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Abstract
The 2015 series of RIO Country Reports analyse and assess the policy and the national research and innovation system developments in relation to national policy priorities and the EU policy agenda with special focus on ERA and Innovation Union. The executive summaries of these reports put forward the main challenges of the research and innovation systems.

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Foreword

The report offers an analysis of the R&I system in Norway for 2015, including relevant policies and funding, with particular focus on topics critical for EU policies. The report identifies the main challenges of the Norwegian research and innovation system and assesses the policy response. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites etc. The quantitative data is, whenever possible, also comparable across the RIO reports for EU Member States. Unless specifically referenced all data used in this report are based on Eurostat statistics available in December 2015.

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Executive summary

This report was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites, etc. The quantitative and qualitative data is, whenever possible, comparable across all EU Member State reports. The report provides an up to date overview of the Norwegian research and innovation system (R&I-system), including funding patterns, organisation, division of labour and recent trends in policies and instruments in the area of R&D and innovation.

General background

Thanks to a hitherto favourable economic situation and solid public finances, Norway has experienced a steady increase in R&D investments during recent years. Except a short period of stagnation following the financial crisis, both public and private R&D expenditures have increased substantially in the years after 2011. Estimates for 2016 indicate that public allocations to R&D for the first time will reach 1% of GDP, a target originally set to be reached by 2019-20.

On the other hand, total R&D expenditure only accounts for 1.71% of GDP (2014), a level which has been rather stable during the last 25 years (min./max. 1.46/1.72%). This is primarily due to a high level of GDP and a high share of value creation in resource based industries, such as fisheries and oil and gas. Reaching the long term target of raising total R&D expenditure to 3% of GDP will require both a substantial increase in private R&D expenditure and a significant change of industry structure. The latter seems to have gained momentum as the recent decline in oil prices clearly demonstrates the need to develop alternative industries for ensuring future value creation.

Main R&D and innovation policy

On this background, the 2016 fiscal budget sets out a rather expansive economic policy with a declared aim to promote employment, growth and structural adjustment in the Norwegian economy. Strengthening higher education and research constitutes an essential part of this strategy. In concrete terms, public R&D funding shows a real growth of above 4% from 2015 to 2016.

Increased resources will follow up the Government long-term plan for research and higher education adopted in 2014. This constitutes the most important strategic document in the area of Norwegian research policy for the period 2015 to 2024. The plan has set out three primary objectives; i) strengthening *competitiveness* and innovation capacity, ii) solving major challenges to society and iii) developing research groups of outstanding quality.

Furthermore, the plan announces increased allocations to R&D-activity in six priority areas (oceans, climate change, public sector renewal, enabling technologies, spurring innovation in the business enterprise sector and developing world-class research groups).

Another important priority is to strengthen Norwegian participation in the European framework programmes. The government's "Strategy for research and innovation cooperation with the EU" from 2013 has set the goal of increasing Norway's total economic return from Horizon 2020 to 2% of total competitive funding in the programme, up from 1.69% in the previous 7th framework programme.

Furthermore, the Government has initiated a process for structural reform in the higher education system. During 2014, all universities and university colleges were invited to consider how they would position themselves in a landscape with fewer institutions and higher academic standards. Based on this process a White paper on the future university structure was presented by the Ministry of Education and Research in March 2015. The paper outlines a new institutional map, where 14 individual institutions will be merged to 5, starting from January 2016.

Main funding streams

Public R&D spending in Norway is almost exclusively a central state matter. Regional funding plays a minor role in this picture. In principle, public R&D funding is widely dispersed as virtually all 16 ministries are responsible for funding R&D within and for their own sectors. This so-called sector principle implies that both the level and orientation of funding to a large degree depends on the needs and priorities of each ministry. In practice, R&D budgets are therefore fairly concentrated, as five ministries stand for 85% of all R&D funding, with the Ministry of Education and Research (MER) allocating approximately half of all funding. The two main funding streams consist of 1) the R&D component integrated in the basic funding to universities and university colleges and 2) funds allocated via the Research Council of Norway (RCN). Other significant streams are R&D funds to health trusts, the portfolio of allocations from the Ministry of Trade and Fisheries and the annual contribution to the European framework programmes/Horizon 2020.

Quality of the science base

Norway performs well in terms of the number of scientific articles per thousand inhabitants, only surpassed by Switzerland, Denmark, Australia and Sweden. The total number of articles has increased by 69% from 2006-2014. Among comparable European countries only Denmark has a higher growth rate (77%) in the same period. On the other hand, natural benchmark countries such as Denmark, Netherlands, Sweden and Switzerland are still ahead of Norway in terms of traditional quality measures. This is particularly the case when one looks at the share of top 10% most cited publications, where Norway is on average EU-level and well behind the leading countries. Other quality measures and evaluations give a similar picture of Norwegian research as highly productive, but more average in terms of the ability to develop cutting edge research.

Research recruitment and open career systems

In 2015, a total number of 1436 doctorate degrees were awarded at Norwegian higher education institutions. This is a slight decline from the earlier peak year of 2013, when 1,524 degrees were awarded. After a strong and steady increase in the number of awarded doctorate degrees the last decades, the number seems to have stabilized around 1500 for the last two years. A significant contribution to the recent increase has been that more women gain doctorates. From a gender perspective, 2014 was a milestone as this was the first year when the majority of degrees (51%) were awarded to women.

Attracting foreign research talents to Norwegian R&D institutions has been a declared priority in Norwegian R&D policies, i.a. expressed in recent white papers on research. During the past decade, foreign researchers constitute an increasing share of new doctorate degrees in Norway. While persons with non-Norwegian citizenship accounted for less than 10% of doctoral degrees at the start of the 1990s, the proportion of foreigners has now risen to more than a third.

Policies and instruments for economic growth and renewal

Merging narrow, sector specific instruments into broader, sector neutral instruments has been a deliberate strategy of Government over the recent 5-10 years. Hence, broad measures such as the R&D tax deduction scheme and open arenas for support to user driven innovation under the Research Council and Innovation Norway are among the most powerful tools for growth entrepreneurship and for innovation policy in general. In the recent years, an increasing share of funding and instruments have been focusing on green innovations and green technologies.

As part of the main strategy for structural change and response to the reduced activity in the petroleum and offshore sectors, the Government presented an "Entrepreneurship plan" in October 2015. The plan addresses the need to promote entrepreneurship on a broad scale. The 2016 state budget also includes a considerable "package" of temporary

support to measures aimed at countering the downsizing of activities in the oil and gas industry and smoothening the transition to other activities.

1. Overview of the R&I system

1.1 Introduction

Norway forms the western and northern part of the Scandinavian Peninsula and has common land borders with Sweden, Finland and Russia. Norway's mainland area is 323,787 square kilometres. The population of Norway was estimated at 5,165,802 as of January 1st, 2015 (Eurostat). This represents app. 1% of the EU 28 population. Norway is thereby Europe's least densely populated country.

Economic structure and major trends

Norway is a diverse industrial society with a free market economy and generally low trade barriers. The country is a member of several international organisations, including party to the Agreement on the European Economic Area (EEA), which includes Norway in the internal market of the European Union (EU). Norway has been an associated EEA-EFTA country with full participation in the European research framework programmes since 1994.

A significant share of the Norwegian economy consists of service industries, including wholesale and retail trade, banking, insurance, engineering, transport and communications and public services. In 2012, the service sector as a whole accounted for approximately 59% of GDP.

Norway's economic development has been strongly influenced by the petroleum industry during the last 40 years. As of 2015, Norway ranks as the world's seventh largest oil exporter. The unusually high profitability of the petroleum industry has generated considerable demand for goods and services from the mainland economy, and high revenues to the state. Since early 2000, rising oil and gas prices have substantially boosted Norway's economic growth and disposable real income. Furthermore, large and increasing exports from fisheries and metal products have provided additional income growth, equally exploiting a global demand and price level in favour of resource based economies.

As a consequence, Norwegian GDP-growth has been substantially higher than EU28 and most western European economies. From 2012 to 2014 Norway's annual real GDP growth has been 2.7 (2012), 0.7 (2013) and 2.2% (2014). In 2014, Norwegian GDP per capita was 79% above EU28 average. Next to Luxemburg, this is the highest level of GDP per capita among all countries in the Eurostat and OECD databases (Eurostat, 2015).

Public finances are also rather solid. General government gross debt is 26.4% of GDP (Eurostat, 2015). In addition, Norway has built up a substantial fund – The State Pension Fund Global - based on revenues from the petroleum sector. The fund was established in 1996 and has shown a considerable growth in the following 20 years. In 2015 the market value of the fund was estimated at approximately €800 bill., more than twice the value of Norwegian GDP. The capital is invested in a broad portfolio of foreign stocks and investments, with the main purpose of accumulating resources for financing future pension expenditures.

The Government Pension Fund Global and the fiscal rule for the use of oil revenue address these challenges, and are designed to support a stable development of the Norwegian economy in both the short and long term. The Government Pension Fund Act stipulates the transfer of the State's net cash flow from petroleum industry to the Government Pension Fund Global. The fiscal rule specifies that the transfers from the Fund to the central government budget shall, over time, follow the expected real return on the Fund, which is estimated at 4%. The fiscal rule also puts emphasis on evening out economic fluctuations to contribute to sound capacity utilisation and low unemployment (4.5% in 2015) e.g. by allowing automatic stabilisers to play out fully.

Together, the fiscal rule and the Government Pension Fund Global comprise a fiscal framework that insulates the fiscal budget from fluctuations in petroleum revenue, stemming either from volatile oil and gas prices or from changing production or investments in the petroleum sector. Through the Fund, the main share State's oil and gas income has been invested in other countries. Nevertheless, the 4% rule has allowed a substantial supplement to annual public spending and thus reduced the need for fiscal consolidation. There are now clear signs indicating that this favourable position may be changing and that fiscal consolidation will be a necessity also in Norway.

Main trends in R&D and innovation

Due to a relatively high share of value creation in resource based industries and a high level of GDP, Norwegian gross domestic expenditure on research and development (GERD) only accounted for 1.71% of GDP in 2014, the second highest share recorded, just below the share in 2009 (1.72 %). Over time, GERD as percentage of GDP has remained relatively stable, fluctuating between 1.5 and 1.7% during the last 25 years.

Approximately half of Norwegian R&D is performed by the Business enterprise sector. Thus, compared with most other European countries, the total level of business R&D in Norway is relatively low, while public R&D expenditure is well above EU-average.

R&D-growth in the aftermath of the financial crisis

Although Norwegian business R&D experienced a decline in 2009 and 2010, the downturn following the financial crisis was less severe for Norwegian companies than in most other western countries. Furthermore, public R&D investments have increased substantially after a period of stagnation around 2010 and 2011. The general picture is therefore that both public and private R&D investments in Norway have shown a steady increase in the years following the financial crisis.

However, due to the more recent decline in oil prices, Norwegian economy is facing a much more demanding situation. During the first half of 2015, Norway has experienced a sharp decline in investments in the oil and gas industry, with serious consequences for companies operating in the offshore industries. It is still uncertain how this trend will affect investments in business R&D. In order to counter the immediate effects of low oil prices and prepare for structural change, the Government has proposed a further increase in public R&D expenditure. Hence, the government budget proposal for 2016 includes a 4.2% real growth in total public allocations to R&D.

Far behind the 3% spending target – on track in terms of public spending

As a number of other countries, Norway has adopted the general target of increasing total R&D expenditure to 3% of GDP. The target was first set in 2005 with the aim of reaching the target by 2010, in line with the original EU Lisbon strategy. It was also specified that public R&D expenditure should constitute 1% of GDP, while the remaining share should come from industry and other sources. The target was modified in 2009 and then treated more as a long term objective with no fixed time frame. However, in its recent Long term plan for research and higher education from 2014, the current government has reintroduced the 3% goal as a concrete spending target, this time to be reached by 2030. Furthermore, the Long term plan specifies that the partial public 1% target is to be measured on the basis of Government budget allocations to R&D (GBARD) and reached by 2019-2020.

As a result of the aforementioned R&D budget increases, it is now estimated that the public 1% target will be reached already in 2016. The latter is also partly due to an expected decline in GDP-growth. At the same time there seems to be broad agreement that the remaining private 2/3 of the spending target will require a substantial restructuring of the Norwegian industry structure.

Modifying the image of Norway as a moderate innovator

Traditionally, the share of Norwegian companies reporting innovation activity has been slightly behind the EU-average and substantially below the level in neighbouring countries. According to the Community Innovation Survey (CIS) 2012, 45% of Norwegian companies reported to have had product and/or process innovation between 2010 and 2012, compared with 48% in EU28 for the same period. Accordingly, Norway has long been characterised as a "moderate innovator" in the European Innovation Scoreboard (IUS).

This moderate ranking in terms of innovation activity appears in many ways as a contrast to Norway's high performance on macroeconomic factors such as income level, public finances, social framework and basic infrastructure in society. This contrast has often been referred to as "the Norwegian paradox" or "the Norwegian Puzzle", a term originally coined by the OECD in one of its economic reviews of Norway (OECD, 2006).

Among a number of possible explanations, it has been suggested that the national innovation surveys in Norway may have systematically underestimated the total innovation activity in Norwegian firms. Unlike most other European countries, Norway has combined the innovation surveys with the regular R&D surveys. As this may have caused a "science bias" among respondents, a separate innovation survey has been tested, firstly as a pilot exercise and then as a full scale experiment. Both cases have demonstrated that a separate survey, in line with common practice in the EU, leads to a substantial increase in i.a. the share of innovation active firms in Norway. As from CIS 2014, the Norwegian innovation survey will be carried out as a separate and mandatory survey. Hence, there is reason to expect a certain change in the relative position of Norway in terms of international comparisons of innovation activity, including its position in future versions of the IUS.

Table 1 Main R&I indicators 2012-2014

GDP per capita	190	186	179	100
GDP growth rate	2.7	0.7 (1)	2.2	1.4
Budget deficit/surplus as % of GDP	13.8	10.8	9.1	
Government debt as % of GDP (consolidated gross debt)	29.2	29.3	26.6	86.8
Unemployment rate as percentage of the labour force	3.2	3.2	3.5	10.2
GERD in €m	263 (2011)	217	243	283 009
GERD as % of the GDP	1.62	1.65	1.71	2.03
GERD (EUR per capita)	1289.1	1286.9	1260.3	558.4
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	3.1	2.9	2.7	2.1

Employment in knowledge-intensive service sectors as share of total employment	51.4	51.4	50.8	51.5
Turnover from innovation as % of total turnover	4.6 (2008)	6.1 (2010)	5.2 (2012)	
Value added of manufacturing as share of total value added	11.2	10.9	11.2	
Value added of high tech manufacturing as share of total value added	0	0	0.7	

Note: 1) Deviation between Eurostat and national data. National data indicate 1% increase.
Source: Eurostat

1.2 Structure of the national research and innovation system and its governance

The Norwegian research and innovation system is relatively dispersed at the political level as well as on the performing level, while at the strategic/intermediary level R&D and innovation funding is concentrated in a few central funding organisations.

1.2.1 Main features of the R&I system

The Ministry of Education and Research (MER) provides by far the largest share of public R&D funding. This Ministry is also assigned a formal responsibility for coordinating R&D policies.

Apart from the Ministry of Education and Research a number of sector ministries provide substantial funding to R&D, in particular the Ministry of Trade, Industry and Fisheries and the Ministry for Health and Care Services. Other important ministries in terms of R&D funding are the Ministry of Foreign Affairs, the Ministry of Petroleum and Energy, the Ministry of Climate and Environment and the Ministry of Agriculture and Food. The Ministry of Defense also has a fairly large proportion of public R&D funding, although heavily concentrated around one performer (FFI, the Norwegian Defense Research Establishment). The Ministry of Health and Care Services has, over a number of years, considerably increased its appropriations for research and has now surpassed the Ministry of Trade, Industry and Fisheries as the second-largest research funding ministry.

The overall responsibility for Norway's innovation policy resides with the Ministry of Trade, Industry and Fisheries. The general innovation policy is less institutionalized and is of more recent origin than the research and development (R&D) policies. The need for a more integrated and horizontal innovation policy was identified in the early 2000s. A strategy plan for horizontal innovation policy was issued in 2004 and followed by a White paper on innovation policy in 2008. In this sense, Norway may be considered an "early mover". In recent years, however, innovation policy seems less pronounced as a dedicated policy area. Instead policies are more oriented towards specific parts of innovation, such as entrepreneurship strategies, industry policies and measures for stimulating business research.

Regional R&D and innovation policies

The Ministry of Local Government and Modernization has the overall responsibility for innovation policy at the regional level. There are currently 19 geographical regions called counties "fylker". These entities also represent 19 administrative units called county municipalities "fylkeskommuner"). A recent white paper presented by government in 2016 has proposed a regional reform, where 19 counties are to be merged into 10 larger regional entities (Ministry of Local Government and Administration, 2016). This reform is however not yet adopted.

Although R&D and innovation policies in Norway are mainly a responsibility of the central state, counties and regions have taken on a more active role in initiating, funding and implementing regional innovation policies.

A 2006 white paper on regional reform discussed several options for strengthening regional perspectives and priorities in R&D and innovation policy (Ministry of Local Government and Administration, 2006). Most measures did not come into effect, but a Regional Research Fund was established from 2010. This fund is organised according to 7 geographical regions, all of which with independent boards appointed by the council municipalities in the region. Funds are allocated from the Ministry of Education and Research and administered by the Norwegian Research Council. Total annual funding amounts to around €29 million as of 2015.

Furthermore, a set of three different cluster schemes have been introduced in order to foster the development of emerging (The ARENA scheme), mature (Centers of Expertise) and internationally oriented clusters (Global Centres of Expertise). These cluster policies are in most cases regionally oriented and include cooperation between local industry, higher education institutions, research institutes, public sector and other relevant stakeholders.

Strong coordination on the strategic level

At the strategic or intermediary level, i.e. below the ministerial level, three agencies are the main institutions for implementing the research and innovation policies of the government.

The major player here is the Research Council of Norway (RCN). Unlike most other research funding agencies, RCN covers all research disciplines and sectors including support to research based innovation. In 2014, more than 25% of all public R&D funding was channelled through RCN via a number of instruments, ranging from support to centres of excellence, infrastructure and large thematic programmes to business oriented and user driven projects. In addition to research funding, the RCN has the mandate to advise the government on research policy and to facilitate networking and communication between different actors in the Norwegian R&D and innovation system. The Ministry of Research and Education and the Ministry of Trade, Industry and Fisheries are the most important contributors to RCN's budget, but following the sector principle, RCN administers funding from 15 ministries.

Innovation Norway and the Industrial Development Corporation of Norway (SIVA) are the primary public institutions providing support for innovation. Innovation Norway provides programmes and services with the objective of promoting innovation at the regional and national level, with a particular focus on small and medium sized companies. SIVA is involved in the provision of science parks, incubators and services mainly to start-up firms. Both the RCN and Innovation Norway are assigned with tasks that in many other countries would be spread between a number of different institutions.

1.2.2 Governance

The Government and ministerial level plays an important role in the Norwegian R&D system. At the political level, the responsibility for research policy is organised according to the so called "sector principle", the essence of which is that each ministry is responsible for financing both applied, short term R&D and more long term research related to their specific sectors. Hence, several ministries allocate sizable resources to

research that are related to the sectors under their respective responsibilities. Although research appropriations are widely distributed between ministries, the Ministry of Education and Research (MER) is by far the largest source of government research funds. MER is also responsible for the inter-ministerial coordination of national research policy and the government's overall research funding.

The Ministry of Trade, Industry and Fisheries (MTIF) is officially responsible for coordinating national innovation policy. During a short period in the early 2000s a dedicated cabinet research board for innovation policy was in place, but was abolished after a short period. The process leading up to the comprehensive white paper on innovation policy from 2009 (Ministry of Trade and Industry, 2009) constituted a formal coordination mechanism. However, at present there are no official fora or routinized processes dedicated to the coordination of innovation policies, besides the coordination role of MTIF.

Until recently, the Minister of Education and Research was heading a cabinet research committee, consisting of 8-9 ministers representing the sectors and ministries with the highest share of public R&D funding. This was an important forum for overall coordination of R&D policies and allocation of public funding. The committee had however no official authority. Its function was mostly internal and a way for the cabinet of organising its decision making process. In practice, the authority and decision power of the committee was therefore rather limited. Its role as a cross-sectoral coordinating mechanism was also challenging due to the strong influence of sector ministries and sector interests.

As from 2014 the Cabinet Research Committee was dissolved. Instead, the Government has introduced a series of high level consultation meetings with actors representing government, research organisations, industry and other stakeholders. At the same time (also in 2014) the Government presented a Long-term plan for research and higher education (Meld. St. 7 (2014-2015)). This plan sets out the primary objectives and priorities for research and education from 2015 to 2024. The plan is also meant to function as an important tool for coordination of R&D policies, in the sense that overall priorities and goals are set for a longer period, thus paving the ground for discussing concrete measures and follow up actions (see also section 2.1 below).

In addition, a number of sector specific strategies – so-called "21-Strategies" – have emerged during the last years and thereby created a new coordination mechanism within specific sectors and research themes. The first strategy, *Oil and gas in the 21st century* –"OG21" was introduced already in 2001, with the aim of gathering central actors related to the oil and gas industries for concerted action and coordination of efforts to strengthen the industry. Based on OG21 as an organisational model, 21strategies have been adopted for a number of other sectors, such as energy, climate, health care, fisheries, forestry and agriculture. Although coordination of actors and measures related to R&D is the main focus of the strategies, research based innovation is also included, especially for the strategies addressing industry development.

In summary, there is reason to say that the coordination mechanisms for R&D and innovation policies in Norway are characterised by pluralism and strong involvement of sector interests.

Evaluation systems

In general, Norway has a well-established tradition for evaluating and monitoring research and innovation activities. As in many other countries, there is a trend towards broader and more system oriented evaluations, replacing a tradition of independent evaluations of single measures.

Since the first white paper dedicated to research policy in the mid-1970s, Norway has produced more or less regular reports (white papers) on R&D policies to the Storting

(the Norwegian parliament) every four years. Even though the long-term plan adopted in 2014 introduces a new 10 year policy cycle, the tradition of presenting research policy white papers every four years seems to be maintained as a way of revising and updating and following up the long-term plan. In addition to addressing new policy questions, the white papers serve as regular "stocktaking" of strengths and weaknesses on a broader systemic level. Furthermore, the white papers make active use of evaluations as background evidence and a basis for proposing new measures and reforms. The most recent white paper processes have also opened up for contributions from a broad range of stakeholders through open online hearings, where all stakeholders are invited to submit contributions and suggestions to the process.

Most new measures and schemes in Norwegian research and innovation policy are subject to an evaluation after a certain period of time. These evaluations are most often initiated by the Research Council of Norway (RCN), Innovation Norway and/or the responsible ministry. As for routinized and cyclic evaluation regimes, the RCN has since the 1990s carried out a series of panel based evaluations of research in various disciplines (*fagevalueringer*). These evaluations are lengthy processes, but have been influential in terms of assessing general quality in academic research and addressing the need for strengthening research quality. For instance, conclusions from the discipline based evaluations in the late 1990s were used as major arguments for introducing the first scheme of Centres of Excellence in Norway in the early 2000s.

For a number of years, the RCN has also carried out annual assessments of immediate and long term impacts of the RCN schemes for public support to user driven research in industry (Møreforskning, 2014).

However, despite the existence of some routinized evaluation regimes, several actors have accused the Norwegian evaluation regime of being "atomistic" and addressed the need for broader and more systemic evaluation processes. Concerns have also been raised regarding the actual follow up and concrete implications of these evaluations. As in many other countries, there is also an increased interest in measuring and monitoring the broader impacts of R&D and innovation. During recent years, several steps have been taken in this direction:

- As from 2013, Innovation Norway has in cooperation with the Ministry of Trade, Industry and Fisheries, introduced a Performance based management system, covering all support mechanisms managed by the agency. This system introduces regular assessment of the effects and impacts of the agency's support schemes, the first of which were presented in 2014 (Innovation Norway, 2014).
- Management by performance and objectives has also been in place for The Research Council of Norway for a number of years. Since 2014, the Ministry of Education and Research has taken actions to introduce a more aggregate and concerted management of the council and strengthen the focus on broader impacts of the council's support schemes (Prop. 1 S 2015-2016).
- In parallel, the Research Council of Norway has adopted an evaluation strategy for the period 2013-2017, paving the grounds for further development of evaluation processes. One recent follow up is the ongoing systematic evaluation of research institutes, which was started in 2014 and will be finalised in 2016/2017. This concerted evaluation process replaces former ad hoc evaluations of individual institutes. Another example of broader evaluation processes is a recently launched comprehensive evaluation of humanities research, covering all disciplines and relating research activities to higher education. This process was launched in fall 2015 and will be finalised by mid-2017.
- The ongoing evaluations of humanities research and the evaluation of social science research institutes both include an element of self-assessment of the societal impact of research. These are the first examples and experiments of introducing this type of evaluation methods in broader evaluations in Norway.

In the Higher education sector, Norway introduced a performance based funding system already in 2002. In 2015, about 30% of basic funding to universities and university colleges is distributed according to a set of performance indicators, thus practicing a system based on indicators rather than routinized peer review assessments.

Furthermore, an elaborate and transparent system for registering and reporting input to the performance-based parts of the system has been developed: The Norwegian Agency for Quality Assurance in Education (NOKUT) is an independent government agency that contributes towards quality assurance and enhancement in higher education and tertiary vocational education. NOKUT conducts quality controls and stimulates the quality development of educational provision at Norwegian universities, higher education colleges and colleges of tertiary vocational education.

A performance based funding system was also introduced for the hospital sector in 2006 and for the institute sector in 2009. In addition, as all universities and university colleges are under the direct responsibility of the Ministry of Education and research, higher education institutions are subject to annual routinized contact meetings with the Ministry, where progress and performance are important aspects of the dialogue, hence constituting an arena for continuous "soft evaluation".

Furthermore, Norway has a long tradition for annual monitoring of the research and innovation system. Since 1997, the Research Council of Norway has published an annual synthesis report (Report on Science and Technology Indicators for Norway) with statistics and indicators covering the whole national R&D and innovation system. As from 2011, the Ministry of Education and research introduced an additional monitoring mechanism - "The Research barometer", where Norway's R&D and innovation performance is subject to an annual benchmark with six selected comparable countries (SE, DK, FI, NL, AUT, CH).

1.2.3 Research performers

On the level of research performance, the Norwegian system operates with three main sectors, i) the Business sector, ii) the Higher education sector and iii) the Institute sector, where the latter constitutes a particular feature of the Norwegian system. According to the most recent figures from 2013, the Industry sector accounted for 44% of total R&D, while the Higher education sector stood for 32% and the remaining 24% was performed by the institute sector.

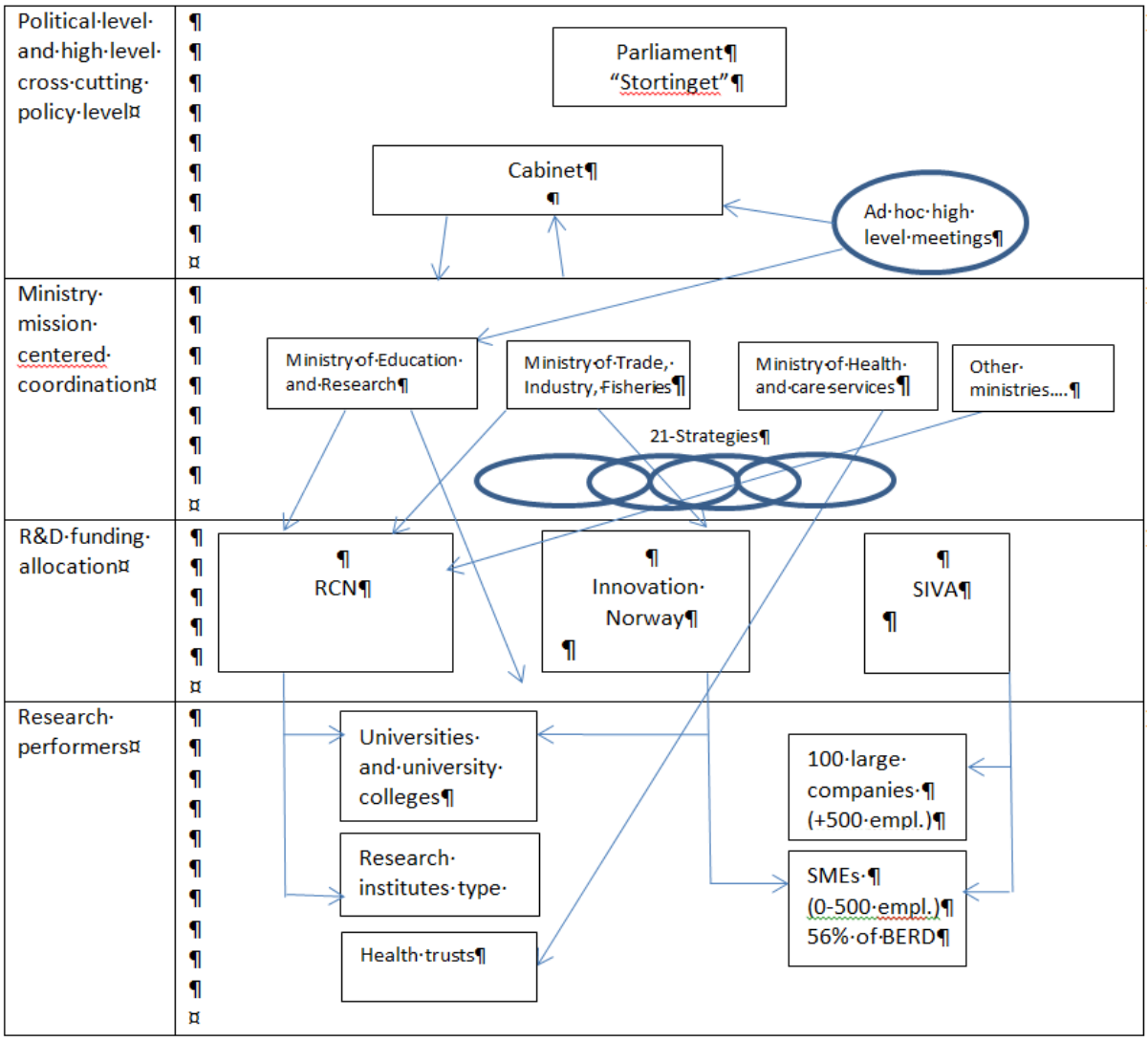
Due to a substantial increase in R&D activity in the Health care sector as well as improved access to data distinguishing research activity in hospitals, national statistics sometimes also operate with the Health care sector as a separate, fourth category, although the sector still accounts for a rather small share of total R&D expenditure (6% in 2013).

In 2015, the Norwegian Higher education sector comprises 33 state institutions, including 8 universities and 25 state university colleges. In addition, Norway has a variety of 21 private higher education institutions. In total, this constitutes a rather dispersed and heterogeneous sector, an aspect which is currently subject to a major reform (see section 2). At the same time, research activity is rather concentrated, as the eight universities (including university hospitals) carry out more than 80% of the sector's total R&D expenditure in 2013.

Compared to other countries, a relatively high share of Norwegian R&D is performed by research institutes, a sector which is also rather heterogeneous, both in terms of the size, profile and legal status of the institutes. The sector includes both public sector oriented and industry oriented institutes, where the latter group plays an important role in carrying out contract research for Norwegian and foreign companies. The institutes are also among the most active Norwegian organisations in terms of participation in the EU framework programmes. The SINTEF group is by far the largest player in the Norwegian institute sector, and is one of the largest research institutes in Northern Europe.

Given the resource based structure of the Norwegian economy, there are relatively few large R&D-intensive companies in Norway. According to the most recent statistics for 2013, the 100 largest R&D performing companies account for less than half (44%) of total business R&D in Norway. Hence, compared with most other countries, a relatively high share of Norwegian business research is performed by SMEs. According to the most recent OECD STI statistics from 2012, 51% of Norwegian BERD is performed in companies with less than 250 employees. Unofficial data from Eurostat indicate that the state owned petroleum company Statoil is the largest R&D performer in 2014. However, a large part of R&D in the petroleum sector is performed outside the companies, which reflects the key role of research institutes within the business sector.

