National Research Agendas

An International Comparison

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Introduction

In November 2015 the Dutch National Research Agenda was published. This agenda describes in 140 overarching questions the major scientific challenges for the future. The agenda was written at the request of the Dutch Ministry of Education. The idea for such an agenda followed from the National Science Vision 2025. According to this Science Vision, the Dutch National Research Agenda should play a steering role in Dutch science policy.

In general, public investment in research is justified from the perspective of the contribution of scientific research to social, cultural, and scientific development, as well as to innovation. In Dutch science policy, as in many other countries, the latter 'innovation argument' has become increasingly important, and the economic crisis of recent years has put even more emphasis on it. Research agendas play a particular role within the scope of science policy instruments. They tend towards thematic prioritization of investments and of other policy instruments.

In this context, the aim of this essay is to explore and compare some aspects of national research agendas in order to examine the position of the first Dutch National Research Agenda. First, the essay considers the policy context of national research agendas. Second, fifteen countries are examined to determine whether or not a country has a national research agenda. Third, looking at countries with national research agendas, these agendas are compared and the character of the agendas and the themes that are prioritized discussed. In addition, the essay describes the process of development of the agendas and some aspects of implementation. Finally, the Dutch National Research Agenda is compared to the other agendas.

Science and innovation policy as context for national research agendas

In many countries science policies show three consistent transitions. First, a transition from direct funding by the government to funding through a system

of calls and tenders, performed by national research councils or comparable institutions. In line with this, a second transition occurred: a turn from a supply- to demand-driven knowledge 'production'. Thirdly, theme-oriented science policies evolved in addition to general science policies. The emergence of the policy instrument of a national research agenda is consistent with this third transition. In a comparative study of six European countries, Lepori et al. (2007) show three comparable developments: an increase in project funding, a differentiation of instruments and an increase in thematic prioritization.

This general shift towards thematic prioritization started in the 1970s as a result of social motives, especially the need to control technological developments. This was motivated by negatively perceived effects of technology and science on social well-being and on the environment. From the 1990s, the motives for thematic prioritization shifted towards the need to innovate, which became stronger in the economic crisis at the beginning of the 21st century.

In many countries not only science policy but also technology and innovation policies are important for research funding. In these policies innovation is generally considered as technological innovation, but social innovation receives greater attention. The general trend can be characterized as a transition from industrial support to innovation policy. In the nineties, many countries supported increases in funding, emphasizing that innovation policy should focus more on key industrial sectors than on lagging or newly developing sectors. This was inspired by the ideas of the economist Michael Porter (1990) and is sometimes characterized as: 'backing winners', as opposed to 'backing challengers', i.e. targeting promising new sectors, or 'backing losers', i.e. supporting companies in trouble. In the Netherlands, for instance, innovation policies are now partly aimed at nine key industrial sectors: knowledge-intensive sectors with a substantial contribution to export.

Against the background of this general development of thematic prioritization, there are some interesting differences between countries. Especially small countries seem to specialize in specific research areas. Soete et al. (2012, p 16) provide an overview of differences in innovation policy (Table 1). They show which countries focus more on proven strengths, such as the Netherlands, and which countries invest more in new dynamics. Israel and the United States are examples of the latter. In addition, supporting 'specific targets' can be distinguished from investing in 'broad absorption'. Broad absorption is the ability to incorporate information and knowledge and to transform it into insights or judgements that enable new innovations (WRR, 2008). The absorption capacity of a national economic system can be enhanced, for instance, by investments in education. Some countries,

such as Finland, combine the latter with a backing winners approach, while China and Germany combine it with a focus on new dynamics.

The table below from Soete et al. (2012, p 16) is just a rough characterization. For example, the Netherlands is characterized in the table as aiming at specific targets, but also has a general tax reduction policy for R&D investments by private companies, in which more public money is invested than in the 'specific targets' of the 'backing winners' policy (Jacobs and Velzing, 2013).

Table 1 Characterisation of innovation policy in several countries

Innovation policy aim	Specific targets	Broad absorption
Proven strength (*Backing winners)*	The Netherlands: top sectors Switzerland	Sweden(?), Finland Denmark, Japan (?)
New dynamics *(Backing challengers)*	Israel USA	China Germany (?)

Source: Soete et al. (2012)

Three discourses as a context for research agendas

Research agendas emerge as an important policy tool in the briefly described developments in science, innovation, and technology policies. The specific role of the agenda depends on the dominant concepts and theories about the mechanisms that connect research and innovation. Herein three discourses are manifested (De Haas et al. 2014).

The first is a discourse on stimulating *general conditions* for innovation, such as tax reduction for R&D, and enhancing the absorption capacity, for instance by investment in education. In this discourse, research and innovation are characterized as evolutionary processes that can only be stimulated by general measures supporting the conditions for innovation. The role of thematic research agendas is a general exploration of new topics rather than a steering instrument. A national thematic agenda is mainly an analytical and explorative instrument.

The second discourse is focused on the idea that explicit *thematic choices* must precede a successful relationship between research and innovation, implying that thematic innovation policy works. The concept of 'Backing winners', focusing attention and resources on existing and proven strengths, is part of this discourse. Thematic research agendas play an important role in this discourse as an instrument of prioritization.

The third discourse is based on the assumption that *networks* between companies, researchers, and governments are essential for a fruitful relationship between research and innovation. In this discourse, agendas are considered less important than the exchange of ideas and knowledge. This networking mechanism is in essence related to specific problem areas or sectors. This discourse, in the Netherlands known as the 'golden triangle', manifested itself successfully in the Dutch agricultural sector (OECD, 2015, p 136). In this discourse a national research agenda represents agreements made by network partners.

Additional analyses

The cooperation between companies, universities and research institutes, and governments is sometimes also described as 'Triple Helix' (Etzkowitz, 1998; Etzkowitz and Leydesdorff, 2000). This is an analytical model that combines two points of view. The first is an institutional viewpoint that focuses on actors and their cooperation. The second is a social-evolutionary point of view which distinguishes between the production of prosperity, production of innovations, and normative control. The Triple Helix model is then more than a practical policy choice for better cooperation between government, industry, and knowledge institutions. This model is extended by others by inclusion of NGOs. Carayannis and Campbell (2009) further extend the Triple Helix model with a cultural dimension. This refers to the mix of actors who operate in the media, in creative industries, the arts, the culture sector, etc., also called the 'creative class' (Florida, 2004).

With reference to the second discourse, research practice does not always react as intended, according to research by Van den Besselaar en Horlings (2011). They showed that the concentration of research resources to key thematic areas ('*sleutelgebieden*') in former Dutch Science Policy had a limited effect on the number of publications in these areas. This was possibly caused by the absorption capacity of the Dutch research system. Researchers are effective in articulating the big goals of the government in concrete terms, as indicated in a recent study by Bos (2016).

In Dutch innovation policy ('top sector policy') all three discourses are apparent (De Haas et al. 2014). In short, this policy combines general instruments from the first discourse with the choice for top sectors from the second discourse. Both are held together by the rhetorical use of the 'golden triangle' metaphor from the third discourse. The Dutch top sector policy is therefore an example of what Hajer (1993) calls discourse coalition, in which even opposing discourses have found a way to cooperate.

National research agendas

This section provides a brief analysis of national research agendas or other kinds of national thematic research prioritization in fifteen countries with well-developed science and innovation policies (Table 2).

Table 2 National research prioritization: characterization for fifteen countries

Country	National thematic research prioritization	Characterization	Cycle (years)
European countries			
Denmark	Yes	Thematic research agenda: *The Research2015 Catalogue*. Priorities: 21 themes in six fields.	4
France	Yes	*Strategic Agenda for Research, Technology Transfer and Innovation*. Aimed at improving the research system. Prioritization around nine major social challenges.	'Will be regularly revised'
Germany	Yes	*High-Tech Strategy*. Broad agenda for mid-term innovation policy. Technological and social innovation. Aimed at system improvement and strategic prioritization. Six thematic priorities.	*
Ireland	Yes	*National Research prioritization*. 14 priority areas around which future investment in publicly-performed research should be based. Aimed at commercial outcomes and sustainable businesses and jobs.	5
Italy	Yes	*National Research Plan*. Main target-setting instrument for research investments in Italy. One of the main targets will be reinforcing the strategy of international research. For basic, applied, and industrial-related research. Seven scientific macro-areas.	3
The Netherlands	Yes	*Dutch National Research Agenda*. 140 questions divided into 16 'routes'.	7
Poland	Yes	*National Research Programme*. Strategic Research directions for the long-term directions. Seven priorities.	10-15
Sweden	No	No explicit national research policy or agenda. No overall vision for the whole system.	n/a
Switzerland	Yes	Periodically renewed set of *National Research Programmes*. Chosen by the national government; substantial bottom-up influence.	2-3
United Kingdom	No	No national strategic prioritization. Seven Research Councils have own strategies and research prioritization.	n/a

Country	National thematic research prioritization	Characterization	Cycle (years)
Non-European countries			
Australia	Yes	*National Innovation and Science Agenda* aimed at improving the research system in general. Followed by the *Science and Research Priorities Australia* with nine priorities.	2
Japan	Yes	*Comprehensive strategy on science, technology, and innovation* as a long-term vision for 2030 to achieve an ideal economic society. Includes the whole picture of science, technology, and innovation policies and action programme. Five priorities, each worked out in 2-5 challenges.	*
Korea	Yes	*Vision 2030*. Five-year Basic Plan for Science and Technology. Regularly updated. A comprehensive long-term strategy to transform Korea into a fully advanced country. Selection of 30 priorities in four fields and 120 strategic technologies.	5
Singapore	Yes	*Research, Innovation, Enterprise 2020 Plan*. Integrated technology and science prioritization to improve health care, boost the economy, and create jobs. Major shifts to capture more value from research. Four strategic technology domains.	5
USA	No	No national thematic research agenda. Large national research initiatives on certain topics, in some cases on specific laws.	n/a

* not indicated

While it is difficult to take all the specific circumstances in each country into account, a number of interesting points can be noted. Most of the fifteen surveyed countries do have some kind of national thematic research prioritization. In most cases, this prioritization is meant to be renewed every three to five years.

Particularly in Asian countries, the national research agenda is closely linked to the overall economic and innovation policy. In Korea and Singapore, this mid-term innovation policy is regularly updated. Japan has a regularly updated mid-term agenda, but also formulated a long-term strategy. These countries show the relevance of a thematic research agenda towards a leap forward in innovation (OECD, 2009).

Furthermore, it appears from this overview that especially smaller European countries such as Denmark, the Netherlands, and Switzerland have chosen national thematic prioritization of research. This may indicate

that smaller countries feel the need to make specific choices or find specific niches to compete. Nonetheless, even countries without a national agenda, such as the United States or Sweden, do have an extensive and proven system of prioritization at the level of sectors, disciplinary science foundations, or otherwise.

Priorities

This section discusses the content of the national research agendas; which themes are prioritized in the agendas? Table 3 shows an overview of the thematic prioritization.

Most national research agendas have a rather broad scope, which means that they do not focus only on technology and innovation, but on the entire range of social issues. A specific feature of the Dutch Research Agenda is that it is made up of questions and 'routes' connecting these questions. Asian countries show a strong focus on technology and innovation, embedded in a strategy for general economic and social development.

A solid comparison is difficult because the agendas' priorities are formulated at different levels of aggregation. Nevertheless, the priorities show a large overlap. Many topics appear on several agendas, for instance energy, sustainability, food, and various health-related topics.

Table 3 Prioritized themes in national research agendas (in italics: themes mentioned five times or more; bold: some notable research themes, for various reasons)

Country	Prioritized research themes
Denmark	Fields: *Energy*, climate and environment; Production and technology; *Health* and prevention; Innovation and competitiveness; Knowledge and education; **People and social design**.
France	Resource management and adaptation to climate change; Clean, secure, and efficient *energy*; Stimulating industrial renewal; *Health* and well-being; *Food* safety and the demographic challenge; *Sustainable* mobility and *urban* systems; Information and communication society; Innovative, integrating, and adaptive societies; A spatial aspiration for Europe.
Germany	Digital economy and society; *Sustainable* economy and *energy;* Innovative workplace; *Healthy* living; Intelligent mobility; Civil security.

Country	Prioritized research themes
Ireland	Future Networks & Communications, Data Analytics, Management, Security & Privacy, Digital Platforms, Content & Applications, Connected *Health* and Independent Living, Medical Devices, Diagnostics, Therapeutics: Synthesis, Formulation, Processing and Drug Delivery, *Food* for Health, *Sustainable Food* Production and Processing, Marine Renewable *Energy*, Smart Grids & Smart *Cities*, Manufacturing Competitiveness, Processing Technologies and Novel Materials, Innovation in Services and Business Processes.
Italy	Scientific macro-areas: *Food*, *Energy*, Society, Nanotechnology, Mobility, *Health*, Safety.
The Netherlands	Sixteen 'routes' through 140 questions: Personalised *medicine*; Regenerative *medicine*; *Health* care research; The origin of life; Building blocks of matter and fundaments of space and time; Resilient and meaningful societies; Between conflict and cooperation; **Brain**, **cognition, and behaviour**; Using big data responsibly; Smart industry; Smart, liveable *cities*; Circular economy and resource efficiency; *Sustainable* production of safe and healthy *food*; **Arts**; Quality of the environment; Logistics and transport. The agenda is open to other routes.
Poland	New energy-related technologies; Diseases, new *medicine* and regenerative *medicine*; Advanced information, telecommunication and megatronics technologies; New Materials; Natural environment, agriculture, and forestry; Poland's social and economic development; State security.
Switzerland	Big data, Smarter *Health* Care, Antimicrobial Resistance, Managing *Energy* Consumption, *Energy* Turnaround, Healthy Nutrition and *Sustainable Food* Production, *Sustainable* Use of Soil, **End of Life**, Resource Wood, New *Urban* Quality, Nanomaterials, Regenerative *Medicine*, Smart Materials, **Gender Equality**.
Australia	*Food*, Soil, and Water, Transport, Cybersecurity, *Energy*, Resources, Advanced Manufacturing, Environmental Change, *Health*.
Japan	Clean and economic *energy* system; *Healthy* and active ageing society; Next generation infrastructure; Regional revitalization; **Recovery and revitalization from the great East Japan earthquake**.
Korea	Traditional priorities: several industries. New priorities: the green economy, the creative economy.
Singapore	Strategic Technology Domains: Advanced Manufacturing and Engineering; *Health* and Biomedical Sciences; Services and Digital Economy; *Urban* Solutions and *Sustainability*

Process and implementation

In developing a research agenda, three different methods are recognized (Table 4, second column).

1 The first addresses a large number of parties including citizens. The Dutch Research Agenda is a good example of this. It started with an invitation to citizens and organisations to submit questions to science.

2 The second method consults various parties outside the government, but is restricted to parties from science and industry. The Irish Research Prioritization is a good example of this.
3 The third method incorporates the agenda as part of a regular policy process. Asian countries often follow this procedure to develop their research agendas.

For the implementation of national research agendas, two models are distinguished (Table 4, third column).

A In one model, the agenda is included in a regular update of the research priorities. Next, these priorities are worked into programmes by research councils.
B In the other model, the calendar plays a role in the renewal of research and innovation policy: in some cases as the first time for a new regular prioritization process, in other cases as part of an overall renewal of the research or innovation system.

Table 4 Process of development and implementation of national research agendas

Country	Process (methods 1, 2, 3)	Implementation (models A, B)
Denmark	Mapping of research needs by a literature scan, a broad public internet hearing, input from the ministries. Expert panels delivered themes. The selection of final priorities was discussed with organisations, ministries, and research councils. (1)	Implementation by the national research council. Inspiration for universities. (A)
France	Close consultation with the scientific community, social and economic partners, the relevant ministries, and local authorities. (2)	Will be implemented through multi-year contracts concluded with research institutions, higher education institutions, the National Research Agency's (ANR) planning department, and other public research funding agencies. (B)
Germany	The High-Tech Strategy has been developed by the government in close cooperation with representatives from industry and science. (2)	Federal projects; coordination (departments, *Länder*); impact analysis. Public involvement in the innovation process; social innovation. (B)
Ireland	Initial deliberations with science organisations. Six expert groups. Steering group made final proposal for the government. (2)	Implementation is the responsibility of the government departments and agencies. (B)

Country	Process (methods 1, 2, 3)	Implementation (models A, B)
Italy	Normal ministerial policy process. (3)	Distribution of resources among the funds of science foundation. (A)
Netherlands	Broad bottom-up process, selection and combination by expert panels (juries); final proposal by a steering committee representing all Dutch science organisations. (1)	Government intends to use it for prioritization in research policy and agreements with universities. (B)
Poland	Draft prepared by the Scientific Policy Committee and discussed with ministries, councils, and agencies. The choice of strategic research priorities was made with the participation of 'distinguished representatives of various communities', especially researchers. (1 / 2)	Worked out by the National Centre for Research and Development into strategic programmes. (A)
Switzerland	Interested parties (federal offices, research institutes and groups, and individual persons) can submit topics and priorities for National Research Programmes. The Federal Council judges these and makes the final selection. (1)	The Federal Council defines the budgets and commissions the Swiss National Science Foundation SNSF to implement the NRPs. (A)
Australia	Chief Scientist in consultation with researchers, industry leaders, and government representatives. (2)	Over time, the priorities will result in an increased proportion of public investment in science and research going to areas of critical need and national importance. (B)
Japan	Priorities are determined along institutional lines. (3)	Reallocation of resources for research by the government from a long-term agenda. (B)
Korea	Regular updates by taskforce of representatives of technology and engineering organisations, research institutes, and universities. (3)	Large role for the government to adapt the science and technology system and allocate resources to priorities. (A)
Singapore	Developed by the National Research Foundation: a department under the Prime Minister's Office. Advised by a committee with representatives from industries and universities. (3)	Worked out in programmes by the National Research Foundation. Emphasis on public-private partnerships. (A)

Dutch National Research Agenda compared to other agendas

Most national research agendas are part of an existing research or innovation policy cycle: the agendas represent choices and are meant to allocate research funds. Two aspects distinguish the Dutch National Research

Agenda from most other agendas. The first is the open call to anyone to submit questions. The second is the choice to describe a number of routes through the landscape of submitted questions instead of a prioritization of some themes. The reasons behind both aspects are possibly found in the traditional autonomy of universities in the Netherlands and the preference for extensive consultation and consensus in Dutch administrative culture. Moreover, the agenda is the result of cooperation between science organisations with, at some points, different interests. These aspects encourage an agenda that transcends interests rather than an agenda based on strong choices.

How does the meaning of the Dutch National Research Agenda compare to the agendas in other countries? In this respect, three roles of a research agenda can be distinguished, in three keywords: lobby, policy preparation, and science communication. In the short term, the Dutch agenda functions as a kind of lobby instrument; the agenda plays a role in the debate on the amount of research funding for the next years, using the bottom-up character of the agenda and the consensus between knowledge organisations as arguments. This role is not found in the agendas of other countries. The policy preparation role is relevant for the medium term. According to the '2025 Vision for Science' of the Dutch government, the agenda will play a role as a seven-year prioritization instrument in the regular update of science policy. This role of the Dutch Agenda corresponds fully with that of the other agendas. The science communication role is relevant for the long term, allowing the agenda to play a role as a continuous articulation of public questions to science. This role is also found in some other agendas; in Switzerland and Denmark, the public has a role in bringing up new ideas and topics. Perhaps this last role is the most challenging, as it can be of great significance for the public commitment to science in the long term.

Conclusions

In this essay, some aspects (context, character, themes, process, implementation) of national research agendas in fifteen countries were compared in order to examine the position of the Dutch National Research Agenda.

Thematic prioritization of research, by means of an agenda, is a general trend that can be observed in most countries. This fits in with a discourse on science policy that emphasizes applying focus. Thematic prioritization is also related to the increased importance of innovation as grounds for science policy. In some of the fifteen countries, research agendas are part

of a regularly adjusted national innovation policy, while in other countries the agenda has a broader scope than just innovation. The Dutch National Research agenda belongs to the latter group.

The themes mentioned in the examined research agendas are largely comparable. Many countries prioritize themes such as energy, sustainability, and health issues. With regard to the preparation of the agendas, two approaches are observed; some countries prepare the agenda as a process between governments, companies, and researchers, while other countries have tried to incorporate citizens in the preparation process. In this respect, the Dutch agenda is unique. It started with a broad invitation to citizens and organisations to submit their questions to science. This approach has the potential to be used for a continuous articulation of research questions from the public, which could be of great importance for the public support of science.

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