more balanced representation of input from natural and life sciences, social sciences and the humanities, and gives more space to bottom-up initiatives. Moreover, it more explicitly emphasizes the need to add a diversity of other societal actors to the research collaboration between government, science, and industry.

This development is indicative of a wider trend in which the distinction between the public and private domain is changing, as considered by the Netherlands Scientific Council for Government Policy (WRR, 2013). Whether it comes to energy conservation, sustainable production, the implementation of a basic package of healthcare services, privacy, security, or reliability of financial markets, governments cannot serve the public interests without a strong commitment from the private domain, both nationally and internationally. At the same time the private sector is increasingly dependent on cross-border public policies. Accordingly, a public-private continuum has emerged, where players pursue their goals in mutual interconnection. In fact, one could speak about a repositioning of both domains in a context of shared responsibility, according to a broader conception of the public interest as already conceived by Spinoza (2010), cause' which is relevant for and must be supported by all of us together. It is precisely this interpretation that fits with the challenges of today and tomorrow, also in the field of research policies and research funding.

No more hierarchy of sciences

The trend to merge top-down programming with bottom-up creativity heralds the end of hierarchical dividing lines between the sciences. Equity and mutual respect in the appreciation of and between the various sciences is a *conditio sine qua non* for productive and motivating interdisciplinary collaboration.

Illustrative in this context is the anecdotic 'Feinstein cycle', presented by Alvan R. Feinstein, founder of modern clinical epidemiology, at a seminar on clinical epidemiology and healthcare research at Maastricht University in 1989 (Knottnerus, 2012). A biologist rather condescendingly tells a biomedical researcher that the latter merely applies the knowledge of mechanisms detected by biology. Next, a chemist challenges the biologist, claiming that not biology but chemistry has provided the fundamentals of these mechanisms. No, says the physicist, our laws of nature and elementary

particles determine all of the living and the non-living world. Subsequently the mathematician poses that physical empiricism merely confirms what he and his colleagues had predicted. The philosopher pushes him aside by saying that math is just one instrument of fundamental thinking, not necessarily the most illuminating. Then, in the retake, the biomedical researcher takes his second chance: 'Colleagues, you have shown that human thinking needs improvement and it is up to my field to enhance brain performance.'

The obvious catching point is that, instead of claiming that any discipline is more basic than any other, it is more fruitful to accept that all disciplines need one another, and have their own unique value as part of the big mosaic of sciences. This certainly is the spirit behind the Dutch National Research Agenda, which has identified research themes that require concerted efforts of many different disciplines.

For the various disciplines to better understand and appreciate one another, there is also a need for a better system of quality assessment of scientific performance across disciplines. Quality assessment should take the diversity of sciences as a starting point and be sensitive to differences in publication and citation cultures. Moreover, various types of scientific and social impact should be taken into account (Knottnerus et al., 2002; Knottnerus, 1988; Wetenschapsvisie 2025, 2014).

There is growing criticism that quality assessment of research has become 'quantity assessment' focusing on counting publications and citations. A fair and more scientifically acceptable assessment can be facilitated by (re)introducing quality of content review: by looking at what in fact has been accomplished; reading, not just counting what has been reported; reviewing originality, quality, and contributions to real progress; and also being critical as to wasting of resources and efforts, and unnecessarily burdening of study subjects and guinea pigs (MacLeod et al., 2014). The use of assessment criteria such as contributing to progress and appropriate use of resources is especially essential at the level of programme clusters and institutions. Moreover, at that level respecting differences in publication culture is extra relevant since in a cluster context comparisons between disciplines are more directly made.

It would not be surprising if such a change in orientation of the assessment system would lead to different quality rankings of researchers and institutions. Originality and innovation, and promising long-term impact – elements that are not easily recognized in a system mainly focusing on past performance and recent citations – would be earlier detected, published, acknowledged, and stimulated.

Public involvement as a game changer

Giving the general public a significant role in developing the Dutch National Research Agenda was seen by many as a bold, innovative, and risky step. Yet it is indicative of a wider trend of growing public involvement in science. The once sharp demarcation between scientific authority and the world of the layman (who was expected to just accept and respect that authority and to unconditionally pay its costs) is rapidly fading. This is a result of a general development that also has a major influence on the societal position of research and on research policy: the continuously increasing commitment of the public (Gregory and Miller, 1998).

While in the sixties research policy was merely a matter of interaction between governments and research institutions, over the past twenty years the perceptions, opinions, and involvement of the public have become a decisive factor. This has been strongly facilitated by the rising levels of education and social emancipation of western populations and by the media. At the same time, the research community has recognized much more than before that the public's trust and confidence in science is crucial for social investments in research and innovation.

This is associated with more direct public accountability: research institutions and groups, but also individual researchers, are now challenged to explain to the public the work they do, why this is important and useful, and why their work needs and deserves public investments. Where in the past politicians could annually decide on those investments in a 'backstage context', nowadays such decisions need explicit public support. Not only since politicians and their decision-making are much more under day-to-day public pressure, but also because in the political arena the various priorities are more transparently brought into intra- and inter-sector competition.

Some consider this enhanced involvement of the general public to pose a risk, in the sense that investments in research and development may become susceptible to short-term fluctuations evoked by opportunism. But it can also be seen as an opportunity to build a direct, strong, and stable mutual relationship with the public, with a view on the longer term future and to provide safeguards against political 'short-termism'. Indeed, it is an important task of responsible stakeholders to provide well-balanced countervailing information, that is, checks and balances based on which the public and politicians can develop long-term views. It is precisely for this reason that the scientific community must actively connect with the public to ensure the indispensable societal foundations for the future of sciences.

As the future of research is increasingly dependent of the public's confidence and trust, public accountability no longer allows 'scientific isolationism'. Public accountability is accompanied with public involvement, and is a sine qua non for sustainable investments in research.

The role of government

The Dutch National Research Agenda was developed at the request of the Dutch government. Rather than formulating such an agenda itself, the government judged it better to ask the main players in the Dutch knowledge and innovation system to develop the agenda through a participatory approach allowing for public involvement.

This makes us reflect on what role government can have in promoting the result: a both scientifically and socially relevant research agenda. In a globalizing world where international and European research agendas play an increasing role and in which private actors have a major, often transnational impact on research and innovation, national governments by themselves are less powerful than before. But they can stimulate fruitful conditions, interacting with science, industries, and social organisations. If convincingly done, this can leverage much greater public impact than would otherwise be possible. In this respect, the initiative of the Dutch government to invite a steering committee with participation from the public and private sectors to develop the national agenda was well considered.

But as research and innovation are internationally competitive activities, public-private cooperation must not be seen as a means to cut down public research funding, certainly not in a situation in which the Dutch investments in research and innovation are lower than those of many comparable Western countries (Deuten, 2015). If we want to optimally utilize and maintain the high 'specific gravity' and comparatively excellent performance of Dutch research and innovation (Prestaties in perspectief, 2012; Cornell University et al., 2015; BiGGAR report, 2010), the jointly deployed relative volume of research resources should at least keep up with international trends. Today's good performance reflects the impact of investments of many years ago, not just of today or yesterday. This is a crucial issue for society's resilience in an uncertain future and therefore represents a major mission for the Dutch government. Being able to maintain a solid base of knowledge- and curiosity-driven research is vital as a foundation for problem-driven research and longer term social gains (Ruimte voor ongebonden onderzoek, 2015).

A related government responsibility is to monitor and safeguard diversity and vibrancy of the research and innovation ecosystem in the interest of long-term resilience. This also implies allowing sufficient space for research that cannot easily be translated into social or economic value in the foreseeable future.

Obviously, the public interest of huge parts of research is that it may result in – often unforeseen – long-term applicability for the public good, and that it is rooted in mankind's proven conviction that we can only be what we are if we continue to look for not yet understood pasts and unknown futures. Think of climate research, basic molecular biological and psychological research, and historical and philosophical research.

One may also think of research topics like safeguarding human rights in deprived areas, or evidence-based discontinuation of excessive, long-term multiple drug use (Centrum voor ethiek en gezondheid, 2009). These topics are obviously crucial for society but not immediately attractive to the market. Consider as well long-term investments in research infrastructures that will not be achieved by single private parties because of market uncertainties, but are nonetheless essential for future generations not yet sitting at the stakeholders' table.

In this context, given limited public resources, a logical question is whether economically attractive research should not be more extensively financed or refunded from the benefiting markets, so that more vulnerable research activities could be better safeguarded by public funding. This would protect the latter against 'market failure', and would also facilitate the 'incubator' and 'back-to-the-drawing-board' functions of academia, which are, in the end, in everyone's interest.

Finally, in the currently complicated geopolitical context, with its increased emphasis on national interests, international scientific and expertise-based cooperation should not be pushed into the background. Such cooperation is both natural and essential for science itself, which needs thinking in and exploring of a world without borders. Moreover, international and especially European scientific cooperation is a prerequisite for addressing cross-border issues such as environmental quality, building and utilizing expensive infrastructures, and optimally handling rare diseases (Knottnerus, 2008), but also for effective competitiveness in a world with increasingly large players (WRR, 2010). It is therefore a good thing that independent researchers at the scientific workplace are keeping a cool head, irrespective of all tensions in the political arena, and continue building international bridges and breaking down walls.

Conclusion

After this short *tour d'horizon* of national and international developments in science and innovation, we are in a better position to situate the Dutch National Research Agenda in the context of emerging patterns. We have seen that the agenda reflects, responds to, and brings to the fore wider trends related to research and research policy.

The chosen approach is timely and meets the needs of our time, and is therefore very promising. Optimism is also warranted as it is a politically adopted innovative approach, and as stakeholders are creatively working together to overcome any hampering dividing lines, such as those between the scientific and the 'lay community', between public and private actors, and between the natural sciences, the social sciences, and the humanities.

The agenda is bound to play a role in the newly developing ecosystem of research and innovation, which is to be flexible and tailored according to the expertise and commitments needed to address major scientific and societal challenges.

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