Figure 1 : Organisational chart of institutions in the field of research and innovation in Norway



2. Recent Developments in Research and Innovation Policy and systems

2.1 National R&I strategy

Long-term plan for research and higher education 2015-2024

The Government long-term plan for research and higher education (LTP) adopted in 2014 constitutes the most important strategic document in the area of Norwegian research policy. The plan sets out the primary objectives and priorities for the period 2015 to 2024.

Although the LTP explicitly also covers higher education, concrete measures and policies for higher education are more implicit than explicit parts of the priorities. The same goes for innovation policy in the broader sense of the term. Hence, the long term plan should be considered first and foremost as a plan for research and research based innovation. Since the white paper on innovation policy in 2008, innovation policies have been more indirectly covered as part of strategies on specific topics and sectors, most recently in the Entrepreneurship strategy, which was launched in 2015 with a view to improving framework conditions and attitudes towards entrepreneurship and innovative start-ups (Ministry of Trade Industry and Fisheries, 2015).

The long-term plan has set out three primary objectives:

- Strengthening competitiveness and innovation capacity;
- Solving major challenges to society;
- Developing high-quality academic groups.

Furthermore, the plan announces increased allocations to R&D-activity in the following six long-term thematic priority areas:

- The oceans;
- Climate change, the environment and environment-friendly energy;
- Public sector renewal and higher quality, more efficient welfare, health and care services;
- Enabling technologies;
- An innovative, adaptable private sector;
- World-class academic groups.

The priorities and main objectives of the plan are primarily based on an extensive open process, where a total of 150 written contributions were collected from various actors, followed by a close dialogue with all ministries and other central actors such as the Research Council of Norway (RCN). The preparation of the plan is therefore more based on a consensus process than on targeted systemic analyses and foresight processes.

In order to follow up priorities, the long-term plan includes a rather concrete escalation plan, which includes the target of increasing total R&D expenditure to 3% of GDP within 2030 and, as a partial goal, increasing public allocations to R&D to 1% of GDP by 2019–2020. Due to a rather expansive public R&D budget in 2016 and an expected decrease in GDP-growth, the public 1% target is expected to be reached already in 2016. The total increase in public R&D spending throughout the period is i.a. planned to include i) an increase in the number of PhD-recruitment positions by 500 new positions; ii) increased allocations to research infrastructure by app. €45 mill. and iii) increased allocations to schemes that encourage Norwegian participation in the EU Framework Programme for Research and Innovation, Horizon 2020, by €45 mill.

Stronger Norwegian participation in EU framework programmes

The latter point above raises another important priority in recent Norwegian R&D policy, namely the ambition to strengthen Norwegian participation in and return from the European framework programmes. Norway is an active participant in ERA and has since the beginning of 1990s participated as a full member in the framework programmes, including the ongoing Horizon 2020.

Norway has consistently performed rather well in terms of success rates (granted projects as a share of total applications). Yet, the government's "Strategy for research and innovation cooperation with the EU" from 2014, expresses a worry that the Norwegian participation is unevenly spread and that too many researchers and actors do not sufficiently utilise the opportunities provided through the European cooperation. On this background, the government has set the goal of increasing Norway's total economic return from Horizon 2020 to 2% of total competitive funding in the programme, up from 1.67% in the previous 7th framework programme. This will require an increase of more than 60 percent in the participation level compared to FP7.

This ambition is followed by a number of concrete measures and support mechanisms, including i.a. increasing the so-called STIM-EU scheme, which is a scheme designed to motivate institutes to maintain and strengthen their participation in EU-projects. The scheme increases the block grant funding of the institutions, depending on how much they have received in EU-funding (by a factor of 1/3). In practice, this additional support covers parts of the financial gap between EU-funding and real project costs. In broader terms, the strategy announces a better alignment and harmonization of national instruments and priorities with those set by the Horizon 2020 and the ERA agenda. Hence, the main priorities in the long-term plan described above reflect to a large extent the main priorities adopted in the EU-system.

Structural reforms in the higher education sector

In 2014, the Government initiated a process for structural reform in the higher education system. The reforms were part of a broader seven point agenda for strengthening Norwegian higher education and research over the next four years 2013-2017 (see below). The overarching goal of these measures is to achieve higher quality in research and education.

The background for the structural reform was a general worry of fragmentation, i.a. that resources are spread too thinly, that there are too many small and vulnerable academic environments and that institutions are competing with each other instead of cooperating. Low funding from EU programmes and insufficient completion in PhD-programmes were also raised as factors justifying a broad structural reform.

During 2014, all universities and university colleges were invited to consider how they would position themselves in a landscape with fewer institutions and clearer expectations regarding academic standards. Institutions were also explicitly requested to consider how an eventual merger with other institutions could strengthen their position. The aim of this open process was to avoid a top down process and encourage voluntary mergers based on the needs and ambitions from the institutions themselves.

Based on this process, a white paper on the future university structure was presented in March 2015. The paper outlined a new institutional map, with 14 higher education institutions merged to 5, starting from 1 January 2016. As of June 2016 all these mergers have been formally adopted. Furthermore 5 state university colleges were considered merged to 2 and 4 private colleges merged to 1. The largest and most visible of these processes is probably the merger of the Norwegian University of Technology and Science (NTNU) with three university colleges, which has made the "new NTNU" the largest university of Norway, surpassing the University of Oslo. The process is still ongoing with further mergers and organisational changes under consideration

A 2016 budget proposal for growth and structural change

The 2016 fiscal budget sets out a rather expansive economic policy with a declared aim to promote employment, growth and structural adjustment in the Norwegian economy. The background is that low oil prices have led to a considerable decline in investments and activities in the oil and gas and offshore sectors. In addition, growth in the non-oil economy has declined and unemployment is increasing, although total unemployment still must be considered relatively low, at 4.3% in October 2015.

The general plans for structural change have a strong focus on strengthening higher education and research. Hence, the 2016 budget includes increased allocations to the structural work and the university merging processes, new recruitment positions, increased allocations to user driven research and thematic research programmes, strengthened support to commercialisation of publicly funded R&D as well as an extension of the R&D tax incentive scheme. The increased R&D allocations constitute in total a real growth of 4.1% as compared with 2015. Based on estimates of GDP in 2016, this last increase might bring the total public R&D funding to just above the declared target of 1% of GDP already in 2016.

2.2 R&I policy initiatives

During the first decade after 2000, Norway has introduced a number of new measures in the area of research and innovation, including centres of excellence and other centre schemes, R&D tax incentives and result based financing for universities, university colleges, institutes and hospitals. Hence, in the period 2013 to 2015 most policies have consisted in strengthening and improving existing tools and measures.

The current Government took office in 2013 and is composed of a coalition between the Conservative Party (C) and the Progress Party (PrP). The government has communicated a clear ambition to prioritise R&D and innovation, and so far budgets and policies have been relatively well in line with declared ambitions. A general approach has been to strengthen R&D and innovation through so-called neutral measures, more specifically through improved general framework conditions for companies, support to business oriented R&D through broad and open funding schemes and a general focus on promoting research quality. Addressing grand societal challenges represents the third pillar in the current R&D strategy. However, so far little concrete action has been taken in order to follow up this part of the strategy.

As the responsibility for both research and education policy resides within the same ministry (the Ministry of Education and Research), research and education policies are generally well aligned and coordinated. For instance, in the beginning of 2014, the Minister of Education and Research presented his four years agenda consisting of seven measures covering both research and education policies. These measures include:

1. Appointing an expert group to examine the funding for universities and university colleges (see below).
2. Structural reform in the higher education sector (see above)
3. Presenting a long-term plan for higher education and research in the fall 2014 (see above)
4. Identifying and investing in relevant research environments and institutions that can contribute to breakthrough research.
5. Ensuring that Norway succeeds in the new EU research program Horizon 2020.
6. Assessing and improving the working conditions in higher education, including recruitment, employment and career structure.
7. Strengthening teacher education.

Innovation policies have so far been less pronounced and explicit. Instead, the government has focused its support on nationwide and broadly aligned instruments,

without thematic limitations. The main assumption is that few thematic constraints should channel the support to projects with the greatest potential for value creation and socioeconomic growth, regardless of their thematic and sectoral focus. At the same time, research based innovation policies have been presented as integrated parts of sectoral strategies, such as a recent Maritime strategy presented in 2015 (Ministry of Trade Industry and Fisheries, 2015b) as well as in ongoing work to elaborate a bio-economy strategy and a "master plan" for aquaculture and fisheries, all of which are processes driven by the Ministry of Trade, Industry and Fisheries.

2.2.1 Evaluations, consultations, foresight exercises

As described in chapter 1, Norway has a relatively poor tradition for conducting broad and overarching foresight processes. The lacking use of foresight has also been raised by Technopolis in its most recent evaluation of the Research Council of Norway (Technopolis, 2012). The closest thing to encompassing foresight exercises are the so-called "Perspective reports", which are regular economic perspectives and projections, issued every four years by the Ministry of Finance as a white paper to the Storting. The most recent report in this series was presented in 2013, focussing on strategies for facing future challenges such as an ageing population, climate change and expected decreasing revenues from the oil and gas sector (Ministry of Finance, 2013). These reports are more based on internal processes and economic and statistical projections rather than scenarios and stakeholder involvement.

Partly inspired by similar processes in Denmark, New Zeeland and Canada, the Norwegian Government appointed in 2014 a committee with a broad mandate of assessing the productivity of the Norwegian economy – the so-called "Productivity Commission". The Commission is composed of experts and researchers in the area of economic research, policy making as well as industry. The commission presented its first general report and assessment of productivity strengths in January 2015 (NOU 2015:1).

The second report put special emphasis on the interactions between the education and research system and private industry activities, thus paving the ground for a broader discussion of the development of the future Norwegian knowledge economy. This report was presented in April 2016 and has triggered a strong debate on i.a. the balance between thematic priorities and sector interest on the one hand and policies dedicated to "pure" research quality on the other hand (NOU 2016:?). The Commission argues for a stronger focus on the latter perspective, claiming among other things that future productivity growth in Norway will depend on the ability of the higher education system to produce high quality research and interact more directly with industry. These arguments challenge several features of the Norwegian R&D system, including the role of research institutes and the relatively strong focus on sector and thematically oriented priorities. Furthermore, the main recommendations imply that parts of competitive funding through RCN should be reallocated from thematic programmes towards programmes and instruments with a stronger focus on research excellence. The recommendations and analyses put forward by the Commission have received both support and criticism, and are currently (June 2016) a central issue of debate in Norwegian R&D policy.

In general, stakeholder involvement in policy processes is assured through formal processes and hearings. There is also a tradition of inviting all stakeholders (including public opinion) to voice their opinion in advance of policy processes and without responding to concrete proposals, e.g. when drafting white papers. These open opinions are often sent by e-mail to the concerned ministry and published subsequently on the ministry's web sites, thus allowing all actors to follow the opinions put forward. This has sometimes led to a proliferation of inputs from a variety of groups and stakeholders, ranging from large institutions to interest groups and individuals. Whether these broad and open processes ensure real stakeholder involvement or just a hearing "for the record" remains an open question.

2.3 European Semester

Since Norway is not a member of the European Union, the country has not been subject to country-specific recommendations under the European Semester. Norway has however taken part in the mutual learning activities organized by ERAC related to the R&I-content of the country reports.

2.4 National and Regional Research and Innovation Strategies on Smart Specialisation

Since Norway does not receive structural funds, the national authorities in Norway currently have no ambition to relate to S3 or to develop a national S3 strategy. Nonetheless, some regions have started to take initiatives to increase knowledge about the concept of smart specialisation.

So far, three Norwegian counties (Nordland, Agder and Østfold) have registered at the S3 platform at JRC-IPTS in Seville. The Nordland County Municipality seems to have come farthest, in partnership with regional policy and R&D institutions. Nordland has established an informal network of partnerships with other Norwegian and Nordic regions that are working with S3 strategies.

2.5 Main policy changes in the last five (5) years

Main Changes in 2011
Major increase in allocations to Environmental technology scheme under Innovation Norway
Establishment of 3 new centres under the scheme for Centres for Environment-friendly Energy Research (FME). All three new centres are social science oriented and constitute a supplement to the 8 technological centres established in 2008.
Merger of the university college of Oslo and the university college of Akershus, including merger of two social science research institutes (for work life research and welfare research)
Main changes in 2012
The public Fund for research and innovation is phased out due to technical issues related to interest rates. The total capital in 2011 amounted to app. €10 bill., with an annual yield of more than €400 mill., accounting for 16% of total GBARD. Ordinary budget allocations are increased with a corresponding amount in order to compensate for the phasing out of the fund mechanism.
The second evaluation of the Research Council of Norway is finalised (Technopolis, 2012)
Main changes in 2013
New government (conservative/liberal) announces stronger focus on innovation and business oriented R&D and research excellence
Main Changes in 2014
Presentation of the Government's long-term plan for Research and Higher Education 2015-2024.
Launch of new government "Strategy for research and innovation cooperation with the EU"
Norway joins EU Horizon 2020 as a full member of the programme.
The Government's Cabinet research committee is dissolved
Main Changes in 2015
Presentation and adoption of structural reform in the Higher education sector (to be implemented from 2016)
The budget proposal for 2016 includes continued growth in public R&D spending and a package of specific measures and allocations to counter downsizing in the oil and gas sector

3. Public and private funding of R&I and expenditure

3.1 Introduction

Norway's total R&D expenditure has been relatively stable during the last 20 years when measured in percentage of GDP. As indicated in table 2 below, this is also the case for the last four years, where R&D expenditure accounts for around 1.6% of GDP, rising to 1.7% in 2014 (NIFU, 2015).

However, as GDP growth has been rather strong compared to most other European countries, the stagnating R&D share of GDP means that R&D expenditure has been growing in line with total economic growth. As most other European and western economies, Norway countered the financial crisis with strong fiscal measures in 2009, including a series of immediate one-off measures in the area of R&D and innovation. Hence, public R&D funding in 2009 increased by more than 8% in real terms.

As many of these immediate measures were phased out, public R&D funding stagnated in the period from 2010-2012. However, from 2013 public R&D funding has experienced four consecutive years with real growth rates around 4%, including in the most recent budget proposal for 2016. This growth trend is both due to a general priority to R&D and an hitherto strong fiscal balance allowing a steady growth in public expenses. In addition, a substantial part of the increases in public R&D funding is of a more indirect nature, as allocations are integrated in expenditures with other main purposes than R&D, such as infrastructure investments and general health care expenditures.

For the business sector, the development in R&D expenditure has followed a slightly different pattern. The financial crisis also had a negative effect on R&D investments in Norwegian companies. Hence, data from 2009 reveals a considerable drop in Norwegian business R&D, but this downturn was much more moderate than elsewhere in Europe and the OECD area. Furthermore, as from 2011, R&D investments in the business sector have started to increase, showing real annual growth rates by 1.6% in 2012, 3.1% in 2013 and 6.7% in 2014. A general trend during the last two decades is that R&D in the service sector grows stronger than R&D in the manufacturing sector. The year 2008 marks the tipping point where R&D in the service sector surpasses the manufacturing sector, and this trend has continued ever since. In addition R&D in the oil and gas sector has shown strong growth rates since 2011, including in the preliminary data for 2014.

Another striking feature of the last years is a sharp rise in R&D funding from abroad. This funding source accounted for approximately 7% for a number of years, but rose to nearly 10% in 2013. The latter was mostly due to increased international funding in Norwegian companies, while income from the European Union account for less than 20% of total funding from abroad.

Table 2 Basic indicators for R&D investments

Indicator	2011	2012	2013	2014	2015	EU average (2015)**
GERD (as % of GDP)	1.63	1.62	1.65	1.71		
GERD (Euro per capita)	1185	1289	1288			
GBAORD (€m)	2 883 376	3 099 865	3 191 919	3 224 512	3 457 284	
R&D funded by	0.72		0.71			

BES (% of GDP)						
R&D funded by PNP (% of GDP)	Not available as PNP is of little importance and size					-
R&D funded by GOV (% of GDP)	0.76		0.76			
R&D funded from abroad	0.13		0.16			
R&D performed by HEIs (% of GERD)	31.4	31.3	31.5			
R&D performed by government sector, including PNP (% of GERD)	16.4	16.4	16.0			
R&D performed by business sector (% of GERD)	52.2	52.3	52.5			

3.2 Smart fiscal consolidation

According to Eurostat data, Norway's public R&D funding has fluctuated between 1.8 and 1.9% of total government expenditures during the years following the financial crisis. The trend is pointing upwards, as R&D expenditure as a share of total government expenditure has risen for three consecutive years until 2014. National data for 2015 and 2016 indicate that this trend will continue. Hence, although total public spending has been growing, there is reason to say the R&D spending has been among the prioritised policy areas, at least since 2011 and onwards.

In general, the Fiscal Budget for 2016 provides a significant stimulus to activity and employment in the Norwegian mainland economy. Including the proposals in the Budget for 2016, the current Solberg Government has introduced tax reductions totalling €2.5 billion since it was appointed in 2013. According to the Government, tax reductions are targeted at stimulating growth and renewal, with €1 billion in tax cuts for enterprises and individuals in 2016.

Reducing the corporate tax and tax for individuals

In 2016, the Government proposes to reduce the corporate tax rate from 27 to 25%. This is meant to encourage investments and at the same time make it less beneficial to shift profits out of Norway to low-tax jurisdictions. To further secure the tax base the Government will also tighten the rule that limits the deductibility of interest paid to associated companies.

In addition, the tax rate on ordinary income is also reduced by 2 percentage points, from 27 to 25%. Finally, the Government has proposed reductions in the net wealth tax in order to strengthen Norwegian private ownership and redirect investments from real estate to business activities.

The overall aim with all tax reductions is to create a more effective tax system to spur productivity and growth and transform the economy in the face of weaker demand from the petroleum industry.

Fiscal Policy

The Government is committed to the 2001 fiscal policy guidelines. The guidelines stipulate a gradual and sustainable use of petroleum revenues over time in line with the expected real return on the Government Pension Fund Global, estimated at 4%.

As described in chapter 1, The Government Pension Fund Global shields the fiscal budget from fluctuations in oil and gas revenues. A decline in the price of oil therefore has no immediate impact on the fiscal stance, but translates into reduced fiscal space over time.

Spending of petroleum revenues in 2016, as measured by the structural non-oil budget deficit, is estimated at 7.5% of GDP for Mainland Norway, up from 6.4% in 2015. The market value of the Government Pension Fund Global is estimated at €770 billion at the end of 2015.

The capital invested in the pension fund provides Norway with a very solid financial basis. At the same time, 2016 marks the first year in the history of the Pension fund where the transfer from the fund to the state budget was larger than the deposit into the fund. There is thus a general consent that Norway will have to face stronger fiscal constraints in the years to come.

3.3 Funding flows

3.3.1 Research funders

Public R&D spending in Norway is almost exclusively a central state matter. Regional funding plays a minor role in this picture. Hence, the major funding streams consist of R&D budgets from a number of ministries. As described in chapter 1, these funding streams follow the so-called "sector principle", where each ministry is responsible for funding R&D on behalf of its own sector needs, including (in principle) long term basic funding for their respective sectors.

At the same time R&D budgets are fairly concentrated, as five ministries stand for 85% of all R&D funding, with the Ministry of Education and Research (MER) allocating approximately half of all funding. The two main funding streams consist of 1) the R&D component integrated in the basic funding to universities and university colleges and 2) funds allocated via the Research Council of Norway. Around 60% of all public R&D funding is allocated through these two streams. In national terminology these two streams are sometimes referred to as "channel 1 and channel 2", indicating a simplified but real trade-off between competitive and non-competitive allocations. The nature and mechanisms of these funding streams is further described in section 3.4 below.

Norway has a relatively low share of R&D funding from private trusts and foundations. This is mostly due to historical reasons. Throughout history, Norway has had fewer wealthy capitalists and family run large companies with sufficient financial resources to establish funds of a certain size and importance. Furthermore, Norway is characterised by a strong reliance on the state as a caretaker of investments in public goods, such as R&D and higher education. During the least two decades this situation has changed, and a handful of private persons have started to provide donations to R&D purposes, some of which are of a considerable size.

In 2005, an incentive mechanism was also set up in order to provide public matching of private donations to R&D. The mechanism guarantees that public funding matches private donations above NOK 3 mill. with a factor of ¼. The aim of this mechanism was to encourage more donations to R&D. The mechanism was later abolished by the labour-socialist government and then reintroduced in a slightly revised format. Nevertheless, private funds and donations still account for less than 2% of total R&D expenditures in Norway.

3.3.2 Funding sources and funding flows

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3.4 Public funding for public R&I

3.4.1 Project vs. institutional allocation of public funding

Norway is among a dozen of European countries which provide data to the voluntary reporting of project vs. institutional funding in annual reporting to Eurostat. Data on this distinction is provided back to 2007. The table below illustrates data on mode of funding according to Eurostat.

Table 3: Total Government R&D funding in Norway by funding mode. Pct 2007-2014

Year	2007	2008	2009	2010	2011	2012	2013	2014
Institutional	56%	56%	55%	54%	54%	54%	53%	54%
Project	44%	44%	45%	46%	46%	46%	47%	46%

Source: Eurostat (GBAORD)

An ongoing study (PREF) commissioned by the EU-Commission addresses the same distinction, although based on an aggregation of funding streams on a more detailed level. This gives very much the same picture, and confirms thereby the impression that the balance between project and institutional funding in Norway is close to 50/50, although with a slightly higher share of institutional funding during the past 10-15 years. Final data from this project will be available by end 2016/early 2017.

Funding modes in Norwegian Higher education institutions

Compared to other research systems, Norwegian Higher Education Institutions (HEIs) have a relatively high share of basic funding. In 2013, 64% of total R&D funding for HEI consisted of direct basic funding from the Ministry of Education and Research. The second most important funding source for HEIs was grants from the Research Council of Norway (RCN), accounting for 17% of total R&D funding to HEIs. The remaining external funding for HEIs comes from other public sources (8%), international sources (3%), industry (5%) and other private sources (3%).

For research institutes, the balance is quite the opposite, as basic funds only account for around 15% of total R&D funding. The latter applies for around 50 research institutes which fulfil the criteria for government basic funding. Government basic funding for Norwegian research institutes is channelled through the RCN, but managed and distributed according to official guidelines, where allocation of basic funds are subject to a set of performance criteria. In addition to the basic funding, a number of research institutes receive specific long term funding related to assigned tasks of national interest and considered unsuitable for open competition, such as maintenance of laboratories, installations and datasets of national interest. On average, institutional funding for research accounts for around 15%, but with large variations between individual institutes.

3.4.2 Institutional funding

Higher education

In Norway, all institutional funds to higher education institutions (HEI) are given as block funding. The size and distribution of these block grants are determined by several factors and with some variations between different institutions:

- The "basic component" of the block grants amounts to around 70 % for the whole sector, and is based on the historical (pre-2002) budget levels.
- The remaining (ca. 30 %) of the block grants are the performance-based components.

This remaining 30% performance based component is distributed on the basis of a mix of reported student performance, research performance, and strategic research considerations. Until 2002 most funding of Norwegian higher education institutions was based on input indicators, such as student enrolment and number of staff. The performance based component was introduced from 2003, implying i.a. that 30% of the funding should be allocated according to two sets of performance criteria:

1. a teaching component, in which funds are distributed on the basis of reported student performance; this component initially amounted to about 24% of total institutional funding and has increased somewhat;
2. a research component, which currently stands for 6% of institutional funding. This component is distributed according to performance-criteria related to research activities. More specifically, these performance criteria consist of the following four dimensions:

a. Scientific publications (calculated as "publication points" according to a national standard based on a distinction between two levels of scientific journals – level 1 and level 2)

b. PhD candidates

c. (Competitive) funding from The Research Council of Norway and Regional Research Funds

d. Funding from EU framework programmes

It is also worth noting that the block funding based on the teaching component (1) is determined by the performance in absolute values on the indicators (e.g. student credits), while the funding based on the research component (2) is based on the institutions' relative share on the indicator among all the HEIs. In other words, the teaching component is open-ended in the sense that if performance improves at the national level, total funding increases accordingly. The research-component is however based on a fixed-limit budget. Increases in e.g. publications at the national level do not increase total funding, it can only affect the distribution of funds between the institutions. This also means that institutions can more easily predict and plan for extra funding from the education component, while additional funding from research performance is more uncertain due to its dependence on the performance of other institutions.

Revisions of the funding criteria

In January 2015 an expert committee appointed by the Government presented its analyses and recommendations regarding the future design of public funding to Norwegian higher education institutions (Hægeland et al 2015). The committee did not recommend any radical reforms, but proposed a set of adjustments in the design, weighting and selection of performance based indicators. A central and much debated question was whether the large historically based share of block funding (see above)

should be subject to a "deconstruction" and allocated according to new criteria and considerations. The committee did not recommend this. Instead, they proposed to introduce a new element of contract based financing, which was suggested to account for 5% of total HEI funding.

In its budget proposal for 2016, the Government has followed up parts of the suggestions put forward by the committee. As from 2016, the performance indicators will be modified while maintaining the main design and structure of the system. The recent adjustments consist mainly of:

- a stronger focus on completed degrees in the indicators for student completion (instead of merely rewarding student points in the existing system)
- technical adjustments in the indicators for scientific publications in order to remove disincentives for scientific co-publishing
- incentives for EU R&D funding will be extended to include all sorts of EU-funding, including education programmes
- a new incentive for rewarding external funding and income from contract research will be introduced in order to increase the institutions' interaction with industry and public sector

In addition, the Government announces an intention to i) introduce an element of contract based funding/monitoring of HEI institutions starting from 2017 and ii) initiate a feasibility study of scientific citations as a supplementary indicator in the performance based funding formula in order to stimulate research quality.

Research institutes

As mentioned above, a new system for institutional funding of research institutes was implemented in 2009. Part of the basic institutional funding is now based on a set of performance indicators. However, the basic funding only account for 10-15% of total funding for most institutes. Furthermore, the share of basic funding which is subject to performance based allocation varies between 2.5% for primary sector institutes, 5% for environmental institutes and 10% for social science institutes and technical industrial institutes.

As a consequence, the result based funding at stake only account for a few percentages of the institutes' total budget. Nevertheless, it seems that the performance based component has a real effect on priorities and strategies for the management of the 50 research institutes which are subject to the system (DAMVAD, 2012). The current system includes the following four performance based indicators:

- Scientific publications
- Total income from contract research
- Funding from international sources (EU and beyond)
- Number of completed PhDs (hosted and/or co-funded by the institute)

Funding of Health trusts/hospitals

In 2004, following a major organizational reform of the Norwegian Health care sector, a new system of performance research funding was introduced. The system builds largely on the system that was introduced in the higher education sector a few years before (see above).

The current system is based on two main funding streams:

1) An earmarked basic funding which is more or less evenly split between five Regional health authorities (representing app. the five geographical NUTS 2 regions). The exception is the South-East region, comprising the Oslo area, which receives 2/5 of the basic funding, due to its relative size and importance. This basic funding accounts for 40% of total funding to the Health trusts/hospitals.

2) The remaining 60% is distributed according to a performance based system, where scientific publications and completed PhDs constitute the main indicators.

3.4.3 Project funding

The main funding stream for project funding in Norway consists of the funding channelled through the Research Council of Norway (RCN). This funding stream sums up to more than 25% of total public funding. Apart from the aforementioned basic funds to research institutes, virtually all RCN-funding is subject to competition. As the RCN covers all types and disciplines of research, the council offers a broad portfolio of instruments, schemes and types of projects. According to RCN's online project database, the council has close to 5,000 projects running as of 2015 (RCN 2015b). On an aggregate level, funding instruments may be grouped in the following main categories:

- Large scale research programmes
- Action oriented programmes
- User-driven Research based Innovation (BIA)
- Independent projects (FRIPRO)
- Basic funding to research institutes (institutional)
- Norwegian Centres of Excellence (SFF)
- Centres for Research-based Innovation (SFI)
- Centres for Environment-friendly Energy Research (FME)
- National Financing Initiative for Research Infrastructure (INFRASTRUKTUR)

The FRIPRO instrument forms the most important support mechanism for researcher-initiated basic research projects. The scheme is funded by appropriations from the Ministry of Research and Education and corresponds to about 15% of annual budget of the RCN. Appropriations for FRIPRO have increased since 2013 after having been stagnant for a number of years. FRIPRO is also one of the arenas with the lowest success rates. In general, around 10% of applications submitted under the scheme are successful. For larger programmes, success rates often range between 20 and 30%.

All applications are assessed by referee panels consisting of external experts. The evaluation process is a multi-stage process and may differ according to the different sub-types of applications under each programme. Besides FRIPRO, support to individual researchers is often granted through support to PhDs incorporated as part of larger projects.

In addition to RCN, Innovation Norway (IN) provides public support to a range of innovation oriented activities. Most of the IN-funding consists of grants and loans to non-R&D innovation activities, and there is thus a rather clear division of labour between RCN and IN. However, IN also administers some support mechanisms with a significant R&D component. This is particularly the case for the Environmental Technology scheme (introduced in 2011) and The Industrial Research and development Program (IRD Program). In general, it is difficult to draw a clear line between R&D and non-R&D mechanisms within agencies such as Innovation Norway. It is therefore more common to consider innovation oriented measures and instruments as a common set of instruments.

3.4.4 Other allocation mechanisms

Another important share of public R&D funding consists of i) direct institutional funding to research institutes and other institutions outside the 50 specialised research institutes under the Government guidelines (see above) and ii) contract research commissioned by ministries and other public bodies. Both types of funding are difficult to identify and measure in a systematic way, but constitute nevertheless an import funding stream in the Norwegian system. For instance, according to recent national R&D statistics, nearly

20% of total public funding in 2013 consists of basic funds and contract research to research institutes.

3.5 Public funding for private R&I

3.5.1 Direct funding for private R&I

Public support to spur business R&D has long been a priority in Norwegian R&D policies. The present Government has made this a key strategy, partly justified by the relatively low R&D intensity in Norwegian industry as well as an increasing awareness of the need to develop new knowledge intensive companies and prepare for "life after oil".

A study conducted in 2014 concludes that direct business oriented R&D support accounts for around 20% of total R&D expenditure (Norsk Industri, 2014). This share is calculated from a perspective R&D funding and does not necessarily reflect how much of this funding is actually performed by companies. When measured from the performance-perspective, in official R&D statistics, only 4% of R&D performed in Norwegian companies is reported as funded by public sources. One main explanation for this discrepancy is that a large part of business oriented public R&D funding is carried out by research institutes on behalf of and in cooperation with companies.

Public programmes and measures oriented towards business R&D constitutes a rather broad portfolio. Amongst the most important are the User-driven Research based Innovation scheme (BIA), Centres for Research-based Innovation (SFI), Centres for Environment-friendly Energy Research (FME) and a number of thematically oriented large programmes. The portfolio of industry oriented R&D-support also comprises a few programmes under Innovation Norway, in particular the Environmental technology scheme and the Research and development contracts (Innovation Norway, 2015).

3.5.2 Indirect financial support for private R&I

Until 2001 government support to business R&I consisted mainly of direct support mechanisms. In 2002 Norway followed the examples of several other OECD countries and introduced a tax incentive scheme for business R&D, the so-called Skattefunn scheme. The first years after the introduction of the scheme, direct support mechanisms experienced a marked drop in available funds, hence indicating a shift from direct to more indirect support. However, during the last couple of years the support allocated through tax incentives seems to have stabilised around €150 mill, while direct support mechanisms have been substantially increased, especially from 2014 and onwards.

The Skattefunn scheme is an open mechanism where all businesses and enterprises that are subject to taxation in Norway are eligible. In principle, all eligible firms and projects receive support as long as the R&D content of the project is approved and formal requirements fulfilled. The firm may receive a tax deduction of up 20 % of the eligible costs in the approved R&D projects. All costs must be associated with the approved project.

To qualify as R&D, any activity must meet the definitions set out by the Research Council of Norway. If the tax deduction for the R&D expenses surpasses the amount that the firm is liable to pay in tax, the remainder is paid in cash to the firm. If the firm is not liable for tax, the entire allowance is paid in cash. Data from the Skattefunn scheme shows that a large share of all allowances are paid as cash contributions, which means that the scheme in practice functions just as much as a form of direct support.

All branches of industry and all types of companies can apply to the Skattefunn tax incentive scheme. Companies submit their applications electronically to the Research Council of Norway via the online submission service. The administration of the service has been regarded as very user friendly, which is also one of the main reasons that the Skattefunn scheme was ranked as the second best tax incentive scheme among 84 schemes in 31 countries in Europe and beyond (CPB Netherlands Bureau for Economic Policy Analysis, 2014).

In its budget proposal for 2016, the government has proposed to further increase the support through tax incentives by raising the maximum amount for eligible tax deduction. However, since most companies that benefit from the scheme are SMEs, it is rather uncertain whether the maximum amount really represents an obstacle.

3.6 Assessment

Total public R&D funding in Norway is high compared to most other countries, amounting to above 1% of GDP from 2016. Public R&D funding has also shown a steady increase with annual real growth rates of around 4% for the last four years.

The repartition between funding ministries is rather traditional, with the Ministry of Education and research in charge of basic research and general R&D funding, while the Ministry of Trade, Industry and Fisheries is mainly responsible for funding to business oriented R&D and support to innovation. A particular feature of the Norwegian system is firstly the sector principle, where all 15 ministries are responsible for funding related to their own sectors. Another aspect worth noting is the relatively large and growing share of funding from the Ministry of Health Care services during the last decade.

The sector principle has been a recurrent issue of debate. Some argue that the principle contributes to mobilise funding and policy attention across ministries and that public R&D is closely related to sector specific issues. Others claim that the principle produces fragmentation, sectorisation and inappropriate steering of funding. The latter is also related to the programme portfolio and priorities within the Research Council of Norway, as the council has to compose its priorities according to the interests and expectations of 15ministries.

Although there is no clear ideal balance between project and institutional R&D funding, as well as between competitive and non-competitive funding, Norway seems to have a fairly good balance of funding modes in terms of total public funding. The funding system is also rather mixed and sophisticated in the sense that formula based funding components are well established in three sectors (HEI, Health trusts and institutes), including evaluations, monitoring and adjustments of the mix of indicators. In addition, public support to business R&D also includes a well-established mix of direct and indirect measures (the Skattefunn tax incentive scheme).

This being said, a number of questions are worth discussing: Firstly, the high share of (historical) basic funding to HEI combined with a formula based and mechanistic performance based funding component may produce a sense of "policy abdication". Some have argued for a stronger steering of HEI funds, for instance in order to allocate more resources to science and engineering. Another issue is the unequal balance between a rather generous share of basic funding to HEI combined with a low share of basic funding to research institutes. A third question is related to the current policy that public support to business R&D should in general be sector and industry neutral and support the most promising projects regardless of thematic scope and industry orientation. Whether this is the best way to increase private R&D or if public support should have a clearer thematic focus remains an issue for debate in Norway.

4. Quality of science base and priories of the European Research Area

4.1 Quality of the science base

Table 4: Indicators for quality of science base

Indicator	Norway (2013)	EU average
Number of publications per thousand of population (full)	3.14	1.3
Share of international co-publications	54.1	36.4
Percentage of publications in the top 10% most cited publications (full)	13.91 (2000-2013)	11.29 (2000-2013)
Share of public-private co-publications (Sci-Val)	2.8 (2011-2013)	1.8 (2011-2013)

The total Norwegian production of articles has increased substantially after 2000. National data indicates that the total number of articles has increased by 69% from 2006to 2014. Among comparable European countries only Denmark has a higher growth rate (77%) in the same period.

On the other hand, natural benchmark countries such as Denmark, Netherlands and Switzerland are still ahead of Norway in terms of traditional quality measures, such as the share of top 10% most cited publications and the share of public-private co-publications.

Other quality measures and evaluations give a similar picture of Norwegian research as highly productive, but more average in terms of cutting edge research. For instance, the success in European Research Council (ERC) applications has so far been rather moderate. An external assessment of academic performance and quality culture in Norwegian academia was presented in spring 2014 (Benner and Öquist, 2015). The report echoed many of the statistical patterns concerning average research quality in Norway, but discussed also structural issues such as mobility, internationalisation and career systems within academic institutions. The following quote sums up the main findings in the report:

"Norway performs relatively weakly when it comes to high-impact publications (as a proxy for research with the potential to transform our understanding of nature, culture and society). The international visibility of Norwegian universities is limited, and only a small share of Norwegian scholars operate at the forefront of their respective areas. The renewal of Norwegian scholars has been strong over the last decades due to the expansion of the research system, but with limited impact. This collectively portrays a research system of good average quality but with limited impact on the frontiers of knowledge." (Benner and Öquist, 2014)

Hence, despite a positive development during the last decade, strengthening the quality in Norwegian research remains a key priority. Since 2013 research quality has become a main target and guiding principle for both structural reforms in higher education as well as the introduction of new and strengthened quality support mechanisms in the Norwegian system (see chapter 1-3).

4.2 Optimal transnational co-operation and competition

As a small country, Norway needs to engage in international research cooperation. International cooperation is therefore an integral part of R&D and innovation policies. A general trend over the past decades is a shift towards stronger engagement in European cooperation, although the links to USA, Nordic countries and a number of bilateral agreements remain important arenas for research cooperation.

4.2.1 European Co-operation

Since the EEA Agreement entered into force in 1994, Norway has participated in the EU framework programmes on research and innovation as an associated EEA-EFTA country. Participation in the framework programmes and in the European Research Area is now a core element in Norwegian research policy. Norway takes part in all ERA-groups as an observer, including the European Research Area and Innovation Committee (ERAC). A Norwegian ERA Roadmap was put forward in May 2016, as a follow-up of the European ERA Roadmap for 2015-2020 from 2015.

In spring 2014, the Government presented a strategy for cooperation with the EU on research and innovation (Ministry of Education and Research, 2014). The strategy establishes a target to increase Norwegian participation in the EU Horizon 2020 (2014–2020) by about 60% compared with previous programmes. The main background is that Norwegian participation and success in previous programmes has been considered too low. At the same time, Norway's annual financial contribution to the framework programmes has risen considerably, due to the continual increase in FP budgets and the high and increasing GDP (which is essential for calculating the annual contribution). In the 2016 budget, the total Norwegian contribution amounts to more than €250 mill., accounting for 7-8% of total public R&D spending. This creates high expectations regarding both financial and knowledge return from the programmes.

In total, Norway received €725.5m or 1.69% of all competitive funds in the 7th framework programme. Although the total success rate is quite high, Norway receives a significantly lower share of the total EU FP budgets than the other Nordic countries (Sweden 3.79%, Denmark 2.38% and Finland 1.93%).

The Norwegian institute sector acquired the largest share of funding from FP7 (about 39%). The higher education sector follows with 34% and the private sector with 21%. A general concern for the future Horizon 2020 is to mobilise higher education institutions in general and the university hospitals and health trusts in particular. Industry and public sector actors are also expected to engage more in applications for the framework programme. At the same time, the hitherto strong performance of research institutes cannot be taken for granted, especially since the first results of Horizon 2020 reveals lower success rates for some of the traditionally strongest Norwegian research institutes.

The EU strategy presents four main objectives for Norway's participation in Horizon 2020 and ERA:

1. Participation shall increase the quality of Norwegian research and innovation and help Norwegian research and innovation succeed internationally.
2. Participation shall contribute to increased innovation capacity, value creation and sustainable economic development.
3. Participation shall contribute to improved social welfare and more sustainable social development through research and innovation targeting major societal challenges.
4. Participation shall help to develop our own research and innovation sector, both through further development of policies and instruments and through new patterns of cooperation across national borders, sectors and fields.

4.2.2 Joint programming, research agendas and calls

In general there is a high degree of consistency between the priorities of ERA and Horizon 2020 on the one hand and Norwegian research priorities on the other hand. Yet there are some important exceptions, where areas of great importance to Norway are poorly covered by EU activities, notably in the area petroleum research, which is a central activity in Norwegian research, but less pronounced in the European context.

Some significant differences in industrial structure also make it difficult to achieve high participation in the framework programmes. The three largest export industries in Norway (oil and gas, suppliers to the oil and gas industries, and fisheries) are not represented in the thematic objectives of Horizon 2020. However, the Government underlines that these industries can take advantage of calls within cross-cutting technology areas, joint technology initiatives and open calls.

Coordination and operationalization

The Ministry of Education and Research has the main responsibility for ensuring a comprehensive approach to Norway's participation in the EU framework programmes and the European Research Area. The Ministry of Trade, Industry and Fisheries has a particular responsibility for coordinating issues that affect innovation, e.g. the previous CIP programme and innovation related issues in the new integrated Horizon 2020. A Ministerial Research Committee (DFU) and an EEA Special Committee for Research provide arenas for joint meetings for Norwegian ministries on issues related to the EU-research participation.

On the operational level, the Research Council of Norway (RCN) plays a key role in coordinating, managing and funding international cooperation initiatives. Many of the Research Council of Norway's programmes and other activities issue calls for proposals that incorporate funding earmarked for international research cooperation.

A number of these activities are also integrated in various ERA-NETs. An overview from 2013 shows that Norway has participated in 65 ERA-NETs and 6 ERA-NETs Plus since the schemes were launched. The RCN has been and is the Norwegian actor in almost all of these actions. In addition, the RCN issues calls for proposals that strategically target areas where international research cooperation is of particular relevance.

Furthermore, Norway has engaged extensively in the European joint programming initiatives (JPI) since their establishment in 2013. EU and EEA member states are free to choose which JPIs they wish to participate in. Norway is participating in all of the existing ten JPI's, although not with the same engagement in all initiatives. The JPI on Oceans is headed by Norway and constitutes probably the most highly prioritised JPI seen from the Norwegian perspective.

4.2.3 R&I roadmaps and ESFRI

Investments in research infrastructure constitutes an important element in the new long term plan for research and higher education (see chapters 1 and 2), including a financial commitment to future investments in the period 2015-2024.

The National Financing Initiative for Research Infrastructure was launched as part of the follow-up to the government white paper on research, Climate for Research (2009), and Norway's national strategy for research infrastructure, Tools for Research (2008-2017). This document established a clear division of responsibility for investment in research infrastructure, distinguishing between basic equipment and research infrastructure of national character.

Funding is also provided for Norwegian participation in Nordic, European and other international cooperation on research infrastructure, including Norwegian participation in the implementation phase of projects on the European Strategy Forum on Research Infrastructures' (ESFRI) Roadmap. As of 2015, Norwegian research institutions

participate in 24 of 48 ESFRI initiatives. Norway will host three of the ESFRI-initiatives (CESSDA, ECCSEL and SIOS).

Funding for research infrastructure involving external investments that exceed €23 mill. is dealt with at the ministerial or government level. The RCN has implemented the initiative to ensure an adequate interface between the funding of research infrastructure and other research funding, as well as to facilitate an integrated assessment of the balance between national investment and participation in international research infrastructures.

The RCN has been assigned the responsibility for drawing up a national roadmap for investment in research infrastructure. This roadmap presents the national and international large-scale infrastructure projects in which the RCN recommends that Norway should invest in the near future, and includes ESFRI projects. The RCN has set the ambitions to

- Support Norwegian participation in international research organisations with advanced research infrastructure;

- Work to obtain partial financing for research facilities in Norway from stakeholders abroad;

- Work together with research groups to gain greater insight into existing infrastructure

4.3 International cooperation with third countries

Internationalization of research and innovation is a strategic policy priority of the Norwegian authorities. This is confirmed by various strategy and policy papers, including the recent long-term plan and in the strategy for European cooperation (Ministry of Education and Research, 2014b).

Furthermore, a main action point in the RCN's international strategy is to focus greater attention on international cooperation and researcher's mobility in internal grant application review processes and to encourage Norwegian researchers to participate in international research through stays abroad and visits by guest researchers to institutions in Norway (Research Council of Norway, 2010a).

Transatlantic cooperation holds a prominent place in the RCN's international strategy. The US and Canada are among the countries with which research cooperation is considered to be of special national priority. The focus of the RCN is on broad-based cooperation within many disciplines and subject areas in transatlantic research and innovation cooperation. The objective is to enhance research quality, address global challenges and promote integration into well-functioning systems for research-based innovation. Norway has a long tradition of scientific and technological cooperation with the USA and Canada. However, since the establishment of the dedicated ERAC-configuration SFIC (Strategic Forum for International Science and Technology Cooperation) in 2009 and Horizon 2020, Europe has become even more important as a strategic geographical focus for international research cooperation (see chapter 2).

For the most part, international research cooperation, is incorporated into grant proposals submitted to the RCN in connection with a regular funding announcement. The Leiv Eiriksson mobility programme aims to contribute to the long-term growth of R&D collaboration with the U.S. and Canada by allowing more Norwegian researchers and research recruits to spend time in the US or Canada, and more researchers and research recruits from these countries to spend time in Norway.

The Nordic Research Opportunity supports National Science Foundation Graduate Research Fellows who undertake stays of between two and twelve months to work with counterparts at Norwegian research institutions.

To encourage bilateral research cooperation, the RCN also provides national support for existing projects to develop new collaborative research efforts with partners in priority countries, first and foremost the US, Canada, China, Japan and India and Brazil

4.4 An open labour market for researchers.

4.4.1 Open, transparent and merit-based recruitment of researchers

Exchange of researchers with other countries is a key factor in enhancing the capacity and expertise of the Norwegian research community as well as opening the door to international research arenas. During the past decade, foreign researchers constitute an increasing share of new doctorate degrees in Norway. While persons with non-Norwegian citizenship accounted for less than 10% of doctoral degrees at the start of the 1990s, the proportion of foreigners has now risen to more than a third. The same trend is also reflected when looking at all researchers in the higher education and institute sector, where the share with foreign citizenship rose from 11 per cent in 2001 to 20 per cent in 2012 (Research Barometer, 2014).

Research training and doctoral degrees at Norwegian research institutions are both financed through direct grants to research recruitment and incorporated in general public allocations. Research recruitment is subject to general laws and regulations, but apart from that the responsibility for providing an attractive and well-functioning career development is left to the individual universities and colleges.

Almost half of the foreign doctoral candidates came from Europe, with 32% from Asia, while about every seventh foreign doctoral candidate was from an African country. Germany tops the list of countries with 250 doctorates in Norway from 2010 to 2014 and China follows second with well over 200 doctorates. There is also a majority of men among the foreign citizens who take a PhD in Norway. Over the past five years, over 60% were men, but there are significant differences in gender balance between individual nations. For a number of Asian countries the proportion of men is particularly high, far above 80%, while there is generally an even gender distribution among doctoral candidates with European backgrounds.

Attracting foreign research talents to Norwegian R&D institutions has been a pronounced priority in Norwegian R&D policies, i.a. expressed in recent white papers on research. The white paper from 2013 (Kunnskapsdepartementet, 2013) points to a general need to attract foreign research talents, but in terms of practical measures the government refers to the responsibility of the Research Council of Norway and individual universities and calls for better use of existing European measures such Marie SkłodowskaCurie scholarships.

Norwegian research institutions are generally open to host well-qualified researchers from abroad, and use measures such as the Norwegian section of ERA-MORE, the European network of researcher mobility portals, in their recruitment activities. Advertising of posts on the EURAXESS Jobs portal is also frequently used. According to EU-statistics, 66 per cent of Norwegian research post are advertised on this portal, while the EU average lies at 43,7.

A comprehensive international scholarship programme has also been established to support recruitment efforts.

In 2015, The Ministry of Education and Research initiated a strategy for enhanced cooperation with six selected non-European countries, the so-called Panorama-strategy (MER, 2015c). This strategy intends to strengthen cooperation within higher education and research with Brazil, Russia, India, China, South Africa and Japan. The Government suggests targeted measures to strengthen cooperation with these countries ia. by

- establishing better schemes through the Norwegian State Educational Loan Fund for language training in non-English speaking countries

- strengthening the UTFORSK Partnership Programme to support cooperation between universities and university colleges in Norway and universities in the strategy countries.

- further developing the INTPART Partnership Programme, a programme which is aimed at research institutes, universities and university colleges for cooperation in higher education or research, networking activities and the exchange of knowledge between institutions. From 2016, there will be separate calls for proposals specifically directed towards the six strategy countries.

4.4.2 Access to and portability of grants

The Research Council of Norway (RCN) is responsible for the majority of competitive research grants in Norway. RCN grants comprise a range of 15 application types, from support to large scale consortia and infrastructure investments to individual grants and support to conferences, events and networking activities.

As a general rule, the formal applicant has to be a Norwegian institution/enterprise with a specific individual, representing the institution, designated as the project administrator. The RCN has drawn up a document which specifies which institutions are eligible for RCN grants. All formal applicants and project owners must be Norwegian institutions/enterprises, with the exception of a handful of Nordic research performing institutions (institutions which are either financed by the Nordic Council of Ministers and/or funded by the authorities of at least three Nordic countries, including Norway). Project partners may however be foreign research institutions, and international cooperation is increasingly encouraged in calls and emphasized in the evaluation of applications.

Personal grants, such as doctoral and post-doctoral grants, are also to be forwarded by a Norwegian institution. In the case of doctoral degrees, the candidate's advisor should serve as the project manager. Doctoral fellows who intend to complete their degree in Norway are not only allowed but also expected to incorporate research visit(s) abroad into their fellowship period. Those who pursue their entire researcher training abroad are usually registered as employees of the RCN. Research fellows should be affiliated with a Norwegian specialist environment during the fellowship period to promote knowledge transfer and active career planning. Furthermore, doctoral and post-doctoral fellows who spend their entire fellowship period abroad may be exempted from the requirement regarding affiliation with an institution/enterprise as project owner.

The Research Council of Norway adopted formally the principles of the European Charter for Researchers and Code of Conduct for Researchers (C&C) in 2006. A number of universities and research institutions have adopted the charter and as of 2014, eight institutions are HRs4R institutions. In addition, the Research Council of Norway incorporated in 2011 a general principle that all grants provided by the agency shall follow the principles of C&C.

A gap analysis of the charter and Norwegian practice that was conducted by The Norwegian Association of Higher Education Institutions in 2008 concluded that most regulations and practice in Norway comply with the principles of the charter (The Norwegian Association of Higher Education Institutions, 2008). The practical implications and follow up from institutions is however more varying, from best practice at some central institutions to less visible actions in smaller institutions.

4.4.3 Doctoral training

Several governmental agencies, higher education institutions and other organisations have particular roles in the provision of PhD education in Norway. The Ministry of Education and Research has the overall responsibility for funding PhD training, primarily through the allocation of block funds to higher education institutions. A significant amount of PhDs are also funded through research programmes managed by RCN. In addition, The Ministry of Health and Care Services that owns the university hospitals has a significant role in funding PhD candidates in health and medical sciences. The Research Council of Norway also has an advisory function towards the Ministry of Education and Research on doctoral education. The Norwegian Quality Assurance Agency for Higher Education (NOKUT) is responsible for quality assurance and quality development in all

Norwegian higher education institutions. At the PhD level NOKUT has a more direct role in accrediting PhD programmes from university colleges (NOKUT 2010).

The higher education institutions are responsible for the provision of PhD training and for rewarding doctorate degrees. Currently, 23 higher education institutions in Norway are authorised to offer PhD programmes, of which 8 universities, 8 specialised university colleges and 6 university colleges . PhD training also takes place in other organisations that do not have their own PhD programs, but where a considerable part of PhD candidates work. Researchers, doctors, and other health professionals are involved in doctoral training. Also teaching staff in university colleges without PhD programmes are enrolled in PhD programmes in the universities.

According to employment statistics (Olsen 2011), almost all doctoral degree holders in Norway are employed. Only about 1% of doctoral degree holders who received their degree after 1990 were registered as unemployed in 2009. Furthermore, the majority of those registered as unemployed in 2009 had graduated in 2009. Thus in general, PhD holders find work, and even this small level of unemployment is likely to be temporary. On the other hand, the recent decline in investments and activities in the oil and gas sector may cause, at least temporary, challenges for researchers in this sector.

Career systems and tracks

In general, academic staff at Norwegian universities and university colleges are expected to engage in both R&D activities, education as well as dissemination and innovation. The balance between these missions may, however, vary between individual researchers, academic positions and the different phases of each academic career. Although Norwegian doctorate holders seem to maintain a very high rate of employment (99%), a number of career challenges are under consideration, some of which are directly related to triangle policies:

- Despite a strong increase in the number of doctorate holders during the last decades, there seems to be a potential for increased mobility of Norwegian researchers between institutions and in particular between sectors (Forskningsbarometeret, 2014). Recent analyses have also demonstrated that researchers with work experience from outside academia have a high propensity to engage in external relations and attract third party funding (Thune et al, 2014). Increasing the cross sectoral mobility of researchers is therefore an issue.
- The Norwegian PhD education received a rather positive evaluation in 2012, but the evaluation also addressed the need to strengthen the generic parts of the education and consider measures to better prepare future PhD candidates to careers outside academia, especially if the expansion of doctorate holders continues (Thune et al, 2012). A more recent report from the Norwegian Association of Higher Education Institutions (UHR) also raised a worry that PhD candidates following research intensive 3 year tracks may risk to get too little experience with education (UHR, 2015).
- Another issue raised in the same UHR-report concerns the lacking engagement in education in post.doc and other "intermediary positions" qualifying for fixed term employment. As qualification to permanent academic positions is mainly based on academic achievements, postdocs tend to be little engaged in activities other than their own research (UHR, 2015).

In general, there seems to be a need for better career systems and traditions for rewarding achievements related to education and external relations/innovation. The report from UHR calls for a "whole of career approach" where institutions develop clear strategies for recruiting and rewarding researchers that are able to combine R&D, education and innovation. Among the existing initiatives are:

- Establishment and strengthening of the Industry PhD and Public sector PhD schemes (see below)

- Since 2008, a national scheme for so-called researcher schools has been in place. The scheme is administered by the Research Council of Norway. The aim is to promote recruitment of PhDs, improve the completion of degrees and enhance the internationalisation of researcher training. The schools also provide an opportunity to better integrate the triangle perspective in researcher training. At present 15 schools are active.
- In 2013, the previous government introduced a pilot scheme of so-called Tenure tracks, where selected PhD candidates are given a fixed contract of 6-7 years, with the right to obtain a permanent position provided that the terms and conditions in the contract are fulfilled. A new regulation for Tenure track was officially adopted by the Storting in 2015, and a total number of 300 tenure track positions have been funded. The further definition of terms and conditions in these contracts constitutes another potential tool for strengthening the triangle perspective.

The government is currently working on a White paper on quality in higher education, to be presented in 2017. This process will provide an opportunity to integrate these and other initiatives in official policy processes.

4.4.4 Gender equality and gender mainstreaming in research

In general, Norway is a country where gender equality is high on the agenda, and where gender balance is emphasised in a number of areas. This is also the case for the research and innovation system, where the balance between male and female researchers has been significantly improved during the last decades. Nevertheless a number of gender imbalances remain a challenge.

As early as 1986, women have represented the majority of the student population and since 2000 the share of female students has been around 60%. In terms of total R&D personnel, the share of women is 36% in 2013. Behind these aggregate shares there are however large differences between both sectors and fields of research. In the industry sector, only 26% of total R&D personnel are women, while women constitute 47% in the higher education sector. Women are also well represented among researchers in the institute sector, where they stand for 42% of total R&D-personnel.

As described in chapter 3 (check), a major contribution to the consistent increase in doctoral degrees in Norway is that more women gain doctorates. In 2015, 53% of all doctoral degrees were awarded to women, an increase from 2014 when women for the first where in majority (51%) in terms of rewarded degrees. In the early 1980s, women only accounted for around 10% of doctorates. The proportion rose to about one-third during the 1990s, and continued to grow after the millennium. Since 2008, the proportion of women annually varied between 45 and 49%, until it in 2014 actually turned 50%.

There are still major differences in gender balance in the field of science. Over the past five years, three-fifths of all PhDs in the largest field, medical and health science, were awarded to women. Women have also been in the majority in social sciences, with 55% of the PhDs in the same period. Regarding the humanities and agricultural sciences, both genders are fairly equally represented, while men are still in clear majority in natural sciences and engineering and technology. Over the past five years, men accounted for three-fifths of all doctoral degrees in natural sciences, while the proportion of men in engineering and technology was even higher at 77%.

Women are also lagging behind in terms of top academic positions in Norway. According to She Figures 2015, 25% of all academic top positions (Grade A) in Norway are held by women. This is about the same level as in the other Nordic countries

4.5 Optimal circulation and Open Access to scientific knowledge

4.5.1 E-infrestructurees and researchers electronic identity

Many Norwegian research groups make use of e-infrastructure such as high-performance computing, fast data networks, archival storage, and associated services. As from 2015, the annual national financing to such infrastructure from the Research Council of Norway increased from €2 mill. to above €3 mill., while the universities are expected to contribute with an additional total annual funding of app. €6 mill. In addition external stakeholders are expected to contribute according to their use and needs.

Until 2015, national e-infrastructure for high-performance computing in Norway was organized through the state owned company UNINETT Sigma, financed partly by the Research Council of Norway, partly by contributions from the four largest universities. In 2015 a new company was established (UNINETT Sigma2), with a more long term and stable financing, a more strategic responsibility and with the aim of increasing access to e-infrastructure from other non-university public R&D performers such as research institutes and health trusts. A new model for user financing will also be introduced gradually from 2015. A general guiding principle will still be that research projects which make use of e-infrastructure shall contribute to the financing.

With regard to research information, the so-called CRIStin (Current research information system in Norway) constitutes a major system and database of researchers and research activities in Norway. The CRIStin-system was established in 2011, following the government white paper on research from 2009 (MER 2009). The system covers researchers in hospitals, research institutes, and universities and university colleges. One of the primary purposes of the system is to collect all the registration and reporting of research activities of institutions within the three sectors in a common system. This gives researchers a place to capture and simplify the registration of common publications.

The system consists of the following four elements:

1) Documented results from research, where an essential part is the national publishing database (NVI-The Norwegian Science Index). This part also includes non-scientific publishing: i.e. reports, popular science articles, books, lectures, media contributions as well as lists of patents and products

2) Researcher profiles with CVs and information about a researcher, background, contact information, tags, CV, awards and research visits.

3) Research projects, with information on projects which one or more CRIStin institutions are involved in.

4) Research Units, with overview of research groups, organizational units and research centers. The information in these modules is open and searchable by everyone. Login is only required for registration or administration of data. At present there are over 160 Norwegian institutions using CRIStin.

4.5.2 Open Access to publications and data

Since 2005 changing governments have expressed a general positive attitude towards open access to research publications. The Government white paper on research from 2013 stated that, as a general principle, all research which is entirely or partly financed by public sources should be openly available (MER, 2013). At the same time it is recognized that open access policies should not undermine academic freedom and standards.

More recently, Norway has engaged in a new EU-initiated cooperation on Open Access. According to the Norwegian Minister of Education and Research, Norway intends to play an active role in this process lead by the Dutch Minister. In addition, the Norwegian ministry established in early 2016 an expert group under the Norwegian Association of

Higher Education Institutions (UHR), with the mandate of elaborating national guidelines for open access publishing.

The Policy on Open Access to Research Data of the Research Council of Norway (RCN) aims to ensure that such data are accessible to relevant users, on equal terms, and at the lowest possible cost. The guidelines in the policy apply to all data generated by projects funded by the RCN – with a few exceptions.

The policy is formulated as a set of recommendations – not requirements. The RCN's various funding instruments will be adapted to accommodate the principles in the policy. One possible measure under consideration is to introduce a requirement that research projects incorporate data management plans. The RCN would use these plans as a basis for accepting data archiving costs as part of the operational expenses of funded projects. In addition, the RCN has expressed an intention to encourage the establishment of well-designed infrastructure for data storage and data management, in part through the National Financing Initiative for Research Infrastructure.

RCN also a policy for open access to publications, which includes a temporary institutional grant scheme (until 2019) to support the building up of institutional funds for open access publishing.

5. Framework conditions for R&I and Science-Business cooperation

5.1 General policy environment for business

Despite the significant structural change during the last decades, the oil and gas sector is still responsible for a large share of wealth creation. With decreasing oil and gas prices, the need to develop new sources of growth is now high on the agenda. Hence, a major priority is to promote more young fast growing companies.

Entrepreneurship policy in Norway is primarily the responsibility of the Ministry of Trade, Industry and Fisheries, and the Ministry also coordinates the Government's innovation policy. The Ministry of Local Government and Modernisation has a major role in promoting entrepreneurship with a regional perspective. When it comes to the framework conditions, the Ministry of Finance, the Ministry of Labour and Social Affairs and the Ministry of Education and Research are also important players. On the operational level, most funding and instruments are concentrated around three agencies; 1) Innovation Norway, which is responsible for loans, grants and advice for business and regional development, 2) The Research Council of Norway, which is responsible for most R&D related instruments and 3) SIVA, the Industrial Development Cooperation of Norway, which aims at developing strong regional and industrial clusters through i.a. investments in infrastructure and knowledge networks.

Favourable framework conditions

In general, and contrary to its traditional image, Norway seems to provide rather favourable framework conditions for entrepreneurship and doing business. According to the 2014 edition of the Word Bank's index "Ease of doing business", Norway ranks as number 6, up from number 9 in 2013 (World Bank, 2014).

On the other hand, Norway has a relatively low share of self-employed in total population, partially due to the fact that unemployment has remained low for more than three decades. Hence, there are few "push factors" for engaging in entrepreneurship and few people start their own company of necessity. Several actions have been taken to improve the culture for entrepreneurship in general, and among women in particular (see section 5.2). Although few young people seem to head for a career as self-employed, the general image of entrepreneurship has improved remarkably over the last few years. According to the Global Entrepreneurship Monitor 2014, 83% of Norwegians have a positive image of entrepreneurship. Only Finland has a higher share of people with positive attitude to entrepreneurship (Global Entrepreneurship Monitor, 2014).

Norway has also improved its score in terms of entrepreneurial capabilities. Particularly noteworthy in this area is the growing inflow of foreign labour. It also appears that Norway is among the countries which receive most foreigners with higher education. How to integrate and exploit this additional labour force is both a challenge and a great opportunity for Norway.

5.2 Young innovative companies and start-ups

Entrepreneurship has received increased political attention. A number of initiatives have been introduced since the first Government entrepreneurship strategy in 2004. Until recently, most policy instruments in this area have focused on removing barriers to entrepreneurship and nurturing an entrepreneurial culture.

Merging narrow, sector specific instruments into broader, sector neutral instruments has also been a deliberate strategy of Government over the recent 5-10 years. Hence, broad measures such as the R&D tax deduction scheme and programmes for user driven innovation are among the most powerful tools for growth entrepreneurship and for innovation policy in general. In the recent years, an increasing share of funding and instruments have been focusing on green innovations and green technologies.

As part of the main strategy for structural change and response to the reduced activity in the petroleum and offshore sectors, the Government presented an "Entrepreneurship plan" in October 2015. The plan addresses the need to promote entrepreneurship on a broad scale. Among the new measures proposed are:

- Strengthening the funds for seed capital to start-ups and promising growth companies
- Increase the funding through start-up grants.
- Strengthening of support to the «FORNY» scheme which provides support to young companies which engage in the commercialization of research
- Establishment of a new scheme for support to students and PhDs who want to engage in entrepreneurship. A pilot scheme with €3 mill. will be established in 2016.
- Promotion of transition processes through support to a new so-called «Idea-lab», where companies and research environments from different sectors and technologies come together and explore how knowledge and technology can be used in new settings
- Continue the efforts to simplify regulations, remove barriers and reduce administrative burdens for firms.

5.3 Enterpreneurship skills and STEM policy

Despite a general high level of education in the adult population, there is a worry that Norway may have a shortage of skilled people in a number of areas. Projections by Statistics Norway indicate that there will be a lack of teachers, health care workers and a general shortage of people with vocational education and training, particularly in the construction sector (Statistics Norway, 2013).

Other challenges relate to generally low completion rates in upper secondary school and a consistently low performance in mathematics and sciences. Although some surveys indicate an improvement in mathematics and science performance of younger students, Norwegian 15-year-olds did less well in the 2012 PISA survey. Their maths results were slightly worse than in the previous survey in 2009, although they were stable when compared with the 2003 survey. The performance in science was also slightly poorer than in 2009. The survey showed that almost a quarter of students were at the lowest maths level, while hardly any were at the highest level.

Furthermore, Norway seems to have a gender problem in the area of maths, sciences and technology. Although the overall number of students studying and graduating from maths and science degrees has risen, the proportion of women on these courses has not. This is in spite of the fact that overall more women than men take a higher education. The same applies in research. Only 40% of PhD students in maths and science are women, and only 20% in technology. That puts Norway behind its Nordic neighbours.

Since 2002 a regular four years cycle STEM-strategy has been issued, with new measures to strengthen science and mathematics on all levels of education. The main goal is to increase interest in maths, science and technology, and to improve recruitment and course completion rates at all levels. Secondary goals include improving Norwegian students' maths and science skills, reinforcing teachers' skills and increasing recruitment to higher education courses in maths, science and technology.

5.4 Access to Finance

Access to finance and venture capital is a key element in entrepreneurship and innovation policies. Despite a strong economy and generally good access to finance, many start-ups and young companies face problems and financial constraints – especially in areas where few investors have the competence and traditions of providing

financial resources. In Norway, a large share of private investors has traditionally been oriented towards oil and gas, offshore technology and real estate.

In order to fill the gaps and increase the access to finance for emerging areas, the Norwegian government has taken on a rather active role in the venture market for several years. This engagement includes a portfolio of public and semipublic seed funds as well as investment companies such as Argentum and Investinor.

- Argentum is an asset manager specializing in investments in Northern-Europe and energy-focused private equity funds. The company was established in 2001, to contribute to efficient capital markets for unlisted companies, and is owned by the Ministry of Trade, Industry and Fisheries. Argentum currently has a capital close to €2 billion under management, whereof two thirds are managed on behalf of the Norwegian Government and one third on behalf of private investors.

- Investinor is also one of the major venture investment companies in Norway, both in terms of manpower and capital. The company manages currently more than €500 mill and invests on the same terms and conditions as private investors. Investinor takes minority stakes (less than 50%) in the portfolio companies and syndicates its investments with other investors.

Innovation Norway also has a broad portfolio of support mechanisms and loans to companies in various stages. Startup grants constitute a particular source of finance for companies in their early phases. Startup grants are both available for the premarket evaluation phase and for the later commercialization phase. The size of grants given in the first phase ranges from €5,000 to 10,000, while grants in the next phase may amount to €50,000.

5.5 R&D related FDI

Apart from improving general framework conditions, Norway has had few specific measures in place to attract foreign R&D intensive companies to Norway.

In 2013, the Government decided to establish an "Invest in Norway" function, the role of which is to act as the official Norwegian investment promotion agency. The agency provides services, market information and access to networks for foreign companies which intend to establish and run their business in Norway.

Furthermore, in its budget proposal for 2016, the Government proposes to reduce corporate tax from 27% to 25%, partly in order to make Norway a more attractive country for foreign investments.

5.6 Knowledge markets

In 2002, IPR legislation as well as the University Act were subject to amendments in order to improve incentives and framework conditions for commercialising publicly funded R&D. Firstly, the legal ownership of inventions was transferred from individual researchers to their institutions, although maintaining a right for university researchers to publish their inventions freely within a defined time limit. Secondly, the mission of contributing to innovation and exploiting inventions was added to the universities' mission as defined in the official University Act.

Following these legislative amendments, a number of policy measures have been introduced and reinforced in order to spur innovation and better exploit inventions developed by Norwegian academic research. Among the concrete measures are:

- Establishment of Technology Transfer Offices (TTOs) at all major universities as well as central Health trusts. A number of TTOs are also joint offices serving the needs of several higher education institutions

- Strengthening of the so-called FORNY programme for public support to commercialisation activities. This is a joint programme between the Research Council of Norway and Innovation Norway, originally established in 1995, but substantially

reinforced and extended during the 2000s. The programme targets academic researchers and provides support to infrastructure for commercialisation (e.g. TTOs), commercialisation projects and processes, verification of technology (proof of concept) as well as individual support to researchers with ambitions to commercialize ideas and research results. The FORNY funding can cover a maximum of 50% of the costs related to the various activities.

- A broad infrastructure of innovation companies, science parks and incubators, of which more than 100 companies are co-owned by the public organisation SIVA, which provides funding to various innovation and start up activities.

- The third mission is increasingly emphasised in current policies and government steering of universities and university colleges, although patenting and other commercialisation activities are not yet included as part of the result based incentive system for funding of higher education institutions. This is primarily due to the lack of sufficient and reliable registration of patents, licenses DOIs etc.

The policy mix and measures for commercialisation of Public R&D was subject to an evaluation which was finalised in 2015 (Spilling et al, 2015). The main conclusion was that the infrastructure and support mechanisms are well in place, but there are still few indications of substantial increase in commercialisation activities, measured in terms of patenting, licensing and share of academic researchers engaging in these activities. The evaluation recommended i.a. a further increase in the support to the FORNY programme, which was followed up in the government's budget proposal for 2016.

5.7 Knowledge for transfer and open innovation

The Norwegian R&D and innovation system is characterised by a relatively high degree of cooperation. Previous studies have characterised the Norwegian system as a collaborative system, with a strong tradition for knowledge sharing and cross-sectoral links (Gulbrandsen and Nerdrum, 2009). In real terms, the share of public private co-publications (2,8%) is well above EU average (1,8%) in 2014. Private funding for public R&D is also relatively high compared to most other European countries. The share of private funding for higher education research is around 5% and has remained stable over the last 10-15 years. Although this share is about the same level as in comparable European countries, there has been a longstanding policy intention to increase this share and strengthen the direct links between academia and industry.

One important factor in the patterns for cooperation is the large variety of dedicated public and semi-public research institutes. These institutes constitute a specific sector in the Norwegian R&D system and stand for approximately 25% of total R&D in 2013 (see also chapter 2). As most research institutes have a rather low level of basic funding – often between 10-20% - institutes are dependent on external funding from industry, public entities and foreign companies and organisations. In particular, the technical-industrial research institutes constitute important research partners for industry. This means that many Norwegian companies rely on external R&D. Some consider this a successful model, which maintains a functioning bridge between research expertise and user needs. Others are concerned that this system creates a barrier between academia and industry and that too few companies are able to build up internal R&D and absorptive capacity (Productivity commission, 2016).

On the other hand, universities and university hospitals are largely dependent on basic funding, although current policies aim at increasing their external funding and cooperation with industry and other external partners.

On this background, a number of public R&D support schemes in Norway allow for, encourage and even require collaboration between industry and various research institutions.

The Skattefunn R&D tax incentive scheme is the largest and most wide-ranging single mechanism for public support to business R&D in Norway. The total support provided

under the scheme amounted to 1.56 bill. NOK in 2013 (app. €165 mill.), which corresponds to 7%of total public R&D expenditure. The support from Skattefunn comes in the form of a possible deduction of 18-20% from a company's payable corporate tax. As a general rule, all branches of industry and all types of companies paying tax in Norway are eligible for tax deduction under the scheme. The scheme was introduced in 2002, and has been subject to several evaluations and subsequent adjustments and extensions. As of 2016, the maximum project costs (ceilings) for which deductions can be claimed amounts to 20 mill. NOK (€1.8 mill.) for business intramural R&D, and 40 mill. NOK (€3.6 mill.) for projects which include the purchase of R&D from approved R&D institutions. The latter constitutes thereby an incentive for companies to cooperate with both higher education institutions and research institutes. Data from 2014 indicates that 28% of all Skattefunn-projects included cooperation in terms of purchase of external R&D. Among these "collaborative projects", research institutes stand out as the most frequent partner, accounting for just above 50 percent of all collaborative projects.

The so-called User driven Research based Innovation programme (BIA) constitutes, in terms of funding resources the second most important mechanism for support to business R&D and innovation. The scheme was established in 2005 through the merger of a set of previous smaller and narrower instruments. BIA is targeted at industry and has an annual budget of approximately €40 mill. (2014). Companies may apply for partial funding of R&D projects which are based on their own strategies and challenges, regardless of branch of industry or thematic area. The projects must result in substantial value creation for the companies as well as for society at large, and must take an international perspective. The projects are organised in consortia whereby companies and R&D communities cooperate on achieving results.

A third central measure in this context is the Centres for Research-based Innovation (SFI) scheme, which aims to enhance the capability of the business sector to innovate by forging alliances between research-intensive enterprises and prominent research groups. More specifically, the SFI scheme intends to i) encourage Norwegian enterprises to innovate by placing stronger emphasis on long-term research and by making it attractive for enterprises that work on the international arena to establish R&D activities in Norway, ii) facilitate active alliances between innovative enterprises and research groups, iii) promote the development of industrially oriented research groups that are on the cutting edge of international research and are part of strong international networks, iv) stimulate researcher training in fields of importance to the business community, and encourage the transfer of research-based knowledge and technology. The total budget allocation for the new generation of 17 centres (approved in 2014) will amount to €150 mill. over the life span of eight years (2015-2023). Each centre will receive an allocation from the RCN of roughly 10 MNOK per year and the host institution and partners must contribute with a at least the same amount as RCN.

Like many other countries, Norway has also introduced an Industrial Ph.D. scheme. The scheme was first introduced in 2008, with the first years as a pilot period. It is inspired by and based on the Industrial Ph.D. Programme in Denmark. The main purpose of the scheme is to enhance interaction between companies and research institutions, increase research activity in industry and equip newly-educated researchers with knowledge of relevance to their company. Companies receive an annual grant equal to maximum 50% of the applicable rate for doctoral research fellowships for a three-year period. The candidate must be an employee of the company and be formally admitted to an ordinary doctoral degree programme. The scheme was subject to an evaluation in 2012, which concluded that the scheme so far had been successful, but recommended on the one hand to make more companies and researchers aware of the scheme and on the other to introduce stronger selection criteria and requirements for companies and candidates.

5.8 Regulation and innovation

Norway has improved the regulatory conditions, in particular, due to stronger competition rules in the areas that reduce the barriers to entry in the network and

service sectors. According to OECD's product-market regulation measures, Norway compares reasonably well with other countries, and has been cutting back barriers to business, although more slowly than in most other OECD countries. OECD still recommends changes towards lighter and more efficient processes and regulations in the interfaces between business and government (OECD 2015).

Access to finance is relatively good in Norway. Norway's strongholds in this area relate to the access to loans and the high country credit rating, where the latter is largely due to the country's solid financial situation (see also chapter 1).

The regulatory framework is also generally good, but the picture is mixed. For instance, bankruptcy legislation in Norway is ranked among the best in the OECD area, which reduces the costs of failure for entrepreneurs. On the other hand, labor regulations are relatively rigid and the tax burden is quite high, even in the Nordic context. Rigid labour regulation is not necessarily a drawback, as many consider this as a core element of the Nordic welfare model. The Norwegian wealth tax is, however, considered one of the highest among the OECD countries, and this is a much debated issue in Norway. The present Conservative/Progress party Government has put a strong emphasis on reducing the wealth tax. A major challenge in this context is how to introduce reductions in the wealth tax which can distinguish between private fortunes and productive capital.

Another challenge is connected to the profile of public support schemes. Many support mechanisms have traditionally been oriented towards rural areas, while entrepreneurship activity is more concentrated around the urban areas. Furthermore, a large share of public support as well as the main policy attention have focused on SMEs, while the real challenge according to many actors, is a lacking ability to grow new large companies. These apparent mismatches have been addressed in recent assessments of the Norwegian system. One example is the final report of the so-called Productivity Commission, which emphasises the need to focus on large companies. The same recommendations have also been brought forward by the OECD in their economic reviews of Norway (see i.a. OECD, 2015).

5.9 Assessment of the framework conditions for business R&I

Shifting governments have long been addressing the issue of increasing R&D investments in Norwegian companies and strengthening innovation activities. During the last decade we have seen a steady increase in public support to business R&D and a number of new support mechanisms. At the same time, and especially in the most recent years, business R&D has shown a stronger growth than in most other European economies. From 2013 to 2014, R&D in the Norwegian business enterprise sector (including technical industrial research institutes) increased by 8.7 % compared to 2.6% in EU28 and 1.5% in Denmark and Sweden. During the last decade (2005-2014) total growth in Norwegian business R&D has been fairly the same as in EU28.

Recent surveys also demonstrate that innovation activities are increasing and may have been underestimated in the past. Nevertheless, R&D intensity measured in proportion of value added remains relatively low, which calls for continued action and policy engagement.

A thorough analysis of the effects of public support to business R&D was recently presented in a broad evaluation of the core innovation instruments under RCN, Innovation Norway and GIEK/Export Credit (Statistics Norway, 2016). The analysis was conducted by Statistics Norway and included also the effects of the Norwegian R&D tax incentive scheme Skattefunn, which is jointly managed by RCN and Innovation Norway.

In general, the evaluation finds positive effects for all types of instruments on one or several indicators of growth in value creation, sales income or number of employees. The results also indicate that the effects become stronger as the amount of support increases, see box 1 for a further summary of main findings.

Box 1 The effects of public support to value creation and innovation

In 2014, the Norwegian Ministry of Trade and Fisheries commissioned an evaluation of the effects of government support measures aimed at promoting value creation and innovation. The analysis was conducted by Statistics Norway, and the final report was delivered in April 2016.

Scope of the evaluation

The analysis included a selected set of central public support mechanisms managed by four different public agencies. The concrete support mechanisms evaluated were

innovation and industry oriented support mechanisms under *the Research Council of Norway (RCN)* (limited to RCN-instruments oriented towards the private sector or joint projects between private firms and research institutions)

innovation-oriented policy instruments under the national innovation agency *Innovation Norway* (IN)

the tax incentive scheme, *Skattefunn*, jointly managed by RCN and IN

export supporting programs managed by the Norwegian Export Credit Guarantee Agency (GIEK) and Export Credit Norway.

Although a number of other mechanisms contribute to support business R&D and innovation in Norway, the instruments which were subject to the evaluation constitute the most central and targeted instruments in this respect. Excluding export support, the funding mechanisms accounted for a total public support of more than 6000 mill. NOK in 2013, which corresponds to nearly 23% of total R&D performed in the business enterprise sector that year.

Approach and methodology

The evaluation analyzed profitability and growth in sales, value added, employment and productivity in firms that received support from IN, RCN or SKF during the period 2001-2013. These effects were compared with a control group of firms that had not received such support. Furthermore, the evaluation calculated the return on R&D investments for firms, which receive government support, and compared it with the return on R&D for firms without any public R&D-support. The evaluation also investigated the impact of government support on the propensity to patent, and the effect of export guarantees and export credit on export.

Main findings

The evaluation finds positive effects for both IN, RCN and SKF on one or several indicators of growth in value creation, sales income or number of employees, and the effects become stronger as the amount of support increases. However, the findings do not necessarily reflect a causal relationship. Even when controlling for potential sources of bias, it is not possible to control for every unobservable factor that simultaneously may affect both the probability of receiving support and the outcome variables.

The most significant effects are found for the group of projects which receive government support above 1.5 million NOK. The effects are weaker or none for support allocations below 500 000 NOK. Neither does the evaluation find positive effects on return to total assets or productivity for firms receiving support compared with the control group. The return on R&D investment in firms receiving government support is lower than the return on R&D that is entirely privately financed. This is consistent with the fact that government support is channeled to projects assumed to have positive effects beyond the purely commercial. The results show that both tax deductions (SKF) and direct subsidies from RCN and IN lead to more patents in Norwegian firms. In addition, the analysis finds positive effects of export financing on Norwegian export. The results indicate that export financing contributes to growth in value creation in the business sectors that use government support schemes intensively.

In general, there seems to be little evidence of clear gaps and shortages in the policy mix for support to business R&D. Access to finance for startups also seems to be generally good. The challenge is often the lack of patient and competent private capital in the early growth phases, the so called "valley of death". Another challenge seems to be the will and culture to become entrepreneurs among academics. Furthermore, the relatively low recruitment of students and PhDs to science and engineering (STEM) has been raised as weakness in terms of paving the ground for future industry development. Recent data shows, however, that the STEM subjects are experiencing increased recruitment. The question is also whether excellence in these subjects is the only way ahead for developing future growth in the Norwegian business sector.

6. Conclusions

6.1 Structural challenges of the national R&I system

Despite a long period of economic growth and increased R&D investments, there is broad political agreement that Norway needs to develop more knowledge and R&D intensive companies in order to prepare for "life after oil". The recent steep decline in oil prices has brought the need for structural change on top of the political agenda. A concrete challenge is how to reorient engineers and other high skilled workers from the petroleum and offshore industries to other areas.

The Norwegian higher education sector has been characterized by a large number of institutions, many of which with small number of students and low R&D capacity. This has raised concerns regarding the quality of higher education and research at some of the smallest institutions and a general risk of too much overlap within the national system.

Another recurrent issue of debate is the role of research institutes and the need for consolidation within this sector. This relates to a larger discussion of the division of labour in the entire R&D and innovation system. Some argue that the large institute sector constitutes a strength and a bridge between R&D activities and users in industry and public sector. Others are worried that research institutes create a barrier between academia and the same users.

Much attention is also devoted to Norwegian participation and success in the Horizon 2020 programme. As an associate EEA-EFTA country, Norway's annual contribution appears as a specific budget allocation to Brussels, amounting to almost €250 mill. or 7% of the total public R&D budget. Hence, achieving a satisfactory knowledge and financial return has high priority. This raises in turn a question of how far national priorities should go in aligning national strategies with EU priorities.

Finally, the sector principle has long been an issue of debate. The principle implies that virtually all 15 ministries are involved in steering and funding of R&D for their own sectors. Although most funding is concentrated around a handful of ministries, this constitutes a considerable challenge in terms of governance and coordination. This challenge is also transferred to the strategic level, where the Research Council of Norway is somehow "caught in the middle", serving different sector interests while providing R&D funding to a broad range of research performers, from individual researchers to large scale projects in all disciplines.

6.2 Meeting structural challenges

The structural challenges mentioned above have all been met with various forms of policy action:

As mentioned in chapter 5 above, Norway has established a broad portfolio of both direct and indirect measures to increase R&D in Norwegian firms. The 2016 fiscal budget sets out a rather expansive economic policy with a declared aim to promote employment, growth and structural adjustment in the Norwegian economy. The budget includes i.a. a specific package of additional temporary support mechanisms to counter the immediate effects of rising unemployment in the oil and gas sector. These plans have a strong focus on strengthening higher education and research, including increased allocations to the structural work and the university merging processes, new recruitment positions, increased allocations to user driven research and thematic research programmes, strengthened support to commercialisation of publicly funded R&D as well as an extension of the R&D tax incentive scheme. The increased R&D allocations constitute in total a real growth of 4.1% from 2015. This will probably bring the total public R&D funding to just above the declared target of 1% of GDP.

In 2014, the Government initiated a process for structural reform in the higher education system. The reforms were part of a broader agenda of which the overarching goal is to

achieve higher quality in research and education. During 2014, all universities and university colleges have been invited to consider how they would position themselves in a landscape with fewer institutions and clearer expectations regarding academic standards. Based on this process, as well as a parallel internal process in the Ministry of Education and Research, a White paper on the future university structure was presented in March 2015 (Ministry of Education and Research, 2015). The paper outlines a new institutional map with a number of concrete mergers to be implemented from 2016, (see also chapter 2.1).

The consolidation process in the higher education sector also opens up for strategic cooperation and mergers with research institutes. The need for consolidation in the research institute sector has so far been more implicit. Most research institutes are also private foundations which cannot be merged or reorganised without their consent. A new support mechanism has been introduced to provide financial support to research institutes which engage in concrete processes of mergers or strategic alliances with other institutes. Furthermore, the Research Council of Norway has initiated a systematic evaluation process, where all four groups of institutes receiving public basic funding (in total close to 50 entities) will be evaluated during the period 2015-2017. There is reason to expect that possible broad systemic changes affecting research institutes will be seen on the background of the whole evaluation process.

As for the participation in the EU framework programmes/Horizon 2020, the government has set the goal of increasing Norway's total economic return from Horizon 2020 to 2% of total competitive funding in the programme, up from 1.67% in the previous 7th framework programme. This ambition is followed by a number of concrete measures and support mechanisms, including i.a. increasing the so-called STIM-EU scheme, which is a scheme designed to motivate institutes to maintain and strengthen their participation in EU-projects. The strategy also calls for better alignment and harmonization of national instruments and priorities with those set by the Horizon 2020 and the ERA agenda.

As explained in chapter 1, the Ministry of Education and Research is responsible for the inter-ministerial coordination of national research policy, while The Ministry of Trade, Industry and Fisheries is officially responsible for coordinating national innovation policy. As previous cabinet research committees in both areas have been dissolved, coordination of R&D and innovation policies is an issue for the whole government. The Long term plan for research and higher education, described in chapter 2, is also meant to serve as a coordination mechanism. Furthermore, a series of high level meetings between government and different stakeholders has been introduced to facilitate discussions and coordination of overarching issues in the areas of R&D and innovation. Nevertheless, there is reason to say that R&D and innovation policies in Norway are characterised by pluralism and strong involvement of sector interests.

Annexe 1 – References

Benner, M. and Öquist, G. (2014) 'Room for increased ambitions? Governing Breakthrough Research in Norway 1990-2013: Report to the Research Council of Norway'. Research Council of Norway, Oslo.

Bergem B., Bremnes H and Hervik A (2015) Resultatmåling av brukerstyrt forskning 2013. Møreforskning, rapport nr. 5017, Molde 2015

Cappelen, Ådne et al. (2016) 'Innovasjons- og verdiskapningseffekter av utvalgte næringspolitiske virkemidler'. Report 12, 2016. Statistics Norway, Oslo/Kongsvinger.

CBC Netherlands Bureau of Eoonomic Policy Analysis (2014) 'A Study of R&D Tax Incentives'. European Commission.

DAMVAD (2012) Evaluering av basisfinansieringen til norske forskningsinstitutter som omfattes av retningslinjene for basisfinansiering, DAMVAD, Oslo, 2012

European Commission (2015) EU Innovation Scoreboard 2015. Publications Office of the European Union, Luxembourg.

Hægeland T. et al (2015) Finansiering for Kvalitet, mangfold og samspill – nytt system for finansiering av universiteter og høyskoler. Sluttrapport fra ekspertgruppe, MER/Kunnskapsdepartementet, 2015

Ministry of Education and Research (2009) Climate for research – white paper on research 2009– St.meld. nr. 20 (2008-2009). Mer, Oslo 2009.

Ministry of Education and Research (2012) Long-term perspectives – knowledge provides opportunity. White paper on research 2012. Meld. St. 18 (2012–2013). Oslo.

Ministry of Education and Research (2014a) Long-term plan for research and higher education 2015–2024. Meld. St. 7 (2014-2015). Oslo.

Ministry of Education and Research (2014b) Strategy for research and innovation cooperation with the EU Horizon 2020 and ERA, MER 2014 Oslo.

Ministry of Education and Research (2014c) Forskningsbarometeret 2014. ("Research Barometer 2014".) Oslo.

Ministry of Education and Research (2015a) Prop 1 S (2015-2016) The state budget 2016, Oslo 2015.

Ministry of Education and Research (2015b) Konsentrasjon for kvalitet: strukturreform i universitets- og høyskolesektoren. ("Structural reform in the higher education sector") Meld. St. 18 (2014–2015). Oslo.

Ministry of Education and Research (2015c) 'The Panorama Strategy'. Oslo.

Ministry of Finance (2013) Perspektivmeldingen 2013. ("Long-term perspectives on the Norwegian Economy 2013".) Meld. St. 12 (2012–2013). Oslo.

Ministry of Finance (2015) Productivity: Underpinning Growth and Welfare: The First Report of the Productivity Commission. Official Norwegian Report (NOU) 2015:1. Oslo

Ministry of Finance (2016) At a Turning Point: From a Resource-Based Economy to a Knowledge Economy: The Second Report of the Productivity Commission. Official Norwegian Report (NOU) 2016: 3. Oslo

Ministry of Local Government and Administration (2006): St.meld. nr. 12 (2006-2007) Regional fortrinn – regional framtid.

Ministry of Local Government and Administration (2016): Meld.St. nr. 22 (2015-2016) Nye folkevalgte regioner – rolle, struktur og oppgaver

Ministry of Trade Industry and Fisheries (2009) St.meld. nr. 7 (2008-2009) Et nyskapende og bærekraftig Norge, MTIF, Oslo, 2009

Ministry of Trade Industry and Fisheries (2015a) Regjeringens grunderplan, Gode ideer – nye arbeidsplasser, MTIF, Oslo, 2015

Ministry of Trade Industry and Fisheries (2015b) Maritime Opportunities – Blue Growth for a Green Future - The Government's maritime strategy, Oslo 2015

OECD (2006) OECD Economic Surveys: Norway 2006. OECD Publishing, Paris.

OECD (2008) OECD Reviews of Innovation Policy: Norway. OECD Publishing, Paris.

Research Council of Norway (2012) 'Tools for Research – Part I: Norway's national strategy for research infrastructure 2012–2017'. Oslo.

Research Council of Norway (2015) Report on Science and Technology Indicators for Norway. Oslo.

Spilling, Olav et al. (2015) 'Virkemiddelapparatet for kommersialisering av forskning – Status og utfordringer'. NIFU Report 18/2015. NIFU, Oslo.

Technopolis (2012) 'A Good Council? Evaluation of the Research Council of Norway'. Technopolis Group, Brighton.

Technopolis (2013) 'Impact evaluation of the Research Council of Norway's support measures to increase participation in EU-funded research'. Technopolis Group, Brighton.

The Norwegian Association of Higher education institutions/UHR (2015) Bedre karrierepolitikk for vitenskapelig personale i UH-sektoren – rapport fra en arbeidsgruppe nedsatt av UHR, Oslo 2015

Thune et al (2012) PhD education in a knowledge society: An evaluation of PhD education in Norway. NIFU Report 25-2012

Thune et al. (2014) 'Noder i kunnskapsnettverket'. NIFU Report 23/2014. NIFU, Oslo

Annexe 2 - Abbreviations

FME – The Centre for Renewable Energy Research scheme (forskningssentre for fornybar energy)

FRIPRO - The Scheme for Independent Research Projects (Fri prosjektstøtte)

IN – Innovation Norway (Innovasjon Norge)

MER – the Ministry of Education and Research (Kunnskapsdepartementet)

MTIF - The Ministry of Trade, Industry and Fisheries (Nærings- og fiskeridepartementet)

NOKUT - The Norwegian Agency for Quality Assurance in Education (NOKUT)

RCN – the Research council of Norway (Norges forskningsråd)

SFF – The Centre of Excellence Scheme (Sentre for fremragende forskning)

SFI – The Centres for Research-based Innovation scheme

SIVA - Industrial Development Corporation of Norway (Selskapet for industrivekst)

Annexe 3 -List of Tables

Annexe 4 - List of the main research performs

List the top 10 R&D performers (public based on publications & private sector based on R&D expenditures

Top 10 Higher education institutions	No. publications 2014
University of Oslo (UiO)	5 356
Norwegian University of Science and Technology (NTNU)	3 748
University of Bergen (UiB)	2 912
The Arctic University of Norway (UiT)	1 720
Norwegian University of Life Sciences (NMBU)	1 022
University of Agder	705
Oslo and Akershus University College of Applied Sciences	678
University of Stavanger	618
Buskerud and Vestfold University College	411
Bergen University College	285
Top 10 Research institutes (public and private)	No. publications 2014
Stiftelsen SINTEF	628
Folkehelseinstituttet	505
Uni Research AS	314
Havforskningsinstituttet	245
Norsk institutt for naturforskning	201
SINTEF Energi AS	198
Bioforsk	177
Nofima	161
Norsk institutt for vannforskning	132
Norges Geotekniske Institutt	128
Top 10 Research companies (public and private)	R&D expenditure MEUR 2015
Note: For reasons of confidentiality R&D expenditure by company are not published in Norwegian R&D statistics. Data below are extracted from "EU Industrial innovation R&D Scoreboard 2015 : World - 2500 companies ranked by R&D"	
Statoil	332,6
DnB (bank)	131,6
Kongsberg (industry)	99,2
VISMA	89
Aker Solutions (industry/offshore)	83,4
TELENOR	74,8
Hydro	46,3
PGS	44,5
ORKLA	28,4
TOMRA	26,6

Annexe 5 - List of the main funding programmes

The list below contains only competitive programmes and open calls. Institutional funding, which accounts for more than half of all public R&D-funding, is not included here.

Name of the funding programme	Timeline	Budget 2015	Target group
Main types of programmes under RCN			
User oriented innovation programmes (including BIA)	running	1179 mill NOK (annually)	Companies and R&D institutions
Large Scale programmes	running	1535 mill NOK (annually)	R&D institutions and companies
User oriented programmes	running	954 mill NOK (annually)	R&D institutions and users
FME (Centres for Environment-friendly Energy Research)		190 mill NOK (annually)	Companies and R&D institutions
SFF - Centers of excellence		290 mill NOK (annually)	Universities and some research institutes
SFI – Centers of research based innovation		200 mill NOK annually	R&D institutions and companies
Basic research programmes, Infrastructure and institutional support		455 mill NOK annually	Universities and some research institutes
FRIPRO - Open arena for basic research		1000 mill. NOK (annually)	Universities and some research institutes
Programmes under Innovation Norway			
National start-up grants		200 mill. NOK (annually)	Companies
Environment technology scheme		350 mill. NOK (annually)	Companies and R&D institutions
OFU/IFU - Public and Industrial research and development contracts		543 mill. NOK (annually)	Public sector and R&D institutions
Skattefunn – tax deduction scheme		1500 mill. NOK (estimated annual tax deduction)	Companies (mostly SME)

Annexe 6 - Evaluations, consultations, foresight exercises

- Comprehensive evaluation of major business oriented R&D and innovation support mechanisms (2016): Cappelen, Ådne et al. (2016) 'Innovasjons- og verdiskapningseffekter av utvalgte næringspolitiske virkemidler'. Report 12, 2016. Statistics Norway, Oslo/Kongsvinger.
- Evaluation of the Environment technology development scheme (2014): Espelien, A. et al. (2014): 'Veien fra FoU til marked: evaluering av miljøteknologiordningen. Publikasjon 10/2014. Menon, Oslo,
- The Ministry of Finance's general analysis and projections for the Norwegian society and Economy (2013): Ministry of Finance, Perspektivmeldingen 2013. Meld. St. 12 (2012–2013). Oslo.
- Analysis and recommendations from the Norwegian Productivity Commission (2015-2016):

o Ministry of Finance (2015) Productivity: Underpinning Growth and Welfare: The First Report of the Productivity Commission. Official Norwegian Report (NOU) 2015:1. Oslo

o Ministry of Finance (2016) At a Turning Point: From a Resource-Based Economy to a Knowledge Economy: The Second Report of the Productivity Commission. Official Norwegian Report (NOU) 2016: 3. Oslo

- Evaluation of the Norwegian the Norwegian centre of excellence scheme: Langfeldt, Liv et al. (2010) 'The Norwegian Centre of Excellence Scheme: Evaluation of Added Value and Financial Aspects'. Research Council of Norway, Oslo.
- Bergem B., Bremnes H and Hervik A (2015) Resultatmåling av brukerstyrt forskning 2013. Møreforskning, rapport nr. 5017, Molde 2015
- Evaluation of the Norwegian the Scheme for Independent Research Projects (FRIPRO): Langfeldt, Liv et al. (2012) 'Evaluation of the Norwegian Scheme for Independent Research Projects (FRIPRO)'. NIFU Report 8/2012. NIFU, Oslo.
- OECD (2008) OECD Reviews of Innovation Policy: Norway. OECD Publishing, Paris.
- OECD (2016) OECD Economic Surveys: Norway 2016. OECD Publishing, Paris.
- Office of the Auditor General (2012) 'The Office of the Auditor General's investigation of the Ministry of Education and Research's coordination of research policy'. Document 3:3. Oslo.
- Oxford Research (2012) 'Mer av det gode: evaluering av forsknings- og utviklingskontrakter/ OFU/IFU-programmet'. Kristiansand.
- Research Council of Norway (2015) 'Midway evaluation of seven Centres for Research-based Innovation (SFI-II)'. Oslo.
- Research Council of Norway (2016) 'Evaluation of Norwegian Technical Industrial Research Institutes: Principle report'. Oslo.
- ScienceMetrix (2013) 'Bibliometric Study in Support of Norway's Stategy for International Research Cooperation'. Brussels, Montreal, Washington.
- Spilling, Olav et al. (2014) 'Høyskolenes rolle i regional utvikling, innovasjon og kommersialisering'. NIFU Report 40/2014. NIFU, Oslo
- Spilling, Olav et al. (2015) 'Virkemiddelapparatet for kommersialisering av forskning – Status og utfordringer'. NIFU Report 18/2015. NIFU, Oslo.
- Technopolis (2012) 'A Good Council? Evaluation of the Research Council of Norway'. Technopolis Group, Brighton.

- Technopolis (2013) 'Impact evaluation of the Research Council of Norway's support measures to increase participation in EU-funded research'. Technopolis Group, Brighton.
- Technopolis (2015). 'Impact analysis of the technical-industrial research institutes in Norway'. Technopolis Sweden (Faugert & Co Utvärdering AB).

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