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A Good Council?

Evaluation of the Research Council of Norway

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Preface

This evaluation of the Research Council of Norway (Norges Forskningsråd) has been undertaken under a contract to the Royal Norwegian Ministry of Education and Research (KD) by a team from Technopolis, the Universities of Leiden (CWTS) and Manchester (MIoIR), and from NIFU and SSB in Norway. Our panel of expert advisors served as an internal sparring partner for the team and comprised

- Prof em, Irwin Feller, Penn State University
- Prof Stefan Kuhlmann, University of Twente
- Prof Marja Makarow, Vice President for Research of the Academy of Finland, former Chief Executive of the European Science Foundation
- Prof Ben Martin, SPRU, Sussex University
- Dr Dorothea Sturn, Director General of the Austrian research council, FWF

During the work, we have received constant and friendly help from RCN, especially Finn Simonsen and Tone Vislie, who were appointed to be our main points of contact, as well as the rest of the management and staff. Arvid Hallén went out of his way constantly to be available to us.

KD kindly organised a reference group to help us as the work progressed, comprising Arne Benjaminsen, FKD; Carl Gjersem, NHD; Gunnar Jordfald, FFA; Keith Smith, BIS; Bente Lie, KD; Sigmund Grønmo, UiB; Hjordis Møller Sandborg, HOD; Tore Li, NHO; Tone Westlie, AD; Kari Balke Øiseth, KD; Geir Arnulf, KD; Sidsel Aarnæs Arbo, KD; Asgeir Fløtre, KD.

We have interviewed something over 200 people as well as running surveys. We are grateful to all the people who contributed for their helpful and friendly support. We hope our report justified they effort they put in and will be of use in the next chapter of RCN's development. While various people have kindly checked and commented on our work, naturally the final responsibility for it (including eventually any mistakes) rests with the authors.

Erik Arnold and Bea Mahieu
Brighton 31 August 2012, for the evaluation team

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Sammendrag

Norges forskningsråd skiller seg fra tilsvarende organisasjoner i andre land ettersom rådet både finansierer forskning ved universiteter og institutter og samtidig støtter forskningsdrevet innovasjon i næringslivet. En annen av rådets hovedoppgaver er å være regjeringens rådgiver i forsknings- og innovasjonspolitiske spørsmål. Forskningsrådet skal også fungere som møteplass for aktører og interessegrupper innen forskning og innovasjon.

Forskningsrådet ble opprettet i 1993. Et hovedformål var å redusere fragmenteringen i finansieringen av forskning og innovasjon, og å legge til rette for en mer koordinert forsknings- og innovasjonspolitikk. Den første evalueringen av Forskningsrådet i 2001 konkluderte med at samordningen av flere funksjoner i ett råd ga en unik mulighet til å samordne og integrere forskning og innovasjon. Men evalueringen fant samtidig at denne muligheten ikke var godt nok utnyttet. Organiseringen internt i Forskningsrådet videreførte langt på vei den tidligere inndelingen i flere forskningsråd. Eksternt var rådet overstyrt, med finansiering og styringssignaler fra 16 ulike departementer. Dette kombinert med begrensete «strategiske» ressurser gjorde at rådet hadde lite rom til å håndtere og være pådriver for endringer. Som svar på evalueringen ble Forskningsrådet omorganisert. Regjeringen hadde da allerede adressert problemet med manglende strategiske ressurser gjennom opprettelsen av Fondet for forskning og nyskaping. Styringen av fondet var lagt til kirke-, utdannings- og forskningsdepartementet (nå Kunnskapsdepartementet), og fondet var ment som et virkemiddel for å støtte langsiktig forskning og prosjekter på tvers av departements- og sektorgrenser. Gjennom den siste tiårsperioden har fondet bidratt til å finansiere en rekke nye initiativer i regi av Norges forskningsråd, blant annet opprettelsen av nye sentra ved norske universiteter og høyskoler og nye store forskningsprogrammer for å adressere nasjonale mål og behov. Fondet har også finansiert andre forsknings- og innovasjonsaktiviteter, blant annet norsk kontingent for deltakelse i EUs rammeprogrammer for forskning og teknologisk utvikling.

Hovedkonklusjonen i denne evalueringen fra 2011-12 er at Forskningsrådet nå fungerer godt og kan fortsatt gjøre det, forutsatt at man evner å balansere departementenes sektorinteresser med kollektivets samlede behov og interesser. En slik balanse vil kreve en kontinuerlig avveining mellom sektorinteresser og strategiske ressurser.

Norges resultater innenfor innovasjon og forskning

Det norske velferds- og inntektsnivået er blant verdens høyeste. Dette innebærer at lønninger og andre innsatsfaktorer er svært høye og Norge har større muligheter til å konkurrere på kunnskap enn på pris. Sammenlignet med andre land investerer Norge lite i forskning og utviklingsarbeid (FoU) som andel av BNP. Samtidig er store deler av økonomien teknologibasert og teknologiintensiv. Målt per innbygger er norske FoU-utgifter på et høyt internasjonalt nivå, men bak ledende land som Sveits og USA og de nordiske nabolandene. Norsk næringsliv investerer fortsatt lite i FoU sammenlignet med næringslivet i andre land.

Publiserings- og siteringsdata viser at norske forskningsresultater holder et godt nivå, uten å være blant de aller beste. Generelt er forskningsrådsfinansiert forskning bedre og mer synlig enn forskning med annen type finansiering, men dette gjelder ikke alle fagfelt. Innenfor enkelte områder skårer norsk forskning høyt, men det er få felt hvor Norge virkelig er verdensledende. En annen indikator som viser relativt beskjedne resultater av norsk forskning er det lave antall stipend finansiert av det nye Europeiske forskningsrådet (ERC) som har blitt tildelt norske forskere.

En stor og ressurskrevende råvareproduserende sektor tiltrekker seg gjerne både oppmerksomhet, kapital og arbeidskraft som kan føre til et økt kronekurs, noe som igjen kan gjøre det vanskelig for andre deler av økonomien å konkurrere internasjonalt. Dette vanskeliggjør konstante omstilling og fornyelse som er nødvendig i alle deler av økonomien. Andelen innovative foretak i norsk industri viser en langsom nedadgående tendens, mens oppstartstakten blant nye, forskningsbaserte bedrifter er langsom og utenlandske investeringer er lave med få impulser til endring. Næringslivets evne til fornyelse virker således for lav til å konkurrere på bakgrunn av kunnskap. Fornyelse innenfor forskningssystemet er minst like viktig, ikke bare som støtte for næringslivet og for å takle vår tids store utfordringer som klimaendringene, men også ut fra en sosial og kulturell begrunnelse.

Behovet for et solid kunnskapsgrunnlag kombinert med kontinuerlig omstilling og fornyelse betyr at forsknings- og innovasjonssystemet må fylle to roller. Den ene er å være en «aggregerings-maskin» som velger ut de beste prosjektene til finansiering og som reflekterer eksisterende samfunnsbehov, ikke minst slik departementene uttrykker dem på vegne av samfunnssektorene de representerer. Den andre rollen er å være «endringsagent», å støtte fornyelsesprosessen ved å fremme endring og innovasjon i vitenskapen og industrien. Dette er en vanskelig oppgave. En organisasjon som Norges forskningsråd må arbeide systematisk og samtidig kunne sprenge grenser.

Forskningsrådets resultater

Norges forskningsråd er del av et sammenvevd norsk policy-system. Mennesker og organisasjoner er i hyppig dialog, og Forskningsrådet er underlagt departementenes overordnede beslutninger og føringer, og arbeider slik ikke alene. Gjennom det siste tiåret har Forskningsrådet oppnådd betydelige resultater. Noen av disse følger av en generell omlegging av forsknings- og innovasjonssystemet initiert av myndighetene for å øke offentlige forskningsinstitusjoners autonomi. En del resultater avhenger dermed mer av generelle incentiver enn av spesifikke kvalitetstiltak. Resultatene omfatter

- Bidrag til utvikling av en rekke nasjonale forskningsstrategier – som på overordnet nivå kommer til uttrykk i Stortingsmeldinger, i strategier for enkelt-departementer og grupper av departementer og i Nordområdestrategien.
- Bidrag til koordinering av den nasjonale forskningsinnsatsen gjennom å slå sammen flere forskningsprogrammer og utvikle programmer som svarer på behovene til flere departementer.
- Økning av andelen midler til forskning og innovasjon som ikke er tematisk styrt, og dermed en bedre balanse mellom forskerinitierte prosjekter og innsats initiert av andre samfunnsinteresser.
- Bidrag til fornyelse, økt kvalitet og mindre fragmentering i forskningssystemet gjennom senterordninger – SFF, SFI og FME – og gjennom etablering av Store programmer.
- Utviklet virkemidler som fremmer fornying, herunder Nærings-PhD og Yngre fremragende forskere (YFF).
- Redusert fragmentering ved å legge mer vekt på å finansiere grupper og samarbeid og mindre vekt på individstøtte.
- Økt den internasjonale deltakelsen i norsk forskning og støttet norsk deltakelse i internasjonalt samarbeid, spesielt gjennom EUs rammeprogrammer for forskning og teknologisk utvikling hvor Norge er en høyt respektert deltaker selv uten å være en medlemsstat.
- Utviklet og iverksatt en strategi for store forskningsinfrastrukturer.
- Bidrag til utvikling og iverksetting av et system for resultatbasert finansiering for instituttsektoren.

- Utviklet og vedlikeholdt systemer for god og effektiv søknadsbehandling og administrative prosesser som er i tråd med god internasjonal praksis.

I flere fall har Norges forskningsråd sammen med KD fungert som en endringsagent i forskningssystemet. Store endringer slik som senter-ordningene og Store programmer er i stor grad iverksatt ved hjelp av Fondet for forskning og nyskaping. Dette understreker betydningen av strategiske ressurser for å fornye forsknings- og innovasjonssystemet.

Forskningsrådets rådgivningsfunksjon

Forskningsrådet er en viktig leverandør av forskningspolitiske råd til regjeringen. Det produserer både kunnskapsgrunnlag som basis for strategidannelse og råd i form av policyforslag.

Forskningsrådet bidrar til å skape og publisere kunnskapsgrunnlag for forskningspolitikk gjennom en rekke forskjellige studier som instituttsundersøkelsen og indikatorrapporten som legges frem hvert år. Rådet er i ferd med å øke og forbedre bruken av interne datakilder om sin finansieringsportefølje. Forskningsrådet har en stor og bred kontaktflate gjennom sine møteplasser, som det bruker for å støtte planlegging og design av programmer. Fra 2004 tok Forskningsrådet i en periode i bruk foresight, som er en måte å finne frem til andre perspektiv og visjoner enn de man får fra interessenter. Dette er en sunn måte å begrense risikoen for at interessentenes lokale synspunkter leder til innlåsning. I dag skapes flere store forskningsstrategier på departementsnivå. Det er viktig fortsatt å bruke foresight og å involvere utlendinger i disse prosessene for å hente inn alternative perspektiver.

Forskningsrådet har en sterk fagevakueringstradisjon og er i ferd med å øke bruken av programevalueringer. Men det brukes for få ressurser på evaluering i det hele tatt, særlig i henhold til å undersøke effektene av egne virkemidler og tiltak. Evaluering er ikke enda systematisk festet i Forskningsrådets planleggingsrutiner.

Forskningsrådet bidrar i utviklingen av departementenes forskningsstrategier gjennom den årlige budsjettdialogen og leverer ofte større bidrag til produksjonen av forskningsmeldinger og andre strategier på nasjonalt nivå. KD skal koordinere forskningspolitikk på departementsnivå og har tatt ansvar for å finansiere mange forskjellige typer av forskning. Men KD kan ikke bestemme hva andre departement skal gjøre. At det ikke finnes en koordineringsinstans på høyere nivå, så som det finske Rådet for forsknings og innovasjon, gjør det vanskelig å skape en forpliktende nasjonal forskningsstrategi og øker de interne koordineringskostnadene i Forskningsrådet.

Forskningsrådet har strategisk ansvar for instituttsektoren og har tidligere evaluert dem systematisk og regelmessig. Det bidro til det nye resultatbaserte finansieringssystemet for instituttene, som ikke enda er implementert fullt ut. Insentivene for fornyelse og restrukturering i instituttsktoren er fortsatt svake og få departement synes å være opptatt av instituttpolitikk. At Forskningsrådet nå stort sett ikke lenger bestiller instituttevalueringer betyr at hverken instituttene selv eller andre får et godt overblikk av instituttene som organisasjoner. I andre land som har innført resultatbasert forskningsfinansiering som bygger sterkt på tellekanter har man erfart at disse kan lede til perverse effekter og innlåsninger. Vi ville derfor heller se en blanding av resultatmåling og skjønn utført av en eller flere kompetente eiere av grupper av institutter enn at instituttsektoren behandles som ett kvasi- marked. Men i dag henger instituttsektoren mellom det gamle (tannløse) evalueringssystemet og et resultatbasert system som ikke fullt er implementert. Dette er ikke tilfredsstillende.

Organisering og styring

Forskningsrådet rapporterer til 16 departementer og har et bredt ansvarsområde som omfatter hele forskningssystemet. Rådet er dermed pålagt tunge organisatoriske og administrative oppgaver. Disse oppgavene blir ytterligere mer krevende ved at forsknings- og teknologifeltet blir stadig mer komplekst, og at problemer på tvers av

fag og sektorer får økende betydning. Samtidig må Forskningsrådet forholde seg til et stort antall interessegrupper.

Forskningsrådet ble omorganisert etter den første evalueringen og på nytt i 2010. Omorganiseringen i 2010 var hensiktsmessig og vel gjennomført. Forskningsrådet er fortsatt en kompleks organisasjon, men dette henger i stor grad sammen med at rådet har 16 eiere. Den nye organiseringen har svart på behovet for mer tematisk og faglig ekspertise i divisjonsstyrene, og har lagt et grunnlag for at Forskningsrådet kan styrke sin rolle når det gjelder utforming av nasjonale forsknings- og innovasjonsstrategier. Ledelsen i linjen er styrket ved å redusere overlapp mellom divisjonene, samtidig som strukturen i Forskningsrådet nå framstår som mer transparent. Men omorganiseringen har etterlatt for lite analysekapasitet sentralt i organisasjonen. Dette er noe Forskningsrådet trenger hvis det skal spille en sentral rolle som forskningspolitisk rådgiver og pådriver for endring. En nylig opprettet analysegruppe i direktørens stab er ment å fylle denne rollen.

Forskningsrådet har tre styringsnivåer: Hovedstyret, divisjonsstyrene og programstyrene. Enkelte medlemmer av Hovedstyret og divisjonsstyrene uttrykker frustrasjon over at beslutningsmakten er begrenset gjennom de detaljerte føringene fra de 16 departementene. Etter vårt syn er alle de tre styringsnivåene nødvendige (hovedstyre, divisjons- og programstyrer) . Den nye organiseringen bør styrke den strategiske funksjonen til de to øverste styrene – særlig hvis styrene blir understøttet av mer uavhengig analysearbeid.

Forskningsrådets administrasjonsutgifter har gått ned fra 8 prosent av totalbudsjettet i 2003 til 7 prosent i 2010. Samtidig med denne effektiviseringen har det vært en rasjonalisering i antall programmer og virkemidler (fra 229 til 178), mens gjennomsnittlig størrelse på hvert prosjekt har økt med om lag 10%. Det er gjort betydelige investeringer i ny informasjonsteknologi og standardisering av søknads- og behandlingsprosessene. Forskningsrådet har også styrket rutinene for behandling av habilitetssaker og andre konfliktsaker.

Forskningsrådet har gjort betydelige forbedringer av kvalitet og effektivitet i søknadsbehandlingen. Disse prosessene er nå så åpne som de kan være og på nivå med god internasjonal praksis. Bibliometriske undersøkelser viser at forskere med finansiering fra Forskningsrådet skårer generelt høyere på sitering enn forskere som har fått avslag på sine søknader. Forskere med mye støtte fra Forskningsrådet skårer også høyest på sitering. I likhet med andre forskningsråd bør Norges forskningsråd se nærmere på hvordan de skal håndtere søknader som går på tvers av disipliner og som søker å sprenge grenser.

Innvilgelsesprosenten varierer mye mellom de ulike programmene. Den er særlig lav innen FRIPRO, av to grunner. For det første er det innenfor dette programmet en mindre, men likevel betydelig andel svake søknader som vi mener søkernes institusjoner burde ha luket ut. For det andre mottar programmet langt flere søknader med høy kvalitet enn det er ressurser til å innvilge.

Måten departementene styrer Forskningsrådet på er et sentralt spørsmål for denne evalueringen. Generelt er forholdet mellom eiere, i dette tilfellet departementene, og underliggende organ, i dette tilfellet Forskningsrådet, forbundet med betydelige styringsutfordringer. Gjensidig tillit mellom eier og underlagt organ samt klarhet om hva som er målene kan bidra til å redusere disse styringsutfordringene. Et organ med flere eiere har et særskilt krevende tillitsforhold, ettersom eierne vil unngå at "deres bevilgninger" blir brukt til å tjene andre eieres interesser. Det er dermed en fare for at eierne "overstyrer" organet og på den måten gjør det mindre effektivt. I praksis er styringsdialogen mellom Forskningsrådet og de ulike departementene preget av åpenhet og tillit, og noen departementer har av den grunn valgt å kanalisere en større del av forskningsbevilgningene sine gjennom Forskningsrådet. Dialogen ser også ut til å være mer toveis enn tidligere. Selv om detaljstyring "låser inn" Forskningsrådet, er det ikke bare departementene som bidrar til dette – Forskningsrådet har også en interesse av å få detaljerte føringer som forplikter departementene.

Forholdet til Kunnskapsdepartementet (KD) omfatter mer enn eierskap. Departementets ansvar går langt utover utdanningsdepartementenes tradisjonelle ansvar for å ivareta grunnforskning. Kunnskapsdepartementet fungerer i større og større grad som et "vitenskapsdepartement" med ansvar for forskning i hele systemet. Kunnskapsdepartementet, det tidligere Forskningsfondet og den nye budsjettposten som erstatter fondet utgjør de viktigste mekanismene for å håndtere systemsvikt. Slik systemsvikt kan blant omfatte strukturelle forhold, behov for kapasitetsoppbygging og forskning som havner i "den grå sonen" mellom departementene. Forholdet til KD avhenger også av en felles oppfatning av hvordan man avgrenser departementenes ansvar for grunnforskning innen egen sektor, og dermed hvor vidt man skal definere sektoransvaret.

Det er innført et nytt system med mål- og resultatstyring (MRS), hvilket vi oppfatter som et forsøk på å overføre tenkningen fra New Public Management inn i styringen av Forskningsrådet. Dette systemet skal bidra til å styrke departementenes utøvelse av sektoransvaret for forskning samtidig som det skal bidra til bedre koordinering og en mer strømlinjeformet styring og rapportering. Til forskjell fra praksis i en del andre land fokuserer den norske styringsdialogen mer på programmer og virkemidler enn på overordnede mål. Det nye mål- og resultatstyringssystemet har til hensikt å løfte styringen opp på et mer overordnet nivå, men i praksis handler styringsdialogen fortsatt mest om programmer og aktiviteter. De fleste departementene har tilpasset det nye MRS-systemet til den typen styring som de alltid har praktisert. De ser dermed liten merverdi med det nye systemet. Et problem med MRS-systemet er at det ikke vurderer effektene av forskningen. Ikke desto mindre gir systemet en mulighet til bedre, klarere og mer målrettet styring samtidig som det legger til rette for bedre koordinering mellom departementene. Departementene trenger sterkere incentiver til å utnytte disse mulighetene i systemet. Det er behov for at departementene samlet gjennomgår sine erfaringer med systemet i samråd med Forskningsrådet. På bakgrunn av det bør man gå i retning av å styre etter mer overordnede mål, sette klarere krav til resultater og innføre et enklere og mer transparent rapporteringssystem.

I vårt mandat lå også en forventning om å se på Forskningsrådets organisatoriske grensedragning mot SIVA og Innovasjon Norge. Forholdet til SIVA er tydelig og avklart. På områder hvor Forskningsrådet samarbeider med Innovasjon Norge, kan det være tilfeller av overlappende aktiviteter. Men samarbeidet mellom de to organisasjonene er vel etablert og synes å forsterke seg. Det er lite som tyder på at brukerne er forvirret over arbeidsdelingen. Samarbeidet kan bli bedre når det gjelder informasjonsdeling, og det kan være potensial for bedre felles utnyttelse av organisasjonenes internasjonale nettverk. Alt i alt ser vi ingen grunn til å endre på arbeidsdelingen mellom Forskningsrådet, SIVA og Innovasjon Norge.

Gjennomføring og videreutvikling av nasjonale prioriteringer

Norges forskningsråd kan påvirke nasjonale prioriteringer gjennom innspill til Regjeringens Forskningsmeldinger. Rådet har en intern matriseorganisasjon som identifiserer og styrer ressursene inn mot prioriterte tema og områder. En effekt av dette er at Forskningsrådet i økende grad utarbeider tverrfaglige programmer. Siden departementene selv bestemmer hvor mye budsjett de skal bruke på de prioriterte områdene må Forskningsrådet implementere nasjonale prioriteringer gjennom 16 parallelle forhandlinger. Forskningsrådets programmer skal matche prioriteringene, og være Forskningsrådets kanal til å rådgi departementene i tildelingsbeslutningene. Departementene samarbeider i økende grad om felles finansiering av programmer i Forskningsrådet, over tid har man dermed oppnådd større samordning av de nasjonale prioriteringene.

Ser man på det generelle utgiftsmønsteret, retter Norges forskningsråd pengebruken mot et mindre antall store programmer som er relevante for de nasjonale prioriteringene eller enkelt-departementers interessefelt. Dette er ledsaget av en viss økning i andelen ressurser som brukes innenfor de ikke-tematiske

finansieringsordningene. Denne skjerping av fokus er nyttig, men gjør det vanskeligere å håndtere mellomstore saker, for eksempel når nye trender innenfor forskning eller innovasjon trenger oppfølging. «Av-programmeringen» av en stor andel innovasjonsprosjekter og putte dem i én enkelt Brukerstyrt innovasjonsarena (BIA) innebærer en risiko for ikke å fange opp og bidra til å organisere nye interessenter, eksempelvis leveransekjeder eller klynger. Det reduserer muligheten til å drive mindre, innovasjonsrettede programmer nært knyttet til nye teknologier og brukerbehov som, i likhet med teknologiprogrammene til Tekes og VINNOVA, fremmer forskningsbasert kompetanseoppbygging og samhandling mellom industri-forskning innenfor nye områder med store innovasjonsmuligheter.

Norges forskningsråd har støttet regjeringens politikk for mer autonomi til institusjonene ved å øke andelen av ressursene som tildeles etter konkurranse, fra litt over 70 prosent ved begynnelsen av tiåret til over 80 prosent. Det nye finansierings-systemet for instituttene ser ut til å ha økt deres publiseringsrate, og i mange tilfeller også påvirket forskningsledelse og oppmerksomhet omkring publisering.

Forskningsrådet har økt andelen ressurser som brukes på systemtiltak: kapasitetsutbygging, strukturtiltak som senterordninger og oppbygging av infrastruktur. Finansiering av større prosjekter og større programmer, samt nettverk, fremmer etablering av større grupper og en mer konkurransebasert arbeidsdeling i forskningssystemet. Ledere av forskingsinstitusjonene mener at Forskningsrådets insentiver påvirker deres forskningsfokus. Mer regionalt baserte forskere blir trukket inn mot forskningsnettverk i Oslo-regionen. Samtidig har Forskningsrådet tiltak på plass for å skjerme unge forskere mot konkurranse fra de etablerte forskerne, slik at neste generasjon av forskere skal få sjanse til å etablere seg.

Mens om lag 40 prosent av stipendene tildeles kvinner, er bare om lag 20 prosent av prosjekt-teamene ledet av kvinner. Den store vekten på teknologi, og matematiske og naturvitenskapelige fag i Forskningsrådets portefølje kan være en delvis (men ikke tilfredsstillende) forklaring på dette.

I det store og hele er Forskningsrådets finansiering innenfor næringslivsrelevante områder i tråd med profilen på næringslivets FoU. Forskningsrådet «overinvesterer» i nanoteknologi og bioteknologi, dette er ikke uventet da det er generiske teknologier man forventer vil få stor betydning. IKT er i så måte et unntak, der Forskningsrådets finansiering virker lav sammenlignet med næringslivets aktivitetsnivå.

Utvikling av forsknings- og innovasjonssystemet

Spørreundersøkelsene viser at både forskerne og lederne ved forskningsinstitusjonene mener Forskningsrådets støtteordninger er attraktive, men ikke alltid like attraktive som relevante internasjonale finansieringskilder. For universitetsforskerne er fri prosjektstøtte (FRIPRO) Forskningsrådets mest attraktive støtteordning, i instituttsektoren er de store programmene mest populære. Spørreundersøkelsene og intervjuene viser at forskerne er middels fornøyde med søknadsbehandlingen og vurderingsprosessene, og det er økende tilfredshet med Forskningsrådets forvaltning generelt. Som en kan forvente er de som har fått tilslag på sine søknader mer positive enn de som har fått avslag. Sammenliknet med resultatene fra surveyene for den foregående evalueringen av Forskningsrådet, synes forskerne nå noe mer fornøyde.

Det finnes begrenset informasjon om effekter av Forskningsrådets aktivitet. Forskningsrådets primære rolle innen forskerinitiert, grunnleggende forskning (FRIPRO) er å være en «aggregeringsmaskin» – rådet finansierer prosjektsøknader og setter en kvalitetsterskel som hever kvaliteten på norsk forskning. Foreliggende evalueringer tyder ikke på at Forskningsrådet her har rollen som endringsagent eller systematisk finansierer grensesprengende forskning. Både FUGE og NAMOMAT startet som grunnforskningsprogrammer som skulle hjelpe norsk forskning til å holde tritt med den internasjonale utviklingen innen to av de tre «nye teknologiene» som resten av verden lenge hadde regnet som generiske. Med andre ord finnes i det minste

anekdotisk grunnlag for å hevde at rollen som aggregeringsmaskin ikke er tilstrekkelig for norsk forskning.

Å involvere brukere og andre interessenter er nødvendig for å sikre at forskningen er knyttet opp mot behov og marked. Samtidig trengs mekanismer for å unngå incentivproblemer (moralsk risiko) og forebygge skjev utvelgelse. Forskningsrådets økte fokus på habilitet viser at det er svært oppmerksom på dette. Samtidig innebærer underinvolvering av potensielle brukere at forskningsprogammer blir utviklet uten tilstrekkelige signaler om hva som er viktig og relevant å satse på for å knytte forskningen opp mot praksis. Dette ser vi blant annet i evalueringene av NANOMAT og FUGE.

Senter-ordningene synes å anspore mer strategisk forskningsledelse og noe omstilling, spesielt ved universitetene. Det kan samtidig forventes at SFI-ene også vil gi bedre samarbeide mellom næringslivet og akademia og mer industriell innovasjon. Her ser vi at Forskingsrådet fungerer som en endringsagent.

Evalueringer viser at brukerstyrt FoU er et godt virkemiddel for å øke næringslivets FoU-innsats. Den gir innovasjon i næringslivet (og nok økonomisk suksess til å gi bedriftene betydelig avkastning), viktig kunnskap som også generer spillovereffekter, og bidrar til at bedriftene (spesielt de små) ønsker å investere mer i FoU. Både den privatøkonomiske og offentlige avkastningen av næringslivets FoU er høy. Mens økonomer ofte forutsetter at offentlig finansiering fortrenger private investeringer og sporer næringslivet til gale investeringer ('picking winners'), viser data det motsatte. Forskningsrådets finansering tiltrekker private investeringer; den privatøkonomiske avkastningen som genereres er omtrent den samme som næringslivet får fra FoU de selv har finansiert; den samfunnsøkonomiske avkastningen er høyere. Skattefunn er et godt virkemiddel for små bedrifter for å øke FoU-innsatsen, og genererer høy privatøkonomisk avkastning, men begrensede eksternaliteter. Når bedriftenes FoU-utgifter vokser er Forskningsrådets tilnærming med søknadsbehandling og seleksjonsprosess bedre og gir økte eksternaliteter. Forskningsrådet kan fremme akkumulering (bl.a. rundt nasjonale prioriteringer) og en unngår problemet med at større bedrifter kan være gratispassasjerer i Skattefunn.

De «teknologi-push»-satsingene som er evaluert har ikke vært så gode som forventet – verken når det gjelder teknologioverføring (FORNY) eller store programmer (FUGE og NANOMAT). Det er behov for en mer integrert tilnærming til kunnskapsutveksling, med mer involvering fra etterspørselssiden.

Deltakere i Forskningsrådets «møteplasser» har generelt et positivt bilde av rådets kommunikasjons- og formidlingsaktiviteter. Informantene satte pris på å bli involvert i Forskningsrådets møter, men flere – eksempelvis de intervjuene medlemmene av Hovedstyret og Divisjonsstyrene – mente at deres innflytelse var nokså begrenset gjennom rammebetingelsene som var satt av departementene.

Næringslivet søker finansiering fra Forskningsrådet for å løse utfordringer knyttet til innovasjon og redusere teknologisk risiko. Her var informantene opptatt av kvaliteten på Forskningsrådets søknadsbehandling, som de mente kunne bli for akademisk, og de var ikke fornøyd med søknadsfristene. Én søknadsrunde i året er ikke nok for næringslivets beslutningstakt og hyppigere søknadsrunder er ønskelig. Næringslivsinformantene så Forskningsrådet som støttende og god rådgiver, men var overrasket over at rådet ikke syntes interessert i prosjektresultatene etter at rapporteringsskjemaene var ferdig utfylt. Forskningsrådets åpenhetskultur ble sett som en viktig styrke som bør ivaretas.

Vårt generelle inntrykk er at Forskningsrådet er flink til å ivareta definerte behov og tjene sine brukere, men mindre god på å være proaktiv. Gitt Forskningsrådets styringsstrukturer, er dette trolig ikke overraskende, og rådet trenger muligens andre mekanismer for å håndtere det som brukerne ennå ikke vet at de trenger, inklusiv evne til diagnostiske og prospektive studier, finansiering av små-skala utvikling av egne lovende initiativ, og vurdere å eksplisitt adressere høy-risiko og tverrfaglig forskning. Rådets rolle som endringsagent kunne slik bli klarere.

Internasjonalisering

Norge har lenge vært internasjonalt orientert, både når det gjelder handel, industri og forskning. I løpet av de siste ti årene har globaliseringen fått stor betydning både for økonomien og det vitenskapelige samarbeidet. Utviklingen innenfor EU-samarbeidet står sentralt i denne sammenhengen. Det samme gjør den sterke framgangen i store land som Kina, Russland, India og Brasil. Dette er land som tradisjonelt har vært mindre framtredende, men som nå hevder seg på den internasjonale arena både innen industri og vitenskap.

Forskningsrådets virkemidler bidrar i betydelig grad til å fremme internasjonalisering. Virkemidlene har også bred støtte, men bør i større grad gjøres kjent i forskningsmiljøene. Forskningsrådet har satset sterkt på å støtte og stimulere norske forskere til å delta i EUs rammeprogrammer for forskning og øvrig europeisk forskningssamarbeid. Det er behov for mer kunnskap om hva som skal til for at flere forskere skal bli interessert i å delta i slikt samarbeid. Norge får fortsatt mindre midler tilbake fra EUs rammeprogram enn det landet bidrar med av finansiering. Derfor kan det være behov for å forsterke Forskningsrådet virkemidler. Samtidig beregnes Norges kontingent til EU på grunnlag av bruttonasjonalprodukt, hvilket betyr at det trolig er urealistisk å forvente at hele kontingenten skal hentes hjem. Deltakelsen i EUs rammeprogrammer har også videre effekter som gjør det vel verdt å opprettholde deltakelsen i det europeiske forskningssamarbeidet.

Internasjonalisering er et overordnet mål i norsk forsknings- og innovasjonspolitikk, og man ser et økende innslag av utenlandsk deltakelse i Forskningrådsprosjekter. Hvis denne utviklingen fortsetter, vil en tredel av Forskningsrådets prosjekter ha utenlandsk deltakelse innen 2015. Forskningsrådet bør derfor se mer spesifikt på hvilke mål de skal ha for internasjonaliseringsarbeidet. Et gjennomgående fokus på internasjonalisering bør kombineres med et bevisst forhold til hva man får ut av internasjonaliseringen, hvilke fagområder man skal fokusere på og hvilke land man skal prioritere. Internasjonaliseringens rolle bør diskuteres mer åpent og på tvers av sektorer. Departementene bør også være mer konkrete og målrettede i sine internasjonaliseringsstrategier. For øyeblikket er det trolig for lite samarbeid med land utenfor Europa og Nord-Amerika.

Anbefalinger

Forskningsrådet kan ikke operere uavhengig av andre. Våre anbefalinger gjelder derfor ikke bare Forskningsrådet selv, men også andre relevante aktører, ikke minst departementene og regjeringen. Våre sentrale anbefalinger er

- Fraværet av et overordnet forsknings- og innovasjonspolitisk råd gjør det vanskelig å koordinere forsknings- og innovasjonspolitikk på nasjonalt nivå. Vi ser problemene forbundet med å opprette et slikt råd innenfor det norske regjeringsapparatet. Men som et minimum anbefaler vi at regjeringen utreder konstitusjonelt akseptable måter å styrke den forskningspolitiske koordineringen på nivået over departementene.
- En nasjonal politikk og strategi for forskning og innovasjon er mer enn summen av viljen til 16 departementer. Fondet for forskning og nyskaping var en viktig mekanisme for å sikre strategiske ressurser til å skape endringer i det norske forsknings- og innovasjonssystemet. Fondet utgjorde en motvekt til sektorinteressenes tendens til å «låse inn» Forskningsrådet og forhindre nødvendig fornyelse av forsknings- og innovasjonssystemet. Selv om regjeringen hadde gode grunner til å legge ned fondet, er det avgjørende at den finansieringsmekanismen som erstatter fondet kan sikre den langsiktige forskningen og behovet for strukturelle endringer i systemet.

- Samlet sett er kvaliteten på norsk forskning god. Men den er trolig ikke god nok sett i lys av at kunnskap får stadig økende betydning for konkurranseevnen. Målet om økt kvalitet bør derfor vektlegges enda sterkere hos Forskningsrådet.
- Forskningsrådet bør ha strategiske ressurser og handlingsrom til å utvikle og finansiere nye satsinger på eget initiativ og dermed være i forkant av samfunnets og politikernes behov og forventninger. Dette er viktig for å unngå at Forskningsrådet kommer sent på banen og blir hengende etter i utviklingen.
- Forskningsrådets vekt på forskerinitiert «fri» forskning når det gjelder finansiering av grunnforskningsprosjekter gjør at dagens aktivitetsmønster i stor grad blir bestemmende for innretningen av framtidig aktivitet. Det er lite rom for eksplorative satsinger, og det kan virke som at Norge har kommet sent i gang med satsing på generiske teknologier. Forskningsrådet bør derfor etablere mekanismer som kan fremme og utvikle mer grensesprengende virkemidler, både innen grunnforskning og anvendt forskning.
- Et viktig forskningspolitisk mål er å øke FoU-investeringene i næringslivet. Skatteinsentivordningen, tematiske programmer og det brukerstyrte BIA-programmet er sentrale virkemidler i så måte. Samtidig er det få virkemidler som fanger opp behovet for mindre, mer tidsavgrensete satsinger som treffer behovene til bransjer eller klynger som er for store til å utgjøre konsortier for en BIA-søknad. Forskningsrådet bør se nærmere på hvordan rådet konkret kan involvere relevante brukere i utformingen av slike teknologiprogrammer og eventuelt utvikle en større mekanisme for slike satsinger.
- Forskerinitiert forskning utgjør et viktig element i ethvert velfungerende forskningssystem – særlig i et rikt land som trenger å ligge i eller nær fronten innen vitenskap og teknologi. Midlene til frie prosjekter (FRIPRO) bør styrkes, særlig til bedre å behandle tverrfaglig og høy-risiko forskning og å øke kvalitet. I tillegg kan Store programmer utvides til også å inneholde en dimensjon som eksplisitt ivaretar mer grunnleggende forskning.
- Forskningsrådet og departementene bør vurdere om Forskingsrådet investerer nok i grunnforskning og anvendt forskning innen IKT. Dette bør ses i sammenheng med utviklingen av en ny strategi for IKT som generisk teknologi.
- Forskningsrådet har for lite systematisk bruk av evalueringer og framtidsstudier. Evaluering bør være en integrert del av programsyklusen, og det bør rettes mer innsats mot å kartlegge og forstå effektene av Forskningsrådets egne aktiviteter. Det trengs mer ressurser og innsats rettet mot framtidsstudier som kan utfordre grensene, blant annet gjennom Foresight-studier. Dette trengs som en motvekt mot de naturlig konserverende (men absolutt nødvendige) effektene som følger av Forskningsrådets brede involvering av brukerne.
- Det resultatbaserte finansieringssystemet for instituttene har allerede hatt positive effekter, og det på grunnlag av ganske små ressursallokeringer. Systemet bør implementeres fullt ut innenfor nåværende rammer. På dette stadium ser det ikke ut til å være noen åpenbar gevinst å hente ved å gjøre mer av basisfinansieringen konkurranseutsatt. Forskningsrådet bør følge opp sitt strategiske og finansieringsmessige ansvar overfor instituttene ved å tilby jevnlige evalueringer av enkeltinstitutter eller grupper av institutter.
- Det nye systemet med Mål- og resultatstyring (MRS) er ment å bidra til en bedre styring av Forskningsrådet ved å løfte styringen opp på et mer overordnet plan. Så langt har dette hatt begrenset effekt. I samråd med Kunnskapsdepartementet og øvrige departementer bør Forskningsrådet jobbe for å løfte styringen fra aktiviteter til mål.
- Forskningsrådets arbeid med å fremme internasjonalisering har vært svært vellykket. Internasjonaliseringsstrategien bør nå revideres med sikte på å gjøre internasjonaliseringsarbeidet mer målrettet.

Summary

The Research Council of Norway (RCN) is an internationally unique organisation that combines the functions of a research council that funds research in universities and institutes and an innovation agency that pays for research to support innovation in business. Its other main task is to advise the government on research and innovation policy. It should also act as a 'meeting place' for stakeholders with an interest in innovation and research.

The government set RCN up in 1993 to reduce fragmentation in the research and innovation funding system and enable implementation of a coordinated policy for research and innovation. The first evaluation of RCN in 2001 found that a single funding organisation offered unique opportunities to coordinate and integrate innovation and research activities but that the government's ambitions had not been well realised. Internally, RCN still reproduced the fragmentation of its predecessor organisations. Externally, it was over-steered. Having sixteen ministries giving it money and instructions without itself having significant 'strategic' resources made it hard to tackle change. RCN re-organised in response to the evaluation. The government had already identified the problem of strategic resources and established the Fund for Research and Innovation, managed by the predecessor of today's Ministry of Education and Research (KD), as a way to address issues like long-term research and other matters that tended to fall outside the interests of the ministries. The Fund provided a way to pay for many of the important new activities launched through RCN during the last decade, such as new research centres in the universities and institutes and Large programmes tackling national needs. It also financed other research and innovation related activities, for example by paying Norway's contribution to the European Union's Framework Programme of research and technological development.

The overall conclusion of this new evaluation done in 2011-12 is that RCN now performs well and is likely to continue to do so provided a balance can be maintained between the individual interests of the ministries and the collective interest, represented by a continuing balance between sectoral and strategic money.

Norway's performance in innovation and research

Norway enjoys one of the highest levels of welfare and income in the world. This means wages and other factors of production are very expensive so Norway has to compete on knowledge. Measured in conventional terms, Norway devotes little of gross domestic product (GDP) to research and development (R&D) but a lot of the economy is technology-using and technology-intensive. Measured per head, Norway's spending on R&D is above the normal international level, but lags a long way behind the leaders such as Switzerland and the USA as well as Norway's Nordic neighbours. Norwegian business still invests little in R&D compared to business abroad.

Measured in bibliometric terms Norway's research output is good but not outstanding. A high proportion is produced in international collaboration. Overall, RCN-funded research is better and more visible than non-RCN funded research, though this is not the case in all disciplines. There are high points in some fields but there are few places where Norwegian research ranks with the world's very best. Another sign that performance is modest is that Norwegian researchers have won few grants from the new European Research Council.

Most countries with a big and important resource sector find that it attracts attention, capital and labour and may increase the value of the currency, so that other parts of the economy have work harder to compete internationally. This makes the constant restructuring and renewal necessary in all economies all the more difficult. The rate of

innovation in Norwegian industry is slowly declining and the rate of entry into new, science-based industries is slow while foreign direct investment is so low that it provides little impulse to change. The rate of industrial renewal therefore appears too low to be consistent with the need to compete on the basis of knowledge. Renewal in the research sector is equally important, not only to support industry and tackle the great challenges of our time such as climate change but also for social and cultural reasons.

The need for a strong knowledge base combined with continuous restructuring and renewal means that the research and innovation funding system has to play two roles. One is as an 'aggregation machine', sorting out the best projects to fund and reflecting existing needs, not least as the ministries express them on behalf of their sectors of society. The other is as a 'change agent', supporting the process of renewal by encouraging change and innovation in science and industry. That is a difficult job. An organisation like RCN has to be orderly and disruptive at the same time.

RCN achievements

RCN is part of a close-knit policy system in Norway. People and organisations work in constant dialogue, and RCN formally follows the instructions of the ministries at the overall level, so it does not act alone. In the past decade, RCN has a substantial list of achievements to its credit. Some of these fit into the bigger pattern of change in the research and innovation system made necessary by the government's decision to increase the autonomy of the state's research performing organisations and therefore to rely more heavily on incentives instead of entitlements to encourage good performance. Achievements include

- Contributing to the development of a range of national strategies for research – at the level of overall government policy as expressed in White Papers, in strategies of individual ministries and groups of ministries and in strategies for the High North
- Helping coordinate the national research effort by consolidating the number of programmes and designing programmes that tackle the needs of multiple ministries
- Increasing the proportion of resources for both research and innovation that are not thematically steered, in order to obtain a better balance between bottom-up and top-down initiative
- Contributing to renewal, increased quality and reduced fragmentation in the research system through 'centres' programmes – SFF, SFI and FME and by starting Large programmes
- Innovated other instruments such as industry PhDs and YFF young researcher grants that promote renewal
- Reduced research fragmentation by shifting the focus of grants away from individuals and towards groups and collaborative research
- Increased international participation in Norwegian research and supported Norwegian participation in international collaboration, notably the EU Framework Programme, in which Norway is a highly-respected participant despite not being a member state
- Developing and implementing a strategy for large-scale research infrastructure
- Helping develop and implement a performance-based research funding system for the institute sector
- Developing and maintaining efficient and effective proposal selection and administration processes that match international good practice

Many of these involve RCN acting with KD as an agent for structural change. Large changes such as the centres programmes and the Large programmes have generally been implemented with help from the Fund for Research and Innovation, emphasising the importance of strategic resources in renewing the research and innovation system.

Strategic intelligence and advice to government

RCN is an important source of research policy advice to government. It produces both strategic intelligence – the information and analysis needed to make strategy – and advice.

RCN contributes to creating and publishing strategic intelligence through a range of studies such as monitoring the research institutes and producing the annual national book of research and innovation indicators. It is improving its use of internal data about its funding portfolio. It consults extensively with relevant stakeholders in formulating its plans and designing programmes. For a while from 2004, RCN actively used foresight, which is a way to provide alternative perspectives to those that stakeholders provide. That is a healthy way to reduce the risk of becoming locked in by stakeholders' local perspective. Now that strategy formulation for large activities tends to be done at the level of one or more ministries, it is important to continue to look for ways to inject alternative perspectives into strategy through techniques such as foresight and by involving foreigners.

RCN has a strong tradition of doing discipline evaluations and is increasing its use of programme evaluation. However, it devotes too little effort to evaluation overall and especially to exploring the impacts of its actions. Evaluation is not yet systematically embedded in the programming process.

RCN contributes to the development of ministries' sector research strategies through budget dialogue and it makes various, often substantial, inputs to White Papers and other national research strategies. KD has the coordinating role for government policy on research and has increasingly assumed responsibility for funding a wide range of research. It is nonetheless one among many ministries and the lack of something like the high-level Research and Innovation Council in Finland makes it difficult to construct a strong national research strategy and imposes coordination costs on RCN.

RCN has strategic responsibility for the research institutes and used to evaluate them on a regular basis. It helped design a new partly performance based funding system, which is not yet fully implemented. The incentives for restructuring the institute system remain rather weak and the interest of many ministries in addressing institute policy seems limited. The end of regular institute evaluation means there is no rounded view of the individual institutes as organisations. International experience with performance-based funding systems suggests that strongly formula-based steering leads to perverse behaviour and lock-ins. We therefore would prefer to see a mix of measurement and judgement by one or more competent owners of clusters of institutes rather than treating the institute system as a quasi-market. But whichever view one takes, the institute system currently hangs between the old evaluation-based system that had no 'teeth' and a performance-based system that is only partly implemented. This is clearly not satisfactory.

Organisation and governance

Since RCN answers to sixteen ministries and has a broad set of system-wide responsibilities it carries a heavy organisational and administrative load. This is further increased by the growing complexity of science and technology, the increasing importance of interdisciplinarity and cross-sectoral problems and the large number of stakeholder groups to which it must relate.

RCN was reorganised after the first evaluation and again in 2010. The reorganisation of 2010 was useful and well conducted. RCN remains a complex organisation but having sixteen principals drives much of that complexity. The new organisation addressed the need for thematic and disciplinary expertise at the Division Board level and allowed RCN the possibility to strengthen its position in relation to the generation of national research and innovation strategies. It strengthened line management by reducing functional overlaps among divisions and made the structure of RCN more transparent. But it left RCN with too little analytical capability at the centre –

something it needs if it is to play a strong role as advisor and change agent. An analysis group recently set up in the Director's staff is intended to take on this role.

RCN has three levels of Board: the Executive Board; Division Boards; and Programme Boards. While some members of the Division and Executive Boards of RCN are frustrated that their power to take decisions is limited by the detailed agreements between RCN and the sixteen ministries, in our view all three levels (Executive, Division and Programme Boards) of RCN's three-level steering hierarchy are necessary. The new organisation structure should increase the strategic value of the two upper levels – especially if better supported by independent analysis.

RCN's administrative costs have declined from 8% of the total budget in 2003 to 7% in 2010. This increasing efficiency has been accompanied by a rationalisation in the number of programmes or schemes offered (from 229 to 178) and an increase of about 10% in average project size. There has been substantial investment in IT systems and standardisation of proposal and assessment procedures. RCN has tightened its procedures for handling conflicts of interest.

RCN has significantly improved the quality and speed with which it processes applications. The process is about as transparent as such things can be and conforms with good international practice. Bibliometric analysis shows that RCN-funded researchers generally have greater citation impact than those whose applications RCN rejects. Those with larger numbers of RCN grants also have the higher impact factors. Like other research councils, RCN needs to review more carefully its handling of interdisciplinary and high-risk proposals.

Success rates vary widely across programmes. They are especially low in FRIPRO for two reasons. First, there is a significant minority of poor proposals that in our view applicants' institutions should have weeded out. Second, there is a significant excess of high-quality proposals over money available. Given the rather flat budget in this area over time combined with growth in the university system and increasing demands for high-quality research, there is a case for increased funding.

The way RCN is 'steered' by the ministries was an important question for the evaluation. In theory, the relationship between principals like the ministries and agents like RCN involves significant risks to the principal. High levels of trust between principals and agents and the use of clear agreements about objectives can reduce these risks. A multi-principal agency has a special problem of trust, in that principals do not want 'their' resources diverted to serve the interests of other principals. There is a risk that, in order to prevent this, they 'over-steer' the agent and reduce its effectiveness. In practice, the steering processes between RCN and individual ministries are cordial and based on trust and some ministries have increased the proportion of their research expenditure that they channel through RCN as a result. The dialogue appears to be more two-way than before. While detail tends to lock RCN in, the ministries do not uniquely cause it – RCN also has an interest in having detailed instructions that commit ministries to working through it.

The relationship with KD has an importance that goes beyond ownership. KD's responsibilities go way beyond the traditional role of an education ministry in looking after basic research. Increasingly, it functions more like a 'science ministry' with system-wide tasks. KD, the Fund for Research and Innovation and the budget line that has replaced it represent the major opportunity to tackle systemic failures such as the need for restructuring, capacity building and research that falls into the 'grey zone' between ministries. The nature of that relationship must also in part depend upon an understanding about the degree to which sector ministries have responsibility for basic research of relevance to their own sector and therefore how 'wide' the sector principle is held to be.

A new Management By Objectives (MBO) system has been put in place that we understand as an attempt to integrate ideas from the New Public Management into the governance of RCN, supporting the ministries in the exercise of their sector responsibility with respect to research while at the same time enabling coordination

and a streamlined process of instruction and reporting. Unlike in some foreign systems, the 'unit of analysis' in the steering dialogue tends to be programmes or other activities rather than higher-level objectives. The new MBO system represents an ambition to steer at a higher level but the real negotiations remain activity-based. Most ministries have simply overlaid the MBO system on what they were doing to instruct RCN anyway and see little added value in it. A problem with the MBO system is that it does not consider impacts. Nonetheless, it offers an opportunity for improving the quality, clarity and specificity of steering and reporting while enabling better coordination among ministries. The ministries need greater incentives to adopt it. There is scope for the ministries collectively to review their experience together with RCN and move towards steering through higher-level goals, set more specific performance expectations and implement a shorter and more transparent reporting system.

Our mandate required us to look at RCN's organisational boundary with SIVA and Innovation Norway. That with SIVA is clear and well understood. Areas of overlap exist with Innovation Norway, where the two organisations cooperate. Collaboration between the two agencies is long established and is increasing and there is no evidence that beneficiaries are confused. Cooperation could be improved in relation to information sharing and there may be potential to make better common use of the organisations' international networks. We see no reason to change the boundaries between RCN and the other two organisations.

Implementing and adding value to national priorities

RCN plays a role in influencing national priorities through its inputs to the periodic White Papers on research. It maintains an internal matrix organisation that tracks and tries to manage the use of resources towards nationally prioritised themes and issues. One effect of this is that RCN increasingly works through multi-disciplinary programmes. Since allocation of money to priorities is done by the ministries RCN can only implement the national priorities through sixteen parallel negotiations. RCN programmes are in place to match the priorities, so RCN has the means to help the ministries make such allocation decisions. Increasingly, ministries are jointly funding programmes at RCN, so a measure of coordination is being achieved towards the national priorities over time.

Looking at the overall pattern of spending, RCN is focusing money on a smaller number of larger programmes relevant to national priorities or the concerns of individual ministries. This is accompanied by a degree of increase in the proportion of resources spent in non-thematic funding schemes. This sharpening of focus is useful but makes it more difficult to handle mid-sized issues, for example where new developments in research or innovation need to be fostered. 'De-programming' most of the innovation projects and putting them into the single BIA arena runs the risk of failing to pick up and help organise emerging stakeholder groups such as supply chains. It reduces the opportunities to run smaller innovation-focused programmes close to developing technologies and stakeholder needs that – like the technology programmes of Tekes or VINNOVA – nurture research-based capacity building and research-industry links in new areas with high opportunities for innovation.

RCN has supported government policy on institutional autonomy by increasing the proportion of its resources that it allocates under competition from just over 70% at the start of the last decade to some 80%. The new funding system for the institutes appears to have improved their rate of publication as well as in many cases their style of research management and the attention paid to publication.

The share of RCN's spending devoted to systemic initiatives – building capacity, shaping structure through centres or building infrastructure – has risen. Funding larger projects and larger programmes as well as networks encourages the formation of larger teams and starts to enforce a competition-based division of labour in the research system. Organisational managers confirm that RCN incentives are

influencing their research foci. More regionally based researchers are being drawn into research networks with those in the Oslo region. At the same time, RCN has measures in place to shelter young researchers from competition from their established peers early in their careers, otherwise the older generation would simply prevent the new one from developing.

While about 40% of individual grant-holders have been female, only about 20% of projects are going to teams led by women. The importance of technology, mathematics and natural sciences in RCN funding may be a partial (but not a satisfactory) explanation.

By and large RCN's spending across different fields relevant to industry is consistent with the pattern of industrial R&D. RCN 'over-invests' in nanotechnology and biotechnology, as would be expected in developing generic technologies of expected future importance. The oddity is ICT, where RCN's spending appears low compared with the level of industrial activity.

Developing the research and innovation system

Researchers and managers surveyed find RCN grants attractive, though some international alternatives are more so. University researchers like FRIPRO best. The institutes prefer Large programmes. Our surveys and interviews show increased satisfaction with RCN administration in general and researchers are moderately content with its proposal management and assessment process. Not surprisingly, managers and researchers who won grants are more positive than those whose applications were rejected. Compared with the equivalent survey in the 2001 evaluation, it appears that the research community is more satisfied with RCN's appraisal system than before.

There is a limited amount of information in the evaluation record on impacts of RCN activities. RCN's primary role in bottom-up, 'basic' research (FRIPRO) is as an 'aggregation machine' – responsively funding proposals and imposing a quality threshold that raises the average quality of Norwegian research. Nothing in the evaluation record suggests that RCN is a change agent here or that it systematically funds disruptive research. Both FUGE and NANOMAT began life as basic research programmes intended to help the research community 'catch up' with international developments in two of the three technologies that the rest of the world has long regarded as generic. Hence there is at least anecdotal evidence that the aggregation machine role is not enough to keep Norwegian science in constant motion.

While the involvement of stakeholders and users is necessary as a 'focusing device' to make sure that appropriate research activities are connected to needs and markets, there must also be countervailing forces to avoid moral hazard and prevent adverse selection. RCN's increased efforts to contain conflict of interest show that it is acutely aware of this issue. Nonetheless, as the NANOMAT and FUGE evaluations show, under-involving potential users leaves the programme designers with too few signals about what is important if the research community is to be built up in areas of relevance and if research is to connect with practice.

The centres programmes appear to have started to induce more strategic research management and some restructuring, especially in the universities. It is reasonable to expect that at least the SFIs will also improve industry-academic cooperation and industrial innovation. Here we can see RCN operating as a force for change.

Evaluations show that user-directed R&D is a useful instrument to increase business expenditure on R&D. It leads to industrial innovation (enough of which is economically successful to generate significant private returns), generates important knowledge and capability spillovers and leads companies (especially smaller ones) to want to do more R&D. The private and public returns to industrial R&D are both high. While economists often like to speculate that state funding of industrial R&D will crowd out private investment and induce companies to invest in the wrong things

('picking winners'), the evidence shows the opposite. RCN funding 'crowds in' private investment; the private returns induced are about the same as companies get from their own investments in R&D; and the societal returns are higher. The Skattefunn fiscal incentive is a useful way to help small companies begin to do more R&D, generating high private returns but limited externalities. As companies' R&D expenditures rise, RCN's selective approach becomes more appropriate because it increases externalities, it can support agglomeration (including around national priorities) and it avoids the problem that at larger volumes companies tend to free ride on tax incentives.

Those 'technology push' efforts that have been evaluated have not worked as well as expected – either at the level of technology transfer (FORNY) or large programmes (FUGE and NANOMAT). A more integrated approach to knowledge exchange is needed, with greater demand-side involvement.

Participants in RCN's 'meeting places' confirmed the view that RCN's science communications activities are good. People were happy to be involved in meeting place activities but – like those we interviewed in the Main and Division Boards – they felt their influence was limited by the framework conditions the ministries imposed.

Companies seek RCN funding in order to help solve problems related to innovation and reduce technological risks. They were cautious about the quality of the assessment process, which could be overly academic and unhappy about the timing of call deadlines. These needed to be frequent – once a year is not enough, given the pace needed for decisions in industry. They saw RCN staff as helpful and a good source of advice but were surprised at RCN's apparent lack of interest in the outcome of projects once the relevant forms were filled in. RCN's culture of openness was a key asset that it should try to preserve.

Our overall impression is that RCN is very good at reacting to defined needs and 'serving its customers' but less good at being proactive. This is perhaps not surprising, given its governance, so it probably needs other mechanisms for tackling things that the customers do not yet know they need, including the ability to do diagnostic and prospective studies, fund small-scale, promising developments on its own initiative and consider explicitly addressing high-risk and interdisciplinary research. Its 'change agent' role could thus be stronger.

Internationalisation

Norway has for a very long time been internationally orientated in trade, industry and science. The past ten years have seen a dramatic acceleration in the process of globalisation of both the economy and the scientific community, both through developments in the European Union and in the emergence of previously less conspicuous but large and important countries like China, Russia, India and Brazil firmly onto the world stage in both industry and science.

RCN funding schemes play a strong role in supporting internationalisation and are widely appreciated but should become better known in the research community. RCN has made a significant effort to encourage and fund Norwegian researchers to take part in the Framework Programme and other European collaborations. More needs to be done to understand what would be needed to increase interest in participating. Norway still does not get as much money back from the Framework Programme as it puts in, so there may be scope to increase RCN's support effort further. However, since Norway's contribution is proportional to its GDP, it is probably unrealistic to expect to repatriate it all. Participation has wider benefits that make it worthwhile to maintain the partnership with the EU.

Internationalisation is a key goal of Norwegian research and innovation policy and foreign participation in RCN projects is growing. At the current rate that would bring it to one third of all projects by 2015, so RCN needs to consider more explicitly what its internationalisation goals are. Mainstreaming internationalisation should be coupled

to a clearer sense of what internationalisation contributes and in what subjects and geographies collaboration should focus. More open debate about the role of internationalisation is needed across sectors and ministries should be more explicit about their internationalisation strategies. At the moment, there is probably too little collaboration outside the EU and North America.

Inward mobility is good, but Norwegians are still too reluctant to go abroad for part of their careers. It may be that enabling short as well as long stays abroad could combat this problem.

Recommendations

As an agent, RCN can largely not act alone. Our recommendations apply therefore not only to RCN itself but also to other relevant actors, not least the ministries and the government. Our main recommendations are

- The lack of a high-level research and innovation council that sets policy makes it hard to coordinate research and innovation policy at the national level. We understand the difficulties of creating such a council in the Norwegian governance system but recommend that as a minimum the government investigate constitutionally acceptable ways to increase the strength of research policy coordination at a level above the ministries
- A national strategy and policy for research and innovation is more than the sum of what sixteen ministries want. The Fund for Research and Innovation was an important mechanism for providing 'strategic' resources to induce change in the research and innovation system – acting as a 'countervailing force' to the tendency of sector requirements to lock in RCN and inhibit necessary change in the research and innovation system. While the government had good reasons to close the Fund, it is vital that the funding mechanism replacing it should be able to address the long-term research and restructuring needs of the system
- The quality of Norwegian research is on the average good but in the light of increasing knowledge-intensity as a key requirement for competitiveness, it is probably not good enough. Increasing quality should be even more strongly emphasised as a goal for RCN
- RCN should have some strategic resources and freedom to explore and fund new opportunities on its own initiative, ahead of collective demand from its principals, in order to avoid problems of late entry and catch-up
- RCN's responsive approach to basic research means that the existing pattern of activity plays a large role in determining the pattern of future activity. There is no provision for high-risk research and some evidence that Norway has moved slowly into key generic technologies. RCN should therefore establish mechanisms that promote disruptive change in basic research as well as in more applied areas
- Raising business expenditure on R&D is an important policy objective, which is addressed through a tax incentive, thematic programmes and the bottom-up BIA funding arena. This leaves a gap for smaller-scale, time-limited programme initiatives responding to the needs of a sub-sector or cluster at a significantly larger scale than BIA consortia. RCN should review at the micro level the opportunities from time to time to involve stakeholders in starting such technology programmes and eventually create a larger-scale instrument for doing so
- Bottom-up, researcher-initiated research is an important component of any healthy research system – especially in a rich country that needs to operate at or near the scientific and technological frontier. FRIPRO funding should be strengthened, especially to tackle more interdisciplinary and higher risk research aiming to drive up quality. This could be complemented by mandating the addition of a more explicit fundamental research component to Large programmes

- RCN and the ministries should review the adequacy of basic and applied research funding in ICT, in conjunction with the development of a new 'generic technology' strategy for ICT
- RCN makes too little systematic use of evaluation and prospective studies. Evaluation should be embedded in the programming cycle and there should be more effort devoted to understanding the impacts of RCN activities. More effort and budget should be devoted to potentially disruptive prospective studies, including foresight, to counterbalance the inherently conservative (but absolutely necessary) tradition of wide stakeholder consultation and involvement at RCN
- The performance-based funding system for the institutes has already had positive effects, based on reallocating quite small sums of money. It should be fully implemented at the present levels of reallocation – there is no evident advantage in making more of the core funding contestable at this stage. To fulfil its strategic as well as its funding responsibility to the institutes, RCN should offer them periodic evaluations at the level of individual institutes or groups of institutes
- The new MBO system is intended to improve the steering of RCN by raising it to a higher level. So far, it has had limited effect. RCN should work with KD and the other ministries to raise the level of steering from activities to goals
- RCN has been very successful in promoting internationalisation. The strategy should now be revised to consider how to make the internationalisation effort more targeted

1. Introduction

This report synthesises the work done in the second evaluation of the Research Council of Norway (RCN), which was undertaken in 2011-12. The background reports on which it is based are published on the World Wide Web by KD.

1.1 Evaluating RCN

The government established RCN in 1993 by merging Norway's pre-existing research councils. Parliament decided[1] that a foreign evaluator should evaluate it once it had had a chance to operate for a few years. Following an open competition for the assignment, a team under our leadership did that evaluation in 2000-01[2]. The evaluation had a wide-ranging mandate but the key question was existential: Was this radical merger to create a single organisation funding innovation and basic research a good idea, or should RCN be broken up – by assumption into a traditional research council and a separate innovation agency? Our evaluation said that the merger was the right thing to do but that it had not been sufficiently well done. To create an effective single council would involve drastic reorganisation and changes not only in the internal way of working but also in the context: how RCN was funded and governed. RCN was indeed drastically reorganised in 2003, and that organisation was further refined in 2010. Not all aspects of the context proved as easy to change.

In the latest White Paper on research[3], the government said it was time to evaluate RCN again, in order to see whether it was now operating well. The Royal Norwegian Ministry of Education and Research (KD) awarded another international team led by us that assignment in open competition. The full mandate is in the Appendix to this report. The scope of the evaluation is 2003-2010, though where possible we try to take account of more recent events. One of the points of discussion with the Ministry during the competition was: Is it a good idea to use the same evaluator twice? On the one hand, such an evaluator would have the background and history in mind as well as a fair understanding of the national research and innovation system (NRIS). On the other hand, there would be a risk of rerunning the old evaluation rather than doing a new one. In fact only two members of the current team were involved in the previous evaluation. We have been conscious of that risk and believe we have successfully managed it. The earlier work has given us a clear and well-documented baseline – which is both useful and rare in this kind of work.

RCN and the first evaluation have received a lot of attention in the research policy world internationally. We called the first evaluation 'A Singular Council' because RCN was (and, with the exception of RANNIS in Iceland, still is) the only hybrid research council and innovation agency in the world. Naturally, everyone wanted to know whether this form of organisation works. It was a little disappointing to have to say 'we are not really sure because RCN in 2000 was rather like six organisations cohabiting in a single house'. The core question in this new evaluation is not 'Should it exist?' but 'Does it work?' Our answer is 'Yes, it does'. How it works in more detail, what is going well, what needs improvement and how these things relate to the context is the subject of this report.

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[1] "*Fleirtalet ser behovet for å få evaluert den nye organisasjonen når systemet har verka ei tid, gjerne av kunnige som står utanfor det norske miljøet.*" Innst. S. nr 231 (1991-92), s.5

[2] Erik Arnold, Stefan Kuhlman and Barend van der Meulen, *A Singular Council Evaluation of the Research Council of Norway*, Oslo: Royal Norwegian Ministry of Education, Research and Church Affairs, 2001

[3] Det Kongelige Kunnskapsdepartement, *Klima for forskning*, St meld nr 30, 2008-2009

1.2 RCN's goals and tasks

During the scope of this evaluation, RCN's statutes[4] said

The Research Council of Norway shall serve as a national strategic and executive body for research. The Research Council is responsible for increasing the general knowledge base, and for helping to meet society's research needs by promoting basic and applied research as well as innovation. The Research Council shall promote international research cooperation. The Research Council shall serve as an advisory body to the government on matters concerning research policy.

Its tasks were to

- *Support basic research and seek to encourage development within the various research fields and disciplines as well as to ensure inter- and multidisciplinarity in research*
- *Support research that encourages public debate and contributes to the development of democracy and the formulation of policy*
- *Promote innovation in public and private sectors in all parts of the country*
- *Promote coherence and interaction between basic research, applied research and innovation*
- *Fulfil national responsibilities with regard to dissemination of research and work to promote the uptake of research results*
- *Promote international research cooperation*
- *Work to ensure the highest possible quality in Norwegian research activities*
- *Work to achieve cooperation and cohesiveness between public agencies within the research and innovation system*
- *Work to achieve constructive distribution of tasks and cooperation between research institutions, and take strategic responsibility for the research institute sector*
- *Ensure the evaluation of Norwegian research activities*
- *Provide advice to government authorities as a basis for the formulation of research policy*

The Research Council is also required to follow political guidelines set out in White Papers on research and other subjects and the government's annual budget acts. Goals and guidelines are also specified annually in letters of allocation from the ministries that finance the Council's activities.

1.3 Approach and methods

KD's terms of reference for the evaluation were extremely wide-ranging but also rather open in the way the evaluator should tackle them. We grouped the evaluation issues into two groups. First, a set of five 'formative' questions, namely: How well does RCN

- Create and provide strategic intelligence on research and innovation to stakeholders in the National Research and Innovation System (NRIS), including itself?
- Operate effective organisation and governance structures and processes within a national division of labour among government authorities?
- Implement and add value to national research and innovation priorities and policies?
- Play a developmental role in the NRIS, supporting the needs of the various component communities and institutions?
- Embed Norway in the changing international research and innovation system?

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[4] These are the first two paragraphs of the statutes that came into force in December 2002. They remain unchanged in the current statutes (2011)

A Good Council?

Second, a set of 'summative' questions: how well does RCN achieve the goals set out in the new Management By Objectives system used for the steering and reporting dialogues with the ministries that fund RCN?

- Goal 1: Increase quality, capacity and relevance in Norwegian research nationwide
- Goal 2: Good use of resources and appropriate division of labour, cooperation and structure in the research system
- Goal 3: Research results are used by business, society and administration throughout the country

We operationalised our approach into seven Work Packages (WPs)

- WP1 Strategic intelligence and advice to government (Technopolis, UK)
- WP2 Organisation (Technopolis, UK)
- WP3 Adding value to national priorities (Technopolis, UK)
- WP4 Developing the NRIS (Technopolis UK and CWTS)
- WP5 Value-added for beneficiaries (NIFU, SSB, Technopolis SE)
- WP6 Internationalisation (MIoIR, Technopolis NL)
- WP7 Interaction with an expert advisory panel

Figure 1 shows how the work packages interrelate. There are background reports that show their results. They are listed in the Appendix, together with details of where to find them on the Internet.

Figure 1 How work packages interrelate
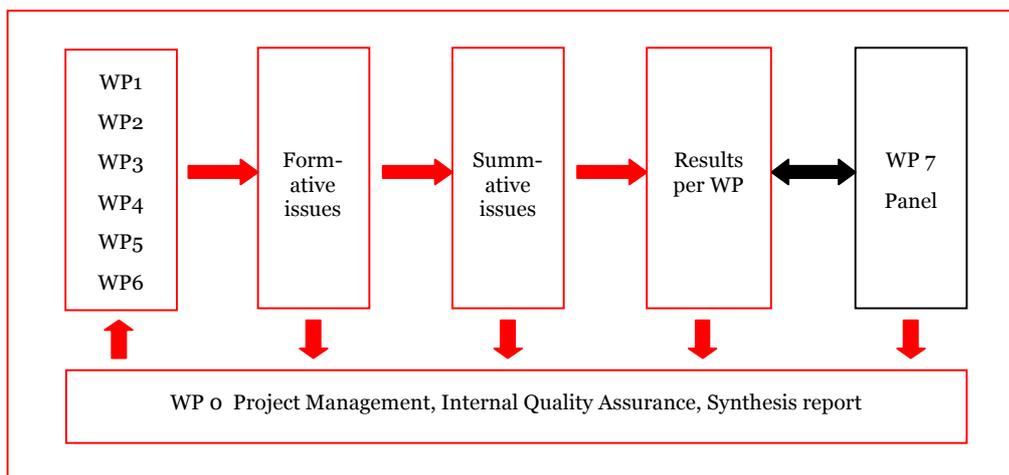
The methods we used across the evaluation were as follows. They are described in detail in the respective background reports.

- Document analyses. (In total RCN supplied us with about 1.5 Gigabytes of data and information)
- Analyses of RCN data, for example composition data in relation to types and beneficiaries of project funding, monitoring data about outputs
- Interviews with people and at key organisations in all the categories of actor defined above. In many cases, the degree of satisfaction of those involved is a primary indicator of the usefulness and effectiveness of RCN actions
- Evidence from existing evaluations and studies, including meta-evaluation of a sample of RCN evaluations
- Bibliometric analysis of publications and citations
- Econometric and statistical analysis of funding and company performance data
- Surveys of beneficiaries: researchers, research-performing institutions, companies and participants in RCN's various 'meeting places'

At many points we bring in international comparisons in order to provide a frame of reference and benchmarks.

1.4 Guide to the report

We used the formative questions as a background to structuring this report. In the course of answering them, we provide the information needed to answer the summative ones.

To discuss RCN, we need first to think about its context and the challenges it faces in the Norwegian research and innovation system. In Chapter 2, we therefore discuss the international and national context. Chapter 3 discusses RCN's role and the way the research and innovation governance system works in Norway. Chapter 4 tackles some questions about the role of basic research, since there is strong pressure from the research community for increased funding of 'free' research.

Chapter 5 evaluates RCN's role as a research policy advisor to government. Chapter 6 evaluates RCN's organisation and governance while Chapter 7 evaluates the ways in which RCN adds value over and above the national priorities and how it works to develop the research and innovation system. Chapter 8 evaluates RCN's effort in internationalisation.

Chapter 9 provides our major conclusions and recommendations in relation to RCN's role in research and innovation policy. We do not there repeat the more operationally- and administratively focused conclusions from the body of the report. The most important recommendations overall are listed in the Summary of the report.

Appendix A contains our mandate. To avoid repetition, we provide summary answers to the individual evaluation questions in Appendix B. Appendix C lists the background reports, which contain evidence and analysis used in this synthesis report.

2. International and domestic challenges in research and innovation

In a globalising world, Norwegian research and innovation policy cannot be considered without reference to the international context. Hence, we start this chapter with a brief reminder of some of the key international trends. We go on to discuss innovation and renewal in Norwegian industry and then what we can see from bibliometric evidence about the performance of Norwegian researchers.

2.1 The international context

Norwegian research and innovation policy has to be made and implemented with an understanding of the increasingly competitive and global nature of research and the economy. Key trends include

- The emergence of the BRIC (Brazil, Russia, India, China) countries and particularly China as a country with a large research and technological development capacity that is becoming recognised for meeting high international quality standards and having large critical mass
- The increased political debate and urgency of global challenges such as climate change, health issues and sustainable energy resources that ask for policy strategies that reach beyond science and innovation policy
- The globalisation of R&D, which is not a new phenomenon, but is becoming more visible particularly in research by large R&D intensive corporations and triggered by the world wide mobility of researchers. This also requires better framework conditions (eg IP protection) that are applied internationally
- Particularly in Europe, demographic developments and the decreasing share of graduates in science and engineering have made the shortage of research talent very urgent. International research collaboration can be used to attract talent from partner countries. The best way to achieve this is by having a visible pool of excellent research of which the most talented people want to be part
- The increased policy debates and ambitions in Europe to provide more critical mass and international profile to research excellence, in which partnering with 'the best' plays a big role. The discussion on the European Research Area and the position Europe should play in the global arena has also spurred more policy activity on this topic

On the latter point, as part of the Europe 2020 strategy, the European Commission adopted the 'Innovation Union' flagship initiative. It sets out a comprehensive innovation strategy to enhance Europe's capacity to deliver smart, sustainable and inclusive growth. A new perspective in the Innovation Union is the intention to link research and innovation more explicitly, which should manifest itself in new types of instruments and research geared to societal and industrial challenges. The Innovation Union plan contains over thirty action points, with the aim to[5]:

- Make Europe into a world-class science performer
- Remove obstacles to innovation – like expensive patenting, market fragmentation, slow standard-setting and skills shortages – which currently prevent ideas getting quickly to market
- Revolutionize the way public and private sectors work together, notably through Innovation Partnerships between the European institutions, national and regional authorities and business

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[5] Innovation Union Web Site

Horizon 2020 is the funding instrument for implementing the Innovation Union. The proposal for Horizon 2020 brings together the innovation related part of the Competitiveness and Innovation Plan (CIP), the European Institute of Technology (EIT) and the Framework Programme for Research and Technological Development under a single heading to remove the separation between research and innovation. The programme will run from 2014 to 2020 with the proposed budget currently standing at €80 billion.

EU research activities are increasingly directed at supporting broader EU policies in most areas of the Lisbon Treaty. These developments in European research policy generate a more thematic based approach that relies on bringing together the best placed actors - user communities, innovators and researchers – to tackle societal and economic challenges. Thus the bottom-up approach of the recent years of the Framework Programmes has formed a junction with more strategic and thematic based policies at international scale. A number of Key Enabling Technologies (KETS) are identified as being the technologies that will underpin the shift to a low carbon, knowledge-based economy.

All these developments require the European Member and Associated States to decide in which strategic research domains they can realistically play a leading role in Europe. The conviction that not every country can be at the forefront of all research and technology domains is also behind the concept of smart specialisation that also stems from the Innovation Union and is regularly quoted by various European Commissioners as the way forward for smart growth in Europe.

2.2 Research and innovation in the Norwegian economy

Innovation and technological change are key requirements for economic development and growth and therefore for maintaining the very high levels of income and welfare that Norway enjoys today. Wealth means that costs – especially, but not only, labour costs – in Norway are high. As a result, Norway has increasingly to compete on the basis of knowledge. This is recognised in the repeated policy commitments over the last ten years to reaching the EU goal of the state spending 1% of gross domestic product GDP on R&D and business a further 2%.

While no indicator is perfect, those that are available suggest that Norway does not do all that well at innovation. Thus, Norway is below the EU average in the European Innovation Scoreboard, which is based on a mix of input and output indicators.

The OECD economic review of Norway in 2007[6] launched a discussion of the 'Norwegian puzzle', namely that the share of gross domestic product (GDP) Norway devotes to research and development (R&D) is comparatively low while income per head is high. There are many reasons why the R&D/GDP indicator is not well suited to Norwegian circumstances. Norwegian GDP is 'inflated' relative to most OECD economies by oil and gas production. The structure of Norwegian industry is biased away from 'high tech' industries and towards large-scale process industries that typically do little R&D. Norway does a lot of advanced technological activity (such as sub-sea engineering) that is skill-intensive but does not count as 'R&D' in the statistics. However, even if Norwegian R&D-intensity is adjusted for the country's unusual industry structure, companies tend to spend only about an amount on R&D that is average for their branch internationally. This is well below the OECD leaders and therefore not consistent with the recognised need to compete on knowledge intensity[7]. A way to compare R&D spending that avoids the problems associated with GDP is to compare it with the size of countries' population. On this measure, Norway spent about the same as S Korea or Germany and well above the OECD average, but also much less than the Nordic neighbours the USA, Israel or Japan (Figure 2).

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[6] OECD, *Economic Surveys: Norway,* Paris: OECD, 2007

[7] OECD, *Reviews of Innovation Policy: Norway,* Paris: OECD, 2008

Figure 2 Gross Expenditure on R&D per capita and as a share of GDP, 2009
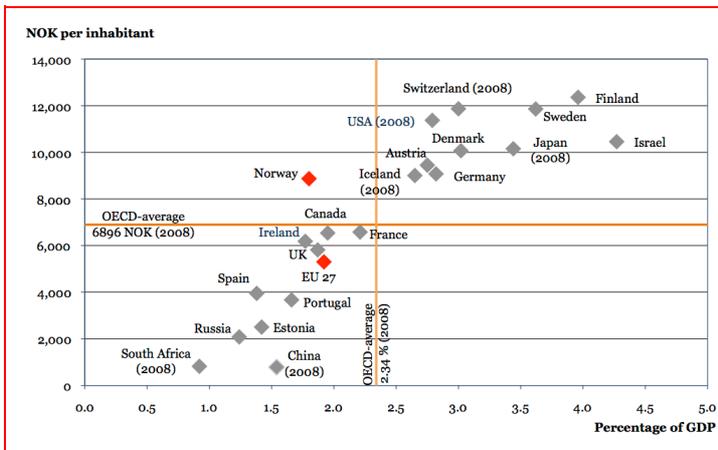
The latest Community Innovation Survey (CIS) in 2008 shows that the proportion of firms undertaking innovation activities in 2006-7 is slightly below the EU average. Slightly fewer Norwegian firms introduced new products or processes in the period 2006-8 than the European average (Norwegian service firms did a little better than average but manufacturing firms rather worse). The proportion of Norwegian firms undertaking product or process innovations is gently declining: from 34% in the 2000 CIS to 33% in 2004 and 30% in the 2008 study.

Market dynamics – the extent to which new firms are created and old ones die – also give cause for concern. Normally we expect high rates of entry in science-based industries as innovators rush to exploit technological and market opportunities. In fact, the rate of entry in these sectors is no higher than in the resource-based industries, which are dominated by large firms and therefore have rather stable market structures. Norwegian innovation is more focused on process improvement than product innovation and Norwegian innovators are less likely to say that the purpose of their innovation was to enter new markets or to increase their market share than is the case with their equivalents abroad[8]. Foreign Direct Investment (FDI) is not only an indicator of the attractiveness of investing an economy but also a source of innovation and restructuring. In Norway, FDI as a percentage of GDP has crept up from about one third of one percent in 1999 to a little less than 1% ten years later; in the same period, in Europe more widely it has oscillated between about 2% and over 5%[9].

Petro-states notoriously fail to use the windfall of finding oil or gas as a way to trigger wider processes of economic and social development. This is a specific case of the more general 'resource curse', which also applies to the discovery of other resources in addition to oil[10]. Policy options to mitigate against the resource curse include

• Invest in productivity in order to offset negative effects on exchange rates

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[8] Fulvio Castellacci, Tommy H Clausen, Svein Olav Nås and Bart Verspagen, 'Historical Fingerprints" A Taxonomy of Norwegian Innovation' in Jan Fagerberg, David C Mowery and Bart Verspagen (eds), *Innovation, Path Dependency and Policy*, Oxford: Oxford University Press, 2009

[9] OECD

[10] Terry Lynn Karl, 'The perils of the petro-state: Reflections on the paradox of plenty,' *Journal of International Affairs*, Fall 1999, 53(1), 31-48; Michael L Ross, The political economy of the resource curse,' *World Politics^, 51, 1999, 297-322*; Jeffrey Frankel, 'The natural resource curse: a survey,' Harvard Kennedy School, Faculty Research Working Paper Series RWP10-005, 2010; Ricardo Hausmann and Roberto Rigobon, 'An alternative interpretation of the 'resource curse': Theory and policy implications,' Working Paper 9424, Washington DC: National Bureau of Economic Research, 2002

- Use part of the windfall to fund the building of upstream and downstream links from the new resource-based industry
- Fight Dutch disease (ie the consumption of the windfall through higher welfare payments) via a tight fiscal policy
- Keep windfall tax revenues outside the country in foreign-currency funds[11]

The experience of Australia, Canada, New Zealand and other countries with significant resource bases shows the way to benefit from them in terms of development, without necessarily falling victim to a resource curse

- Development through knowledge upgrading and investment strategies in resource-based industries
- Development through leveraging resource bases into upstream and downstream industries
- Knowledge creation via knowledge infrastructures[12]

Norway is normally held up as **the** good example of a country managing to avoid the resource curse. Its strong mechanical engineering and ship building tradition, supported by a large and capable industrial research institute sector, provided an excellent basis for developing offshore technologies, integrating the oil and gas sector with other parts of the economy. This was strengthened by a canny policy of requiring those who obtained concessions to do or pay for R&D in Norway. While in the late 1970s the first oil income to the state did prompt increased welfare spending, inflation, increased national debt and reductions in the competitiveness of both agriculture and manufacturing, its effects on the economy were managed thereafter via existing state institutions and controls. Nonetheless, by the early 1990s, oil and gas R&D were tending to 'crowd out' R&D activity in other branches[13]. Since 1990, globalisation and liberalisation of the oil industry and finance combined with increased production has made Norway a country with surplus capital. Despite the creation of the Petroleum Fund in 1996, intended to soak up excess state income and place it abroad, Moen argued in 2005 that the economy had begun to suffer symptoms typical of the resource curse

- De-industrialisation
- Reduced competitiveness
- Low propensity to innovate
- Low investment in R&D
- Low growth in sectors based on new technology
- Increased investment by Norwegian firms abroad, at the same time as Norway attracts little Foreign Direct Investment[14]

Clearly, active policies for innovation and renewal are needed to meet these challenges and the rather modest innovation performance of the Norwegian system. Unfortunately, such policies have a bad name in Norway, as a result of some of the weaknesses of industrial policy in the 1980s.

Hauknes and Wicken argue that there have been three 'strategies' followed in post-War Norwegian innovation policy. Elements of each strategy have been present throughout the period but different ones have been dominant at different times.

- Strategy 1 – big industry (1945-75), when the main aim was to build big companies. It was driven by concern to close the 'productivity gap' with the USA

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[11] Michael L Ross, 'The political economy of the resource curse,' *World Politics*, 51, January 1999, 297-322

[12] Keith Smith, "Innovation and growth in resource-based economies," in CEDA Growth No 58, Committee for Economic Development of Australia, Melbourne, 2007

[13] Keith Smith and Olav Wicken, *Olje og gass som hovedinnsatsområde – prosessevaluering*, Oslo: NTNF, 1992

[14] Eli Moen, *Næringsnøytralitet eller næringsavvikling? Norsk oljeøkonomi, næringsutvikling og næringspolitikk i et politisk-institusjonelt perspektiv*, Discussion Paper 1/2005, Handelshøyskolen BI

A Good Council?

in the 1950 and the 'technology gap' identified by the OECD in the 1960s through the introduction of 'American methods', including transfer of best practice (US) technologies. The state was able to exert influence by controlling investments and inputs into production (especially imports) and labour cooperated even in rationalisation because the welfare state provided a good safety net and there were good opportunities for people displaced from one firm to find work elsewhere

- Strategy 2 – new industries (1980s), focused on new technologies and newer industries. It was felt that national positions in resource-based industries were insufficient basis for creating the future growth needed. From the 1960s a growing share of research funding from NTNF (the former innovation aency) and elsewhere flowed into the national champions engaged in ICT or defence, with the Norwegian Defence Research Establishment (FFI) and the state-owned Kongsberg Weapons group at the core. They became central proponents of a science-based industrial strategy linked to the creation of a national defence industry that resulted in a number of new technology-based firms and the entry of some of the older national champions into aspects of ICT. A lot of effort went into fish farming and offshore technology. And technology Agreements with oil companies. These were major successes. However, in 1987-8, two of the major national champions in ICT experienced crises – Norsk Data went bankrupt and Tandberg pulled out of high-volume consumer electronics. Large industry, especially Norsk Hydro, began to pull back from research-based expansion.

- Strategy 3 – technology diffusion (1990s onwards) pulled back from the optimism about new technologies and branches that characterised Strategy 2. From the early 1990s the 'research driven strategy' for industrialisation was replaced by a 'user-driven strategy' – reacting to the needs of established industry rather than aiming to create new industry. A strong doctrine of branch neutrality developed and policy began to pay more attention to the needs of SMEs than was the case earlier.

The research White Papers over the past decade provide an interesting contrast to the branch neutrality doctrine by proposing thematic priorities. There has also been an increased interest in clusters rather than branches as the basis for intervention, notably in Innovation Norway. This works against the logic of branch neutrality while probably providing an approach that is more robust than the firm-centric selective policies of the past.

The recently-completed Knowledge Based Norway project analyses the major, value-producing parts of the Norwegian economy. It underscores the importance of knowledge for generating the successes so far and the increasing importance of knowledge – expressed not only as research results but especially as human capital – for future success. It also points out that the major successes have build on pre-existing endowments and capabilities and argues that the role of industry policy is to generate externalities beyond those that would be generated by market mechanisms alone by building on strengths and not to try to compensate for weaknesses. The developmental policy of levering oil and gas concessions to build domestic R&D and supply capacity in offshore has been a spectacularly successful example of this. The transformation of a declining general ship-building industry into a high value, specialised provider of ships and equipment for off-shore oil and gas applications is another one of the successes used to illustrate the point. But there are also large opportunities in other areas. The study points out the need to connect emerging generic technologies with the needs of existing clusters and argues for a more selective, cluster-focused innovation policy[15]. The thematic priorities of the recent research White Papers pull in a similar direction.

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[15] Torger Reve and Amir Sasson, *Et kunnskapsbasert Norge*, Oslo: Universitetsforlaget, 2012

2.3 Norwegian performance on bibliometric measures

We chose to compare Norwegian publication performance not only with the world average but also with that of a basket of similar or otherwise interesting countries (Figure 3). The quality and productivity of Norwegian research measured in bibliometric[16] terms is good but has definite potential for improvement.

Over the past ten years, the proportion of Norwegian publications in journals indexed by the Thomson-Reuters Web of Science (WoS) that is produced by authors at two or more organisations working together has risen from about 75% to 80%. Over half the total output involves international collaboration and this (as is normally the case) is cited significantly more than the national output. So good researchers collaborate internationally. In less mature research systems (such as the Czech Republic[17] and China) the quality of internationally co-authored papers goes up over time, which we suspect means that it is not only that the best researchers can persuade others to work with them but also that the collaboration raises quality. Often, nationally produced papers fall below the world average level of citations even in developed Western countries. In Norway, national papers just about reach the average world citation level, indicating that average quality is reasonably satisfactory.

As in other countries, national scientific output has been growing in Norway (Figure 3). Average quality, measured by field-normalised citation scores, is well above the world average level (1.0), rather stable and similar to Canada, Sweden and Belgium – but some way behind the leading group of benchmark countries, ie Switzerland, Denmark and The Netherlands (Figure 4). Norwegian authors tend to publish in journals with above-average impact factors – but less in the very top journals.

Figure 3 Number of Norwegian and other papers in the Web of Science, 2001-9
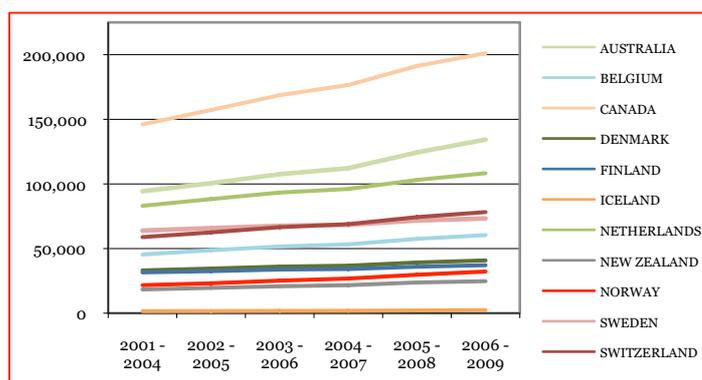
Source: RCN Evaluation, 2012 – Background report No 6: Bibliometric Analysis of the Research Output of Norway in an International Context, CWTS

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[16] Bibliometrics – ie devising performance indicators based on the quantity of scientific articles produced and the extent to which other authors cite them – is a very useful technique but has a number of well-known biases. It focuses only on **part** of what research produces; the journals indexed are weighted towards the English language and developed countries (though researchers know this and therefore try to publish in such journals); it is more appropriate to the hard sciences than to social sciences, engineering and humanities, where other communication channels than journals are more important. There are big differences between fields in how many papers people write, and while it is possible to field-normalise indicators to correct for this, it is inevitably an imperfect process.

[17] Czech Audit; NSFC evaluation, van Leeuwen, CWTS, 2009

Figure 4 Field normalised impact scores of Norwegian and other countries' publications in the WoS, 2001-9
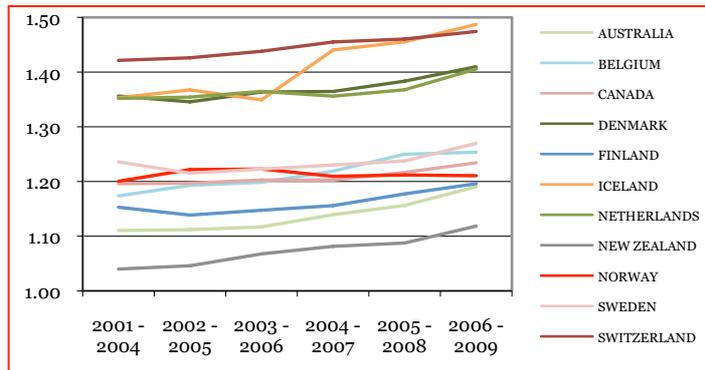
Source: RCN Evaluation, 2012 – Background report No 6: Bibliometric Analysis of the Research Output of Norway in an International Context, CWTS

In terms of productivity, even when adjusting for differences in the fields of research, Danish and Swedish scientists produce more papers than Norwegian, Dutch or Finnish ones. Relative to funding, Danish, Swedish and Dutch papers are cited more frequently, while Norway is at a similar level to Finland and Canada, so arguably the quality of the research is somewhat low in relation to the amount of money spent on doing it[18]. Clearly, research quality improvement to the high level needed for Norwegian long-term competitiveness is an important challenge for RCN and the research-performing system.

2.4 Conclusions

International developments – not only in Europe but more widely in the world – mean that the Norwegian research and innovation system is under increasing pressure to perform well and that it must prioritise international presence and competitiveness.

Norway's great economic success since the start of the oil and gas adventure has a downside, which is that Norway and Norwegians have become very expensive. The non-oil and gas branches therefore find it harder to compete that would otherwise have been the case and Norway needs constant restructuring of industry into increasingly knowledge-intensive and innovative branches. However, the evidence suggests this is not happening. Norway therefore needs significantly to increase its research and innovation activities and to promote development of new business activities. Often, this is easiest to do in areas related to existing strong points in the economy.

On the research side, Norwegian performance is good but not outstanding. Given its high cost base and the need to compete in an increasingly large-scale and competitive global research system, Norway needs to make significant further efforts to drive up research quality.

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[18] Jan Fagerberg et al, *Et åpnere forskningssystem,* NOU 2011:6

3. RCN and governance in the Norwegian research and innovation system

3.1 The role of RCN

RCN is an internationally unique organisation that combines the functions of a research council and an innovation agency. Its origins are in the inability of the previous research councils to coordinate the implementation of the nine national thematic priorities (*hovedinnsatsområder*) established by the government in the second half of the 1980s. These were all cross-disciplinary and cross-sector fields of research, and each priority area could involve several ministries and research councils. The research White Paper of 1993[19] said that the existing research councils quickly fragmented the innovative organisational potential of the main target areas. The government had explained in its research White Paper[20] of 1988–89 that the research funding system had become complex and unworkable. Responsibilities were unclear and the government wanted to see a simplification of the entire structure. It appointed the Grøholt committee to suggest how to do this. That committee proposed creating a single research council. After a lot of discussion, the research councils were merged and RCN began operations in 1993.

RCN is an agency of KD. In the Norwegian research and innovation governance system (Figure 10), all Ministries have responsibility for research in their sectors and all of them, except Defence, allocate part of their research budget through RCN. The Council's share of the overall Government expenditure for R&D has fluctuated slightly in the last decade around a value of some 27%. With 16 ministries using RCN as a channel through which to fund research and innovation, RCN is an extreme example of a 'multi-principal agency'.

Close to half of RCN's income is provided by two ministries: the Ministry of Education and Research (28% of Ministry funding in 2010) and the Ministry of Industry and Trade (23% in 2010). Other ministries with a relatively important share in RCN's funding are the Ministry of Oil and Energy (~10%) and the Ministries of Fisheries and Coast, Agriculture & Food, and Environment, each accounting ~5%.

Government spending on R&D has seen a large increase in the last decade, rising from 10,137 MNOK in 2000 to 15,749 in 2010 (real prices, fixed 2000). This rise in spending was reflected also in the budget allocations to RCN by the various ministries – especially by the Ministry of Education in 2004 and the Ministry of Industry and Trade from 2006 onwards.

Figure 5 shows the trends in RCN's sources of income from 2005 to 2010. The Ministries of Agriculture Oil & Energy and Fisheries all increased their shares significantly.

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[19]   St Melding nr 36 (1992-93) *Forskning for fellesskapet*

[20]   NOU 1988:28, *Med viten og vilje*

Figure 5 Trend in RCN's sources of income (current prices)
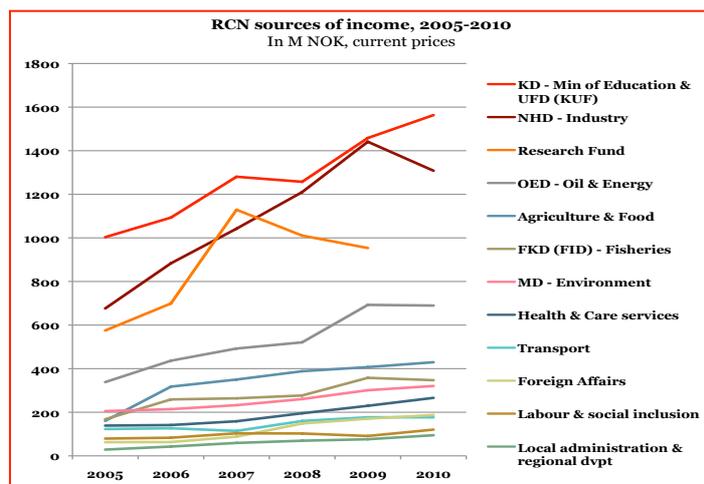
Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on RCN data

RCN's programme portfolio encompasses 4 programme categories: basic research programmes, large-scale programmes, policy-oriented programmes, and user-directed innovation programmes. There is also a category of 'independent projects', predominantly for bottom-up basic research.

The growth in the budget for competitive research funding was primarily in the Large-scale programmes focusing on the societal challenges (Figure 6). The User-directed Innovation programmes, focusing on industry-oriented research, had a close-to-parallel growth pattern, slightly more marked in 2009. Funding of Policy-oriented programmes dropped with the rise of the Large-scale ones, but gradually returned to the level of 2000. In the field of basic research, funding for bottom-up basic research increased slightly as of 2004; support through basic research programmeswas fairly stable in 2000-2010.

In 2010, the Large-scale programmes were the largest programme category, accounting for ~30% of the budget for research funding, closely followed by the user-directed innovation programmes (~25%). Policy-oriented programmes and bottom-up basic research accounted for ~20% and basic research programmes for ~5%.

Figure 6 Funding of research through the programmes

Notes: data include only the funding for research
Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

RCN money goes to the university and institutes in about equal measure, but the institute share is slowly rising (Figure 7). Much of the industry funding is for user-directed R&D projects, which largely subsidise companies buying research from the institute sector. Hence, much of the money that industry receives flows through to the institutes, in addition to what they get directly from RCN.

Figure 7 RCN funding by beneficiary category
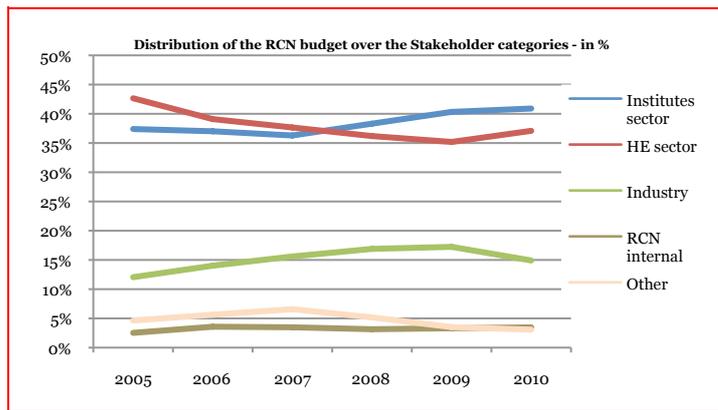
Source: RCN, 2011

Like most countries, Norway has a 'binary' research funding system, where state research performers get general core or 'institutional' funding and supplement this by competing for external project-based funding. Since RCN provides such external funding, its expenditure is heavily biased towards science and technology, where significant external funding is needed in order to do much research.

Figure 8 RCN spend by discipline, 2000-2010

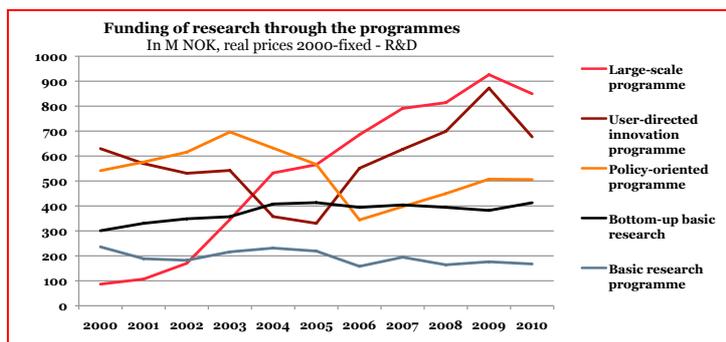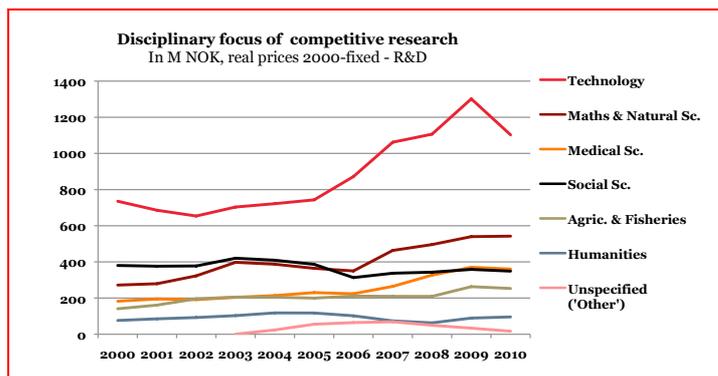Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

3.2 The Fund for Research and Innovation

The risks inherent in sector-based steering of research were clearly identified in the report of the Grøholt committee. The documents that set out RCN's goals and responsibilities include the report of the parliamentary committee for KUF (the predecessor of KD) identified the need for a 'countervailing force' that would balance the fragmenting tendency caused by sector interests with centralising tendency that reflected the collective interest. Amongst other things, it says

> *The government will give RCN framework conditions that enable the Council to play an independent strategic role. In this connection, the government will ensure stability in the overall budgets given to RCN as it becomes established, and to ensure that the funding structure allows RCN to act as an independent strategic research agency.[21]*

Such strategic resources were eventually provided by the government via the Fund for Research and Innovation (FFN – Fondet for forskning og nyskaping) set up in 1999.

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[21] Innst. S. nr. 192 – 1992–93, p 5

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The FFN was a construction to ensure stable funding to research and innovation in the long-term, but was terminated in 2011. Each year capital was channelled to the FFN, and each year KD used the returns for research and innovation activities. The growth of the Fund has effectively enabled KD to expand its coordinating role by evolving from a traditional education ministry focus on basic research to a wider, almost 'science ministry' style with much wider responsibility for research across the system as a whole.

A fundamental idea behind the use of the FFN resources was to support longer term and broad thematic initiatives and thereby to complement more sector-specific activities[22]. The use of FFN resources changed a bit over the years; the initial thought was to channel all resources to RCN for basic research, but then the government decided to add to the Fund and to use the resources also for broad, thematic purposes and to distribute resources also outside RCN. Substantial amounts of the returns from the FFN have been used to fund Centres of Excellence programmes (Sentre for framragende forskning, SFF; Sentre for forskningsdrevet innovasjon, SFI) and RCN-led programmes in nationally prioritised areas such as biotechnology, energy, climate, nanotechnology, and seafood. Significant resources have also been used for investments in infrastructure and for (now abolished) co-funding of large research donations to universities or university colleges.

Since 2006, the Fund constituted the third largest source of revenues for RCN; it accounted for 15% of RCN's overall income in 2005 and 2006, rose to 20% in 2007 and then gradually dropped back to 15% in 2009. Figure 9 shows that the FFN has played a major role in funding newer kinds of intervention by RCN (various centres programmes, infrastructures) as well as basic research.

Figure 9 How RCN used income from the Research and Innovation Fund (FFN), 2006-2011, MNOK

	2006	2007	2008	2009	2010	2011
User-directed R&D	20.5	55.0	55.0	55.0	55.0	55.0
Basic research programmes	15.0	89.0	86.0	86.0	93.5	12.0
Policy-oriented programmes	15.0	27.0	20.0	19.0	23.0	61.6
Large programmes	225.3	271.0	269.2	260.0	260.0	265.0
FRIPRO	61.3	62.7	61.7	0.7	0.7	40.7
Other basic research	37.3	11.0	12.2	12.2	1.2	1.2
Other free-standing projects	1.0	0.0	0.0	0.0	34.2	35.2
Strategic institution support	41.2	18.0	20.0	10.0	10.0	10.0
SFF/SFI/FME	130.0	300.0	325.8	391.0	390.4	418.1
Research infrastructure	0.0	23.0	12.0	12.0	152.0	276.0
Other	162.5	83.5	80.2	85.6	73.2	74.5

Source: RCN, 2012

The FFN was terminated in 2011 due to projected unstable or low returns following the economic crisis and low interest rates 2008-2011. While replacing the Fund with a new line in KD's budget made obvious sense in the context of declining interest yields, this runs counter to the original reason for creating the fund: namely, the need for long-term and cross- or inter-sector resources in the research and innovation funding system.

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[22] St Meld Nr 39, (1998-99) *Forskning ved et tidsskille*

3.3 The governance and policy context

We cannot evaluate RCN without reference to the overall governance context. Norway lacks an effective national research and innovation council in the Finnish style – a style that is increasingly imitated in various ways around the world. There seem to be two reasons for this. First, such councils provide an effective way to coordinate research and innovation policy. Second, they establish a legitimacy for action in the research and innovation system that often brings results only in the long term and is therefore uninteresting under the short-term incentives of the political system. While KD has lead responsibility for research coordination across the government and for RCN, its ability to coordinate is constrained by the sector principle and the lack of a higher-level 'referee' such as a research and innovation council. This in turn regulates the effectiveness of RCN as an advice-giver.

In the past 20 years or so, an increasing number of countries have established committees or councils to advise the government on national research and innovation strategy. The Finnish Research and Innovation Council has inspired many of these. The growth appears partly to be due to the increasing degree to which research and innovation policy issues affect several sectors of society and partly to the spread of the 'innovation systems' perspective, which recognises the systemic nature of innovation and therefore the need for a coordinated approach from government.

There is no wider literature about such councils, so we have had to rely on our own earlier work looking at councils internationally[23]. The councils almost always involve both industry and academia as advisors. Curiously, only the Finnish council involves the research institute sector, despite its inherent closeness to innovation processes. The councils considered tend not to suffer policy capture. They engage with a sufficiently wide set of stakeholders and provide a neutral forum for discussion, so that attempts by special interests to pursue their own objectives quickly become visible.

From the government perspective, the councils reviewed provide three possible choices

- A **joint planning model** (Japan), where the government uses the council as a virtual 'horizontal ministry of innovation', much as engineering companies build project teams by bringing together people across different disciplines
- A **coordination model** (Finland, Netherlands Innovation Platform, Austria, Czech Republic, Chile), where the intention is that the council should communicate horizontally across ministry responsibilities so as to align policies in support of innovation, without this alignment always being binding
- An **advice model** (Canada, Ireland, Netherlands AWT, Switzerland, UK), where the government is happy to be advised on research and innovation policy but does not want to be restricted by that advice

The planning and coordination models require significant commitments of ministers' time as well as willingness across political parties to see research and innovation as permanently central aspects of government policy. The councils examined all inhabit systems where there is considerable distributed strategic intelligence within the state's part of the innovation system. This means that a great deal of instrument and even policy design takes place in ministries, agencies and at other levels 'below' that of the advisory council. It has the advantage of exploiting the superior knowledge of needs and implementation found at lower levels of the system and demands good communication between the council and organisations working at 'lower' levels. Making good use of the intelligence distributed across the system appears to depend to a fair extent on developing what might be called 'social networking capital'.

Desiderata that emerge from the survey of councils include

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[23] Erik Arnold and Gernot Hutschenreiter, Chile's National Innovation Council for Competitiveness: Interim Assessment and Outlook, Paris: OECD, 2009

- An innovation policy council should serve as a publicly open arena in which stakeholders and decision-makers debate and influence the directions of long-term research and innovation policy. This arena role should be complemented by actively consulting stakeholders
- Its composition and status should be such that it is socially and politically legitimate and therefore largely robust against changes in government. It should include scientific and technological expertise
- The council may sometimes need to act as referee and take decisions with which not everyone agrees, but an important goal is to create consensus about policy, so that it is natural for stakeholders to do things that are consistent with the policy
- Part of the council's function is to create and collate the 'strategic intelligence' it needs in order to analyse deficiencies in the innovation system and propose improvements. This should be part of a wider pattern of distributed strategic intelligence
- The council should produce a long-term strategy for the innovation system that does not only tackle systemic and market failures but sets thematic priorities, is holistic, suggests an appropriate policy mix and serves to reduce the 'dynamic inconsistency' between the long time constants of the research and innovation system and the shorter term perspectives of the world of politics
- A key role of the council is coordination: vertically, horizontally and over time. In many countries, coordination also needs to have a regional dimension. Coordination serves to reduce inconsistencies and goal conflicts among policies and actors, make the division of labour in the support system efficient and reduce fragmentation of effort while empowering the actors involved to do their jobs effectively
- The council needs to maintain a high profile with the public and at the level of opinion-formers, promoting the importance of research and innovation and demonstrating its own impact
- It should be sufficiently independent of the system that it can act as a change agent. This means it should have no agendas or operational functions other than its brief to promote R&D&I and it should not have an interest in acquiring or spending significant resources of its own
- The council should have a clear interface to government, at least at the level of ministers, so that someone is responsible for accepting (or rejecting) and implementing its advice. This often means that some ministers should be members of the council

Figure 10 The RD&I Governance system in Norway
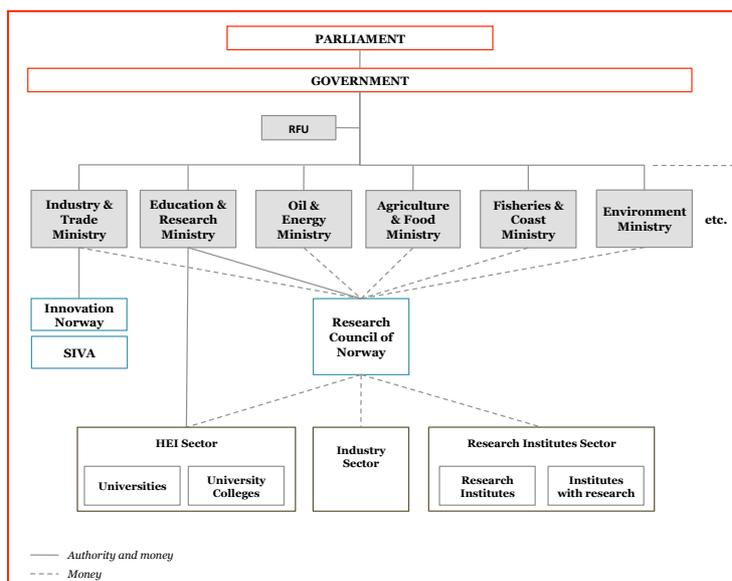
The governance structure of the Norwegian research system – including the government budget procedures – means that coordination is a problem. Which actor, or body, plays the role of national coordinator of research and innovation policy? Formally, the highest authority in the governance system is the government, which can choose to prepare decisions through its research committee (regjeringens forskningsutvalg – RFU), comprising a sub-set of ministers chosen by the government. In practice it has tended to be chaired by the Education Minister. RFU was re-established in 2005 as the highest level coordinating and policymaking mechanism for research. It was chaired by the Minister of Education and Science (kunnskapsministeren), and comprised the ministers for trade and industry, labour, finance, fisheries, agriculture, health, oil, environment, development and a secretary of state from the prime minister's office. All the ministries that spend money on research have officials who sit on Departementenes forskningsutvalg (DFU).

RFU's task is much more narrow than that of international policy councils like the Finnish one, focusing on setting government policy. The wider set of governance tasks is effectively distributed across the government the ministries and agencies in the Norwegian system. Committees to advise government on research and/or innovation policy in Norway have had a troubled and uncomfortable history, during which few have had strong influence. Since no prime minister has taken overall responsibility, there has been (and still is) no referee at the top of the governance hierarchy[24]. This necessarily influences the way RCN and KD have to do their respective jobs of coordination within the national research and innovation system.

In analytic terms, KD's coordination of research is 'weak' coordination, where the role of KD is to collect and share information about the research activities of the various sector ministries and bottom-up to prepare the national research budget. FFN provided resources that KD has used to fill gaps and launch new policies. We distinguish this from 'strong' coordination, which would involve imposing priorities or reallocating resources among ministries. KD's leadership of the process of setting national priorities in successive White Papers similarly amounts to 'weak' coordination, where the White Paper proposes directions rather that being strongly coupled to mechanisms that impose them[25].

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[24] Erik Arnold, Stefan Kuhlman and Barend van der Meulen, *A Singular Council Evaluation of the Research Council of Norway*, Oslo: Royal Norwegian Ministry of Education, Research and Church Affairs, 2001

[25] Jasper Deuten and Patries Boekholt, *Prioritering in kennis- en innovatiebeleid*, Ervaringen uit Canada, Duitsland, Frankrijk en Noorwegen, Den Haag: Ministerie van Economische Zaken, Landbouw en Innovatie, 2009

Figure 11 Norwegian Research Governance and Steering Structure
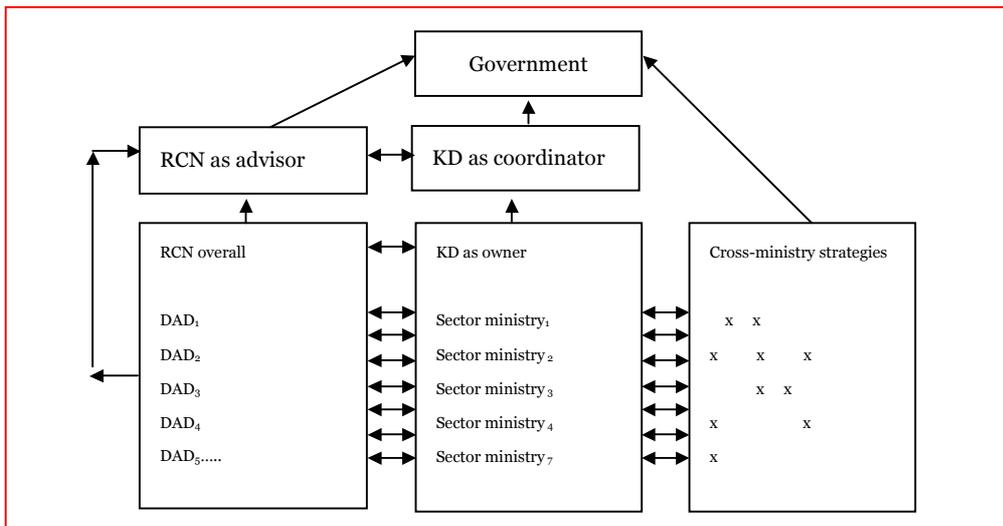
This lack of strong coordination at the top means that the balance of the structure shown in Figure 11 effectively steers research policy. The arrows represent communication and negotiation links. A large part of the power to define policy sits in the sector ministries, where it is modulated on two sides. On the one side there is interaction with RCN (and in many cases with other agents – both agencies such as regional health authorities, through which the ministries spent a considerable proportion of their research and research performers such as the Marine Research Institute). RCN devotes considerable effort to 'add value' by defining cross-sectoral programmes, which it then tries to 'sell' to sector ministries. On the other side, the steering is modulated by the formation of a small but growing number of cross-ministry national strategies, especially in the so-called 2020 processes, where RCN plays a partly agenda-setting role by acting as the secretariat. (This cross-ministry coordination may potentially be reinforced by the appointment of a 'lead' ministry for each of RCN's Large programmes and the role of the four ministries in charge of the institute 'competition arenas'.) The result is a structure where ministries choose à la carte among strategies on the one side and programmes on the other, in addition to specifying their own specific needs to RCN in the expectation that these will be satisfied through ministry-specific action. The lack of a strong coordinating force at the top combined with the lack of strategic resources at the level of RCN means there are few countervailing forces to the policies of the ministries. Over the last decade, in the hands of KD the Research and Innovation Fund has been such a countervailing force.

3.4 Autonomy and external funding

The 2002 Quality Reform of the Higher Education Sector introduced significant changes in governance. It granted the HEIs more autonomy (e.g. for the use and internal distribution of their public funding) and tackled quality in teaching and research by introducing a performance-based funding model (PBRF), fully implemented in 2006. A similar model was also implemented for part of the core funding in the research institute sector in 2009. The reform aimed to encourage modernisation and greater ability to respond strategically to contextual changes and pressures. This implied a change in the relationship between the higher education sector and the government. Government maintained its ability to influence research directions, steer the research base to align with policy priorities, and ensure performance through more external competitive funding and shifting the balance of core funding towards more performance-related funding. More open competition for funding based on quality and relevance was expected to lead to a more 'dynamic'

division of labour in the research system. A key objective was to ensure effectiveness and efficiency of the university and institute sectors in fulfilling their roles in the education and research system.

Other interventions such as the 2005 Act on Universities and University Colleges increased the their responsibility for strategic management of research and granted them the right commercially to exploit intellectual property they developed. The Acts also mandated that the universities facilitate research-based innovation through the licensing of technology and spinning off new enterprises. The universities responded by establishing Technology Transfer Offices, in some cases jointly with university colleges and other institutions. (RCN's FORNY commercialisation programme was for a time used to support these start-up operations.) Norway opted not to have a Danish-style forced merger between the government laboratories and the universities, although there has been some merger activity on a voluntary basis, through mergers among the food research institutes and a merger between certain institutes and Oslo University College.

3.5 Conclusions

RCN was created in order to combat the tendency of the sector principle to fragment the Norwegian research and innovation system. It channels almost a third of the state's spending on R&D from sixteen ministries, of which five provide the largest shares. The intention from the outset was to provide it with 'strategic' resources to counterbalance that tendency to fragmentation. In 1999, the government established the FFN fund as a mechanism to provide these resources under the management of KD and through the KD budget. The Fund has been a significant actor in expanding KD's role in research policy and coordination and in allowing the implementation of new R&D funding instruments and programmes intended to drive important changes in the performance of the research and innovation system.

Norway lacks a Finnish-style, high-level research and innovation council. This means that the research coordination and strategy function is distributed across many actors in the government and the state.

Like other countries, Norway has chosen to make its research performers increasingly autonomous and to a great extent to steer them using performance-based core funding systems to promote quality and external project-based funding to guarantee quality and to steer research in thematic terms.

4. The role of basic research

'Basic research' is a key component of a research and innovation system. The term has both cognitive and political meanings, so we start the Chapter by disentangling these. We go on to describe a different way of thinking about allocating research funding that is not based on a distinction between basic and applied work but between research that maintains and develops the broad research capabilities of the research system partly through bottom-up funding and partly by using signals about social needs to add investment to the parts of the research system for which there is high demand. We then establish that the proportion of the research effort that is 'basic' in a cognitive sense in Norway is about normal for an advanced country. Finally, we consider whether there is space to adjust between funding university research (as a proxy for basic research more generally) directly and competitive funding.

4.1 Basic research in the innovation system

The 'research on research and innovation' community has been proclaiming the death of the linear model for some decades now. The 'linear model' is the idea that basic research somehow causes applied research and that that somehow then drives innovation and wealth creation. These days, we think in terms of 'innovation systems' and recognise that the impulse to innovate can start anywhere; thats it very often starts with the need to solve a real-life problem; and that innovation may use the results of research but that may well be old research. Science and research more generally becomes socially useful and play roles in innovation where they are coupled to needs and users. This systemic view underpins the construction of RCN as a single organisation

Research is not just about new ideas. We have begun to recognise the huge importance of human capital (trained people, especially those with PhDs or equivalent experience) in enabling the conduct of R&D in industry and more widely in society, as well as in the scientific research sector. Indeed, in many smaller countries it is plausible to argue that the most important reason for national funding of basic research is to generate the people that give the national research and innovation system the 'absorptive capacity' to exploit global science.

In Norway as in many countries research policy debate tends to crystallise around two 'tribes' of researchers: the academic, 'basic research' faction that is prone to argue that there should be no research programmes and that the universities should be given money for research and left to get on with it without further controls or questions; and the 'relevance' faction that focuses on applied research and development in the service of society. While some members of the basic research tribe see a contradiction between doing high quality research and doing relevant research, the evidence suggests the opposite. In many if not most fields, research-industry links improve research performance[26].

There are both **cognitive** and **political** definitions of 'basic research'. When collecting R&D statistics, the OECD uses a cognitive distinction among three components

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[26] See for example: Magnus Gulbrandsen and Jens-Christian Smeby, "The external orientation of university researchers and implications for academic performance and management," *Science and Public Policy*, 2003; Gustavo Crespi, Pablo D'Este, Roberto Fontana and Aldo Geuna, *The Impact of Academic Patenting on University Research and its Transfer,* SPRU Electronic working Paper Series No. 178, Sussex University: SPRU, 2008; L-M Lebeau, M-C Laframboise, Lariviére and Y Gingras, 'The effect of university-industry collaboration on the scientific impact of publications,' *Research Evaluation*, 17 (3), 2008, 227-232; M Perkmann, Z King and S Pavelin, 'Engaging excellence? Effects of faculty quality on university engagement with industry,'*Research Plicy*, 40 (2011), 539-552

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- Fundamental research: work undertaken primarily for the advancement of scientific knowledge, without a specific practical application in view

- Applied research: work undertaken primarily for the advancement of scientific knowledge, with a specific practical aim in view

- Development: the use of the results of fundamental and applied research directed to the introduction of useful materials, devices, products, systems and processes, or the improvement of existing ones[27]

This distinction between fundamental and applied research is quite odd. It literally means that the same piece of research can be applied if the researcher knows why she or he is doing it and fundamental if not. These days the OECD tends to refer to 'basic' rather than 'fundamental' research but the meaning is the same. Godin, not unreasonably, argues that the idea of 'basic' research would have been dropped as incoherent a long time ago were it not for the fact that most of the developed world is committed to collecting statistics about it[28].

Alternative definitions have been attempted. One recurring idea is that basic research produces knowledge that is **general**. Applied research is needed in order to build on that knowledge in ways that make it ready to apply it to particular situations, such as the development of a specific product[29]. 'Basic science' — curiosity-driven research without regard to applicability — usually carries a higher prestige than 'applied science'; and even a certain snobbery of the basic toward the applied scientist can sometimes be observed[30].

'Basic research' also has a political or governance-related definition as research whose subject is chosen by the investigator. 'Basic research' in the governance sense is important (a) because it connects to the idea of academic freedom and (b) because it relates to who steers the allocation of resources and therefore the ability of the individual researcher to follow her or his personal research trajectory.

The right of academics to say things unpalatable to church and government involves a battle going back hundreds of years. In the European university tradition, the emergence of 'Humboldtian' universities in the early Nineteenth Century marked the legitimisation of the role of universities in research as well as in teaching and the principle that university teachers' academic freedom consists not only in saying what they want but also in researching what they want. What emerged in the post-War years was a 'social contract' that gave the scientific community a high degree of control in running the 'basic' science funding system, bolstered by the 'linear model' idea that there was an automatic connection between doing basic, researcher-initiated research and social and economic welfare. The essence of that social contract was that "The political community agrees to provide resources to the scientific community and to allow the scientific community to retain its decision-making mechanisms and in turn expects forthcoming but unspecified benefits."[31] From the 1960s and 1970s, there is a clear breakdown of the post-War social contract, with society increasingly demanding to see useful results from its investment in science.

[27] Organisation for Economic Cooperation and Development, *The Measurement of Scientific and Technical Activities: Proposed Standard Practice for Surveys of Research and Development* (Frascati Manual), DAS/PD/62.47, Paris: OECD, 1962

[28] Benoît Godin, 'Measuring science: is there "Basic Research" without statistics?' *Social Science Information*, 42 (1), 57-90

[29] Keith Pavitt, 'What makes basic research economically useful?' *Research Policy*, 20, 1991, 109-119; Mario di Marchi and Giovanni Napolitano, 'Some revised definitions of Aplied Research and Experimental Development', *Science and Public Plicy*, 20 (4), 1993, 281-284

[30] JD Bernal, *The Social Function of Science,* Cambridge, MA: MIT Press, 1967, first published 1939

[31] DH Guston, *Between Politics and Science: Assuring the Integrity and Productivity of Research*, Cambridge University Press, 2000

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4.2 Finding the right mix

While Sweden is one of the places where the battle between the two tribes is noisiest, it is also the place where the need for all the different styles of research was most clearly and early recognised, when a new innovation agency (Styrelsen för Teknisk Utveckling – STU) was set up in the late 1960s to act as a 'change agent' and combat the stagnation in national research identified by the OECD at that point. STU came to argue that Sweden needed the conventional research councils to fund bottom-up and foster excellence across a very wide range of disciplines in order to keep the university teachers current, make sure the foreigners could not fool the Swedes and to ensure that any field that proved promising could quickly be expanded, based on the human capital already in place. This it called 'Programme 2'. STU saw its own role as 'Programme 1': funding research activity in the parts of the system that underpinned industrial and other societal needs – connecting non-academic actors like the major Swedish companies with the academic research community and making sure that enough knowledge and people were generated in the areas of contact between the scientific and other societal systems. Note that the idea of 'basic research' was not part of the discussion: the research to be done was the research that was needed, irrespective of its nature.

Figure 12 Programme 1 and Programme 2
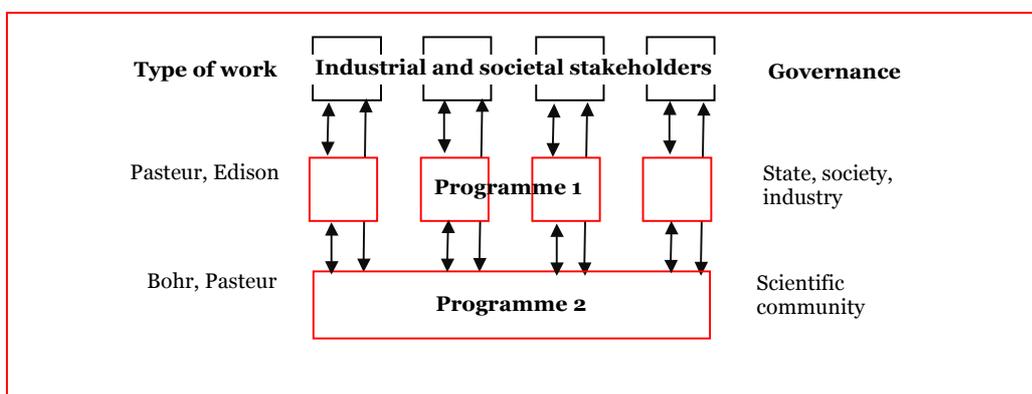
In practice, richer countries tend to do more R&D than poorer ones. One of the best-known regularities in economic development is that the proportion of GDP spent on R&D tends roughly to rise with rising income[32]. There are important divergences from this norm: for example, Italy and Norway manage to have a surprisingly high GDP per head of population while devoting a comparatively small proportion of GDP to R&D; the inverse is true of Sweden. But since we can observe a rather clear relationship between R&D (as a proxy for innovation) and GDP, and since there is plenty of economic evidence to show that changes in technology drive a large part of growth in productivity and the economy as a whole, policymakers tend to regard this as a driving relationship – hence the EU's continuation of the old 'Barcelona Goal' of spending 3% of GDP on R&D in the new Europe 2020 strategy.

Business expenditure on R&D becomes increasingly important as incomes rise but needs to be supported by increased education and research activity in the Higher Education sector. As industrial development proceeds, so industry's R&D effort grows faster than that of the state. Figure 13 shows the relative proportions of Business Expenditure on R&D (BERD) and Higher Education Expenditure on R&D (HERD) for a number of countries over 2006-9. It suggests that there is a certain minimal level of HERD necessary even at low levels of BERD. You need universities to train people

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[32] Curiously, however, it has not been possible to establish a short term relationship between growth in R&D and GDP

and do research; otherwise business cannot start doing R&D. There is an 'entry ticket' to development, meaning that the state has to make the initial investment in research and learning. Second, the slope of the ftrend is shallow: growth in BERD is faster than growth in HERD. So once business starts doing R&D it still needs the universities to do teaching and research. HERD needs to grow in order to support BERD – but not at as fast a rate. In European policy, this is reflected in the fact that the 3% goal is made up of 1% from the state and 2% from industry. The interdependence of different parts of the innovation system is underlined by Brusoni and Geuna's work showing that high-performing countries such as the USA and Germany publish strongly across all types of research: basic, applied, development and engineering[33].

Figure 13 Relative importance of BERD and HERD, 2006-9
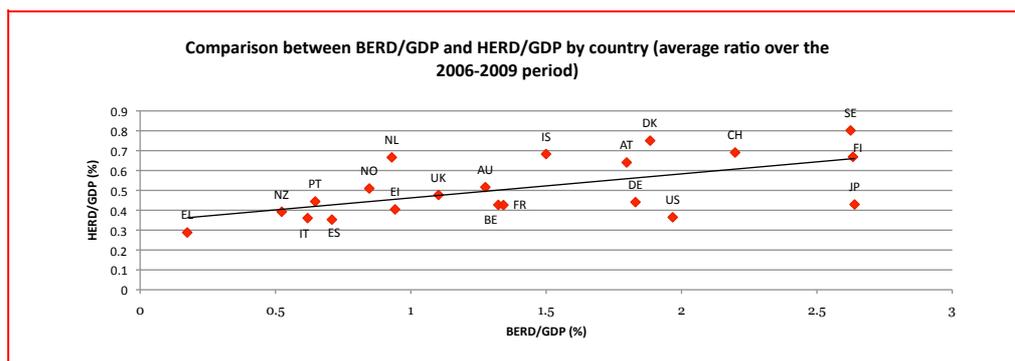
Source: OECD Main Science and Technology Indicators

Basic research is also growing in importance as a function of development – advanced countries have to do more basic research because their opportunities for imitation decline – and because technologies are becoming more 'scientific'. However, the most innovative and dynamic economies maintain a balance between more fundamental research and activities associated with application and development via big mission-driven programmes where the state plays a large role.

As long as national technologies remain behind the technological frontier, companies can operate in 'catch-up' mode and need to be supported by the state research infrastructure maintaining significant applied research capability. Once the frontier is reached, however, the way forward is no longer defined by earlier developers; companies and countries need to search more widely for knowledge and this typically leads to an increase in the proportion of fundamental research done, in order to generate or absorb knowledge from new directions. This proportion goes up not only in the research sector but also among companies. We can see this effect both in national R&D statistics and in the spending pattern of certain R&D funders at national level. The balance of basic and more applied research is very different in different circumstance.

Many countries do not collect data that distinguish between different types of R&D. In Figure 14 we present a view of the division among types for the 'average country' in the basket of developed countries that do provide such data. (We have excluded the former Soviet Bloc countries because their expenditure pattern is dominated by the restructuring of their research and innovation systems since 1989.) The movement among categories during the period is slight: basic research nonetheless increases as a percentage from 18.6% in 1989 to 20.2% in 2009. Norway is at about the same level as the other countries that collect these data.

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[33] S Brusoni. and A Geuna, Persistence and Integration: The Knowledge Base of the Pharmaceutical industry, in: C. C. Antonelli, D. Foray, G.M.P. Swann and W.E. Steinmueller (Editors), *Technical Choice, Innovation and Knowledge: Essays in Honour of Paul A. David*, Cheltenham: Edward Elgar, 2001

Figure 14 Absolute and Relative Development of Research by Type over Time and in 2006-9 for a Basket of Countries
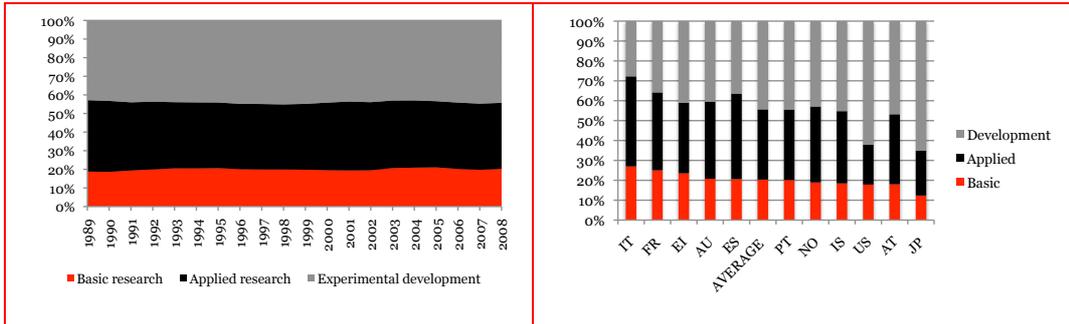
Source: OECD, Main S&T statistics, R-D expenditure by sector of performance and type of R-D (in Million 2005 Dollars - Constant prices and PPPs)
Note: Due to gaps in data series, some data are interpolated. Data presented on the left are the mean of the percentages for each country considered – they are not weighted by the absolute amounts of R&D done in the different countries

It is very hard to find many data about which organisations other than research councils fund basic research. Figure 15 shows that the major US mission-orientated research funders spend quite a lot of their money on it while of course the National Science Foundation spends almost all its money on basic research. So it is reasonable to expect to see quite a lot of basic research funded in 'Programme 1' or in pursuit of sector missions, as well as via 'bottom-up' or free research programmes.

Figure 15 Proportion of Basic Research in the main Departments and Agencies involved in R&D funding (1986-2009)
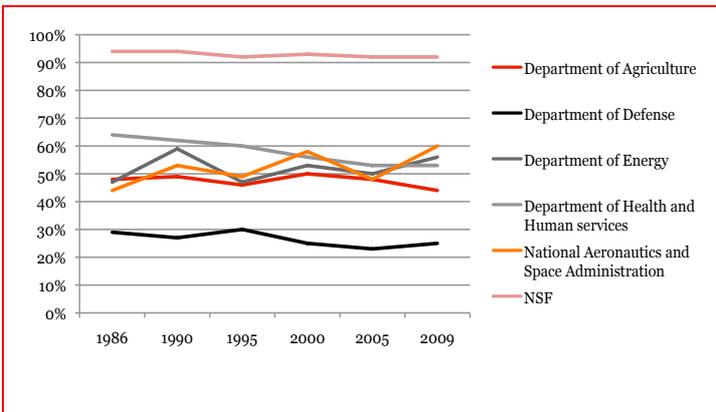
Sources: Technopolis, based on National Science Foundation Division of Science Resources Statistics, Survey of Federal Funds for Research and Development

We cannot disaggregate what the universities do sufficiently to get a comparative picture of the way basic research funding splits between core funding and externally funded projects, but we can look at the overall balance between core or General University Fund research and external project funding in a selection of countries (Figure 16).

Figure 16 Government Funding of HERD: Institutional Funding vs. Project Funding (2008)
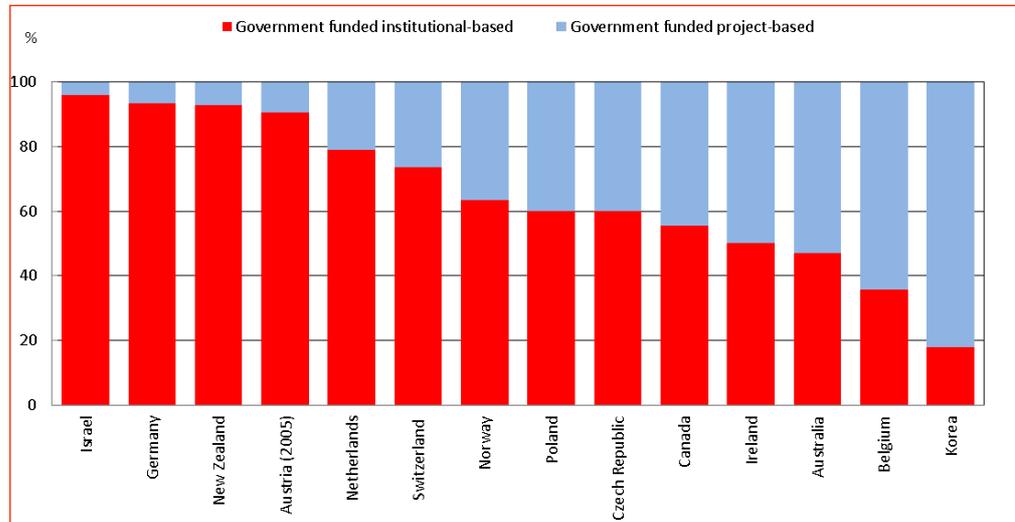
Source: OECD, *Measuring Innovation: A new Perspective*, Paris: OECD, 2010

Different countries choose different balances between institutional and project-based funding of research. In principle, the project-based component involves competition and therefore induces quality as well as providing a way to reallocate resources towards excellent research. The institutional component provides stability: it makes it possible to take decisions about things like the number and size of research-performing entities (for example, it may not be desirable for all research in a field to be done in one place), supports the provision of infrastructure and enables exploration and capacity-building by providing resources that are sheltered from competition.

A growing number of countries are using Performance-Based Research Funding (PBRF) systems that allocate some or (rarely) all of the institutional resources in the medium term, based on performance so that institutional funding also becomes competitive. Historically, the trend has been for countries to move from 100% institutional funding to a mix of institutional and project funding and then finally to making part of the institutional funding performance-based. In the 1990s, higher education funding was split in many countries between 20-30% project funding and the balance of institutional funding, but the share of project funding has risen since then[34]. There appears to be no 'ideal' mix; rather, the objective is to maintain a balance between competition, stability and restructuring that ensures quality while keeping the research system up to date and relevant. Project funding is itself normally a mix of researcher-initiated ('bottom-up') funding and programmed ('top down') funding.

Figure 17 breaks Government sector funding of Higher Education R&D (HERD) down into General University Funds (GUF) and Direct government funding, i.e. project funding – most often competitive. Norway is among the countries with the highest proportion of university research funding via the GUF. In this table we colour coded the comparison countries: those with similarly high levels of GUF are coded green; those with more competitive funding by the government are highlighted orange.

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[34] Barend van der Meulen, *The Austrian Science Fund: Governance and Processes*, Enschede: Universiteit Twente, 2001

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Figure 17 Share of GUF versus direct government funding of R&D expenditure in the Higher Education Sector, 2009 (in millions of €)

	Government sector funding	General university funds (GUF)	Direct government funding (projects)
Belgium	1,117	36%	64%
Denmark	1,653	72%	28%
Ireland	704	31%	69%
Germany	7,575	71%	29%
Spain	3,012	66%	34%
France	7,972	50%	50%
Italy	5,204	85%	15%
Austria	1,669	76%	24%
Finland	1,033	58%	42%
Sweden	2,041	57%	43%
United Kingdom	5,545	48%	52%
Iceland	55	51%	49%
Switzerland	2,000	82%	18%
Russia	548	6%	94%
Japan	6,877	73%	27%
Norway	1,380	73%	27%

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on Eurostat

It is clear from the Table that different stable positions are possible. We showed in Section 2.3 that Denmark and Switzerland are both high performers in terms of citations and both – like Norway – allocate most of the university research money through the GUF. But on the other hand, the UK (a high performer not considered in this report) has a very different way of distributing the money, with a high proportion of competitive projects in addition to a strong performance-based way of allocating the research component of the GUF. A proper analysis of the relationship between funding mechanisms and performance is well beyond the scope of this evaluation; however we can conclude that there is space for the government and RCN to change the way competition and incentives work for basic research in Norway.

4.3 Conclusions

'Basic research' is a key component of a research and innovation system. The term has both cognitive and political meanings. Part of the political meaning is the idea that research is basic if the researcher herself decides what research to do, so it is strongly connected to the idea of academic freedom – hence it is discussed in Norwegian as 'free research'. One of the things that a research funding system has to do is to find a way to manage the mix of free (or bottom-up or researcher-initiated) research and thematically steered research, despite the fact that these modes usually have different governance systems.

International statistics show that basic research (in the cognitive sense) plays an important role in the research mix for many advanced countries. Norway has about the same proportion of basic research in the mix as others. This basic research needs to be done partly in a 'free' mode and partly in a thematically programmed mode. Especially in Norway, the universities dominate basic research. Norway has chosen to fund university research via a mix between core funding and competitive project funding where almost three quarters of the money comes through the core funding. Some other countries do the same; yet others do not, and there is no simple link between this funding pattern and performance. Given the quality issues discussed in Section 2.3, it may be useful to change aspects of that mix. We return to this question in Chapter 9.

5. Strategic intelligence and advice to government

We distinguish between strategic intelligence and advice. In this Chapter, we first discuss RCN's development and use of strategic intelligence and then its role as an advisor to government. Finally we discuss RCN as an advisor to the research performers and its strategic responsibility for the research institutes.

5.1 Strategic intelligence

The idea of 'strategic intelligence' has become important in the way we think about research, innovation and the institutions in which these happen in last 25 years or so, since the idea of 'national innovation systems' took hold. National innovation systems are nationally specific not only because of differences in factor endowments, geography and culture but also because they co-evolve with national systems of **governance**. In the systems view, governance is not a simple matter of top-down 'steering', in which an all-knowing principal sets agents to work to achieve goals that can be set from the top alone, but involves competition, consensus-building, networking and negotiating decisions in arenas in which multiple actors are involved[35]. Strategic intelligence – in the sense of the knowledge needed to make strategy but also the deliberate use of evaluation, foresight and technology assessment in policy formulation and implementation – is a characteristic of research and innovation systems that needs to be decentralised, to enable components of the system to work well. It is not enough that one central actor knows everything – knowledge must be developed and particularly shared across the system of actors involved.[36]. The system of distributed intelligence therefore needs to: be networked; involve active actors or 'nodes' in the different organisations involved; be transparent so that as many parts of the innovation system as possible can share intelligence; publicly supported, so that there are resources available to provide data and analysis; and quality-assured through the participation of multiple providers of intelligence and regular efforts to keep the knowledge involved up to date. [37]

5.1.1 Information and studies

Today, in partnership with others, RCN generates a lot of 'systems health' indicators. These are now complemented by KD's 'research barometer'. One of the most conspicuous pieces of strategic intelligence is the Indicators Report – *Indikatorrapporten*[38] published by RCN, NIFU and Statistics Norway, which describes and documents the Norwegian research and innovation system. The report produces and presents key indicators for Norwegian R&D&I with the purpose of giving an overall view of Norwegian activity in R&D, higher education, science and technology.

RCN undertook a number of research foresights from 2004 onwards, especially in connection with the new Large programmes. The use of foresight studies has since

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[35] Renate Mayntz and Fritz W Scharpf, 'Der Ansatz der akteurzentrierten Institutionalismus' in (same authors) *Gesellschaftliche Selbstregelung und politische Steuerung*, Frankfurt: Campus, 1995

[36] Stefan Kuhlmann, Paries Boekholt, Luke Georghiou, Ken Guy, Jen-Alain Héraud, Philippe Laredo, Tarmo Lemola, Denis Loveridge, Terttu Luukkonen, Wolfgang Polt, Arie Rip, Luis Sanz-Menendez and Ruud Smits, *Improving Distributed Intelligence in Complex Innovation Systems*, Final report of the Advanced Science and Technology Planning Network (ASTPP), TSER Contract No SOE1-CT96-1013, Karlsruhe: Fraunhofer-ISI, 1999

[37] Stefan Kuhlmann, Governance and Intelligence in Research and Innovation Systems, address delivered upon the acceptance of the office of a Fraunhofer-ISI Professor of Innovation Policy Analysis at Utrecht University on 7 October 2002, Universiteit Utrecht, 2002

[38] www.forskningsradet.no/servlet/Satellite?c=Page&pagename=indikatorrapporten%2FHovedsidemal&cid=1224698172624

declined to a low level within RCN. National strategies corresponding to the Large programme areas are now developed by ministries, with varying degrees of support by RCN. RCN and the ministries continue the practice of broad stakeholder consultation for the development of new programmes, but there is still little use of foresight exercises or other disruptive approaches such as technology assessment in RCN and in the policymaking system as a whole.

5.1.2 The role and value of RCN 'meeting places'

The term 'Meeting Places' refers to all opportunities created or exploited by RCN, for knowledge sharing with key stakeholder groups, government and research institutions. They play roles in both strategic intelligence and in governance. In its 2012 report on the meeting places[39], RCN reports on an internal survey trying to establish the intensity of RCN's activities from this perspective. In 2011, RCN organised or participated in approximately 350 'meeting places' involving meetings with stakeholder groups or events, excluding management committees and appraisal/competition panels. This implies that there is a fraction less than one meeting for every single day of the year. Our analysis of the RCN committees showed that in the period 2003-2011, RCN set up a total of 238 committees, involving 1,541 individuals. Currently, there are 172, of which the great majority are Programme Boards (Figure 18), which play an essential role in defining and managing RCN programmes. Except in the Innovation Division, university researchers are the category of people most frequently involved in the RCN steering committees. Some 44% of members are women. Industry is the most represented stakeholder group in the Innovation Division but is little represented in the Strategic Priorities Division. The Institutes sector is also poorly represented. According to interviewees, this is the case in order to avoid conflicts of interest, especially in the programme boards. The largest group of meeting place members is 'researchers'.

Figure 18 Type of committees or boards (2003-2010) (Percentages)
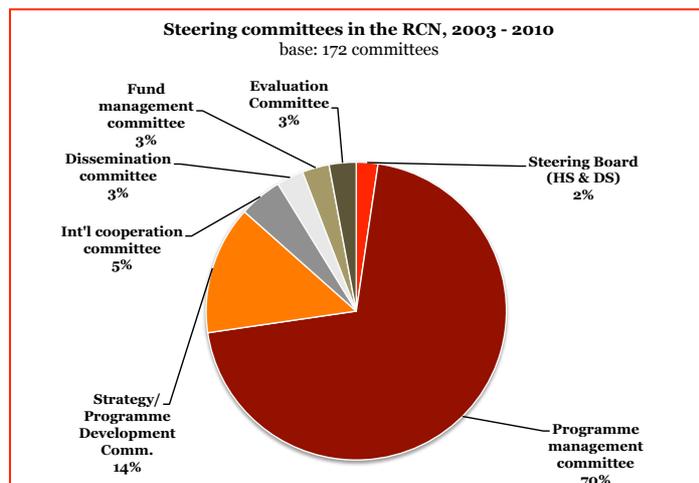
Source: RCN Evaluation, 2012 – Background report No 2: Organisation, Governance and Institutional Boundaries of the RCN, Technopolis; based on the RCN committees database

RCN continues to be very open in the extent of its consultations with stakeholders. Stakeholders regard it as an important arena for counselling and dialogue on research and innovation policies. However, meeting place participants tend to see participation as an opportunity to learn and to network rather than as a chance to exert much influence on RCN policy or practice. This is true both at the level of stakeholder meetings and in RCN's Boards.

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[39] Forskningsrådets møteplasser 2011 og 2012 – Rapport fra kartlegging, RCN, 2012

5.1.3 Evaluation

The statutes say that RCN should "ensure the evaluation of Norwegian research activities"[40]. RCN describes its evaluation activities as

- *Scientific field evaluations*, for which the RCN science division has a five-year plan. The cover research at universities, instotutes and university hospitals
- *Evaluations of instruments*, predominantly programme evaluations
- *Evaluations of institutes*. RCN has stopped doing these on the understanding that their direction is replaced by the new performance-based funding system
- *Other types of evaluation* where RCN acts as purchaser of large-scale policy evaluations on behalf of ministries, such as in the area of social reforms
- *Self-evaluations,* predominantly undertaken by the Innovation Division and focusing on the improvement of additionality in innovation programmes

Field evaluation is an area where RCN does well – it has inherited and improved the former NAVF tradition. Evaluations are normally followed up and a number of research roadmaps for discipline development have thus been developed. These are valuable and play a role in guiding events among the research performers. Where relevant, they can have an effect on future RCN programmes. However, we can see little evidence of work that problematises new fields or that tackles the problems of interdisciplinarity. These are important complementary issues in discipline development.

In the 2001 RCN Evaluation, we estimated that in the years 1995-1999, the level of spending for evaluation represented no more than a maximum of 0.33% of the RCN research budget. Data for 2003-2010 show that little has changed. RCN's expenditure and activity in evaluation is thus modest – this is an under-used tool. Evaluation is otherwise poorly institutionalised. The evaluation strategy dates from 1997 and has never been implemented. Evaluation is not embedded in the programme or policy cycle, though individual programme strategies have begun to call for evaluation, especially in bigger programmes and instruments and there is some evidence that these influence practice. There is a lack of meso-level studies. There is little apparent interest in the impacts of RCN funding (outside the company sector, where beneficiaries of user-driven R&D projects have been surveyed about impacts annually since the early 1990s). Changes in minimum grant size, the launch of the FUGE programme, creating the SAMKUL programme and adding resources to FRIPRO are examples of events at least partly triggered by evaluation.

Dropping the former practice of evaluating the institutes means that there is now no institutional perspective on their performance and that their chief source of feedback is instructions from their parent ministries and signals from markets and the new performance-based research funding system.

5.2 Advice to government

RCN plays an important role with others as a co-producer of strategic intelligence and policy advice. The annual budget proposals are argued to be a key source of advice to government. They result from 16 intimate, parallel and increasingly detailed dialogues between RCN and the ministries and are becoming longer and more detailed over time. Ministries' needs of and attitudes to RCN differ widely. For example, some say they want more advice about priorities while others prefer RCN to limit its suggestions to the level of instruments. It is very complex to handle this diversity – RCN therefore acts case by case, using dedicated 'account managers' ('DADs').

At the level of national policy, RCN is a big and active participant in a debate that involves many other actors in addition. RCN systematically inputs into the research White Paper processes. Many (but by no means all) of the ideas proposed find their

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[40] Statutes of the Research Council of Norway, New version – 1 January 2011

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way into the White Papers and there is then a good correspondence between the priorities of the White Papers and those RCN sets in its own strategies. This RCN advice on national policy appears to be influenced by the fragmented nature of its dialogue with the ministries. It sometimes produces proposals orthogonal to the contents of those discussions but there is not a clear whole-system vision from which RCN generates such advice. We argue that this results at least in part from overly decentralising the production of strategic intelligence within RCN to the divisions.

However, RCN has succeeded in signing up more and more ministries to a declining number of common programmes, so it clearly is able to set or exploit cross-ministry agendas and find synergies in R&D funding. This is an important (if labour-intensive) form of policy coordination. A number of '21' national research strategies have been set up by individual ministries, sometimes with only modest support from RCN. The ministries themselves increasingly show signs of coordinating specific strategies, such as the new ones for generic technologies where multiple ministries develop a strategy together with help from RCN and widespread stakeholder consultation. In these cases, RCN aims to contribute strategic intelligence and secretariat support to the process of developing strategy. RCN coordination from 'below' to a degree therefore complements inter-ministry coordination from 'above. In other words, the system is itself evolving to cope with the coordination deficit at the highest level by moving the *locus* of strategy formation that underlines large programmes from RCN to the ministry level.

At the government level, the sector principle is very valuable. While KD has responsibility for coordinating research policy, in practice it has limited authority. A consequence is that there is only in a limited sense a national strategy – that is the strategy that KD can negotiate with the other ministries during the White Paper and budget processes. There is no higher-level mechanism for creating a view that goes beyond the individual ministry views or the sum of ministry views when they choose to develop national strategies together, eg in bio- and nano-technology. This is increasingly problematic as the *locus* of research policymaking in Europe shifts towards Brussels. Among the consequences is difficulty in prioritising. Thus, RCN became involved in a very large proportion of the early EARA-NETs and is currently taking part in all the Joint Programming Initiatives of the Framework Programme.

5.3 Advice to the research performers and strategic responsibility for the research institutes

The closest thing RCN produces to direct 'advice' to research performers is the results of its field evaluations. Government policy has been to make the research performing organisations more autonomous. RCN and others have identified needs for structural change in the research system, notably to tackle fragmentation, lack of mobility and the need for greater internationalisation. Hence, the 'advice;' that RCN can give them has to be given at least in part through providing incentives. The three Centres programmes (SFF, SFI and FME) provide clear signals about building critical mass, training researchers and better international exposure. Other measures such as the research infrastructure plans, developed in 2006 and since revised, similarly promote de-fragmentation and a better division of labour in the research system. More generally, RCN influences research performers through its thematic and non-thematic programmes and by operating the performance-based funding system for the institutes, which has already affected their rate of publication and in a number of cases caused them to increase their attention to research management.

RCN has always had 'strategic responsibility' for the research institutes – a responsibility it has been difficult to fulfil, given its lack of authority over them and lack of control over budget. In line with the government's policy to make research-performing institutions more autonomous, RCN helped develop a new performance-based research funding (PBRF) system for reallocating parts of the core funding among the institutes. It also revised its programme for providing 'strategic' funding to institutes, to help them develop capacity. Not all the ministries have been prepared to

transfer core funding into the PBRF-based part of their funding arena and only one area has so far implemented the new strategic programme. There has been a little restructuring in the institute sector to adjust to the new regime, but there is probably scope for more.

Internationally, the use of a PBRF in the institute sector is unusual but not unique. In western countries, it is similarly unusual for **all** the institutes to have a single owner, but parts of the system are often grouped under umbrella 'owners' (like the Fraunhofer Society) in order to give common management to common categories of institute. Evaluation and funding tend to be done at the same level, so that evaluations have consequences. And where there is a need to steer the portfolio of institutes, it is done by active management rather than using indirect incentives such as PBRFs. International practice would not suggest that all the institutes should have a common owner (as was the case in the old Soviet academy system) but it does imply that active ownership or stewardship can be useful across groups of institutes, involving more of a 'visible hand' than the 'invisible hand' of markets or PBRFs.

5.4 Conclusions

RCN has a substantial list of achievements to its credit. In many cases these cannot solely be attributed to RCN because they are co-produced in partnership with others. The ones we mention here are nonetheless ones where RCN has at least played an important role – and our list is not exhaustive.

- RCN produces or co-produces a very large volume of strategic intelligence at the level of indicators and surveys. These range from the Indicators Report to detailed monitoring of the research institutes. They are of general interest for making and implementing policy
- Strategic intelligence and policy are developed in the context of large-scale stakeholder consultation. This is difficult to benchmark but is certainly towards the most consultative end of the spectrum of policy development internationally
- Field evaluations are regularly conducted and provide information that is valuable to participants and their organisations as much as it is to RCN itself. These have consequences for participants' strategies and for RCN programmes
- Evaluation is to a growing extent informing RCN programming beyond disciplinary research (to which the field evaluations are primarily relevant)
- RCN plays a significant role in helping sixteen ministries plan a large and growing part of their research expenditure. The budget is a key process for doing this. While there are two parts to this discussion – one on the next year and one on the following year – a longer-term element might also be beneficial
- RCN is an active and well-informed partner for ministries responsible for writing White Papers. The main interaction is with KD for the research White Paper, but there are also others
- RCN supports the coordination of sectoral research needs by developing and implementing research programmes of interest to multiple ministries. In this way, a declining number of programmes is satisfying the needs of a growing number of ministries (in the sense that the mean number of ministries per programme is increasing)
- Ministries are, singly and in groups, preparing thematic national strategies on research. RCN is increasingly providing coordination by supporting these with strategic intelligence and by providing or hosting secretariats
- These two coordination mechanisms appear to be evolutionary adaptations to the lack of an overall 'referee' in the policy system
- RCN is playing a significant role in the development and deployment of programmes that tackle structural deficits in the research system, including the Centres programmes (SFF, SFI and FEM), research infrastructure and the regional research funds. These systemic interventions tend to lie outside the interests of individual sector ministries and have been tackled using money from the Research and Innovation Fund. This underscores the importance of RCN as a

change agent and the need for 'strategic' resources to be available to counterbalance the tendency of sector-driven funding to cause lock-in

- RCN has made a major contribution towards strengthening the institute sector by designing and implementing the new performance-based funding system, even if that system has by no means been fully rolled out at this stage

Issues and problems raised in this chapter include the following.

- RCN made use of foresight for a short period but seems since largely to have dropped it. Foresight is a useful component of strategic intelligence because it helps you move away from consensus to explore disruptive possibilities and counteract the tendency of research agendas and programmes to lock in to existing ideas and trajectories
- Equally, we were not able to identify much strategic intelligence about interdisciplinarity or new and disruptive directions in research
- Evaluation is not properly embedded in the programming cycle at RCN. While we are wary of the idea that everything has always to be evaluated, formally deciding whether to evaluate before, during or after a programme and in relevant cases doing such evaluations ought to improve the quality and efficiency of intervention
- Nor does evaluation adequately tackle impacts. As a result, RCN lacks evidence for accountability and to demonstrate the value of what it does
- The European and global context means it is increasingly important to have a clear national strategy in relation to quality, thematic focus, internationalisation, etc. Without this a small country easily becomes irrelevant in the international research system and resources are wasted on sub-critical and fragmented efforts. Given the lack of a 'referee' in the system, such a strategy is hard to make truly national in Norway
- Advice giving to government appears overly embedded in RCN's interactions with the ministries. RCN needs capacity to develop strategy and advice that is not captive to the ministry agendas and that therefore has greater potential to induce disruptive change
- The availability of strategic resources in the form of the Research and Innovation Fund has been key to RCN's ability from time to time to act as a change agent
- The reform of the research institute system is unfinished business. Neither component of the new funding system is fully implemented. The incentives for restructuring the system remain rather weak and the interest of a number of ministries in addressing institute policy seems limited. The end of institute evaluation means there is no rounded view of the individual institutes as organisations. International experience with performance-based funding systems suggests that strongly formula-based steering leads to perverse behaviour and lock-ins. We therefore would prefer to see a mix of measurement and judgement by one or more competent owners of clusters of institutes rather than treating the institute system as a quasi-market. But whichever view one takes, the institute system currently hangs between an evaluation-based system that had no 'teeth' and a performance-based system that is only partly implemented. This is clearly not satisfactory

6. RCN organisation and governance

The central question for this chapter is 'Does RCN function well as an organisation?' That is a multidimensional query. Organisations have to have structures and processes that are the right ones for their context and it is in the nature of a state agency that it is in part externally governed, so we need to treat organisation and governance together. Functionally, we can view the organisation of RCN as extending upwards into the way it is governed by the ministries; and we can also view ministry organisation as extending down into the agency.

We start by discussing RCN's internal organisational structure, how it has changed during the period covered by the evaluation and the three-level internal steering structure of RCN, with a Main Board, four Division Boards and many Programme Boards. Second, we look at the key process in RCN – funding. Third, we look at the way ministries steer RCN – in effect the extension of the organisation up to the policy level. The new Management by Objective (MBO) system is intended to be an important part of that steering. Fourth, we look at the boundaries of the organisation: Are the dividing lines between RCN and Innovation Norway, on the one hand, and SIVA, on the other, in the right places? Finally, we bring together some conclusions.

6.1 RCN's internal organisation and steering

RCN's character as a multi-principal agency with a broad set of system-wide responsibilities imposes a heavy organisational and administrative load. This is made heavier by the growing complexity of science and technology, the increasing importance of interdisciplinarity and cross-sectoral problems and the large number of stakeholder groups to which it must relate.

Until 2003, RCN's organisational structure consisted of six 'research' divisions, organised primarily according to disciplinary and sector boundaries (Figure 19) that reflected boundaries among the organisations merged to form RCN in 1993. All the divisions except Industry and Energy (IE), funded basic and applied research, while the Science and Technology division (NT) funded basic research activities that underpinned the disciplines covered by the other divisions.

RCN was radically reorganised on 1 September 2003, with the aim of breaking down internal barriers that hung on from the pre-RCN organisation, making it easier to run programmes that spanned applied and fundamental research and supporting change in the programme portfolio so that RCN could be a change agent in the research and innovation system. Three overarching 'specialist' divisions were set up.

- The *Division for Science*, focused on funding long-term and basic research
- The *Division for Innovation*, focusing on industry-oriented research and having a greater emphasis on user needs
- The *Division for Strategic Priorities*, which was to provide the opportunity to exploit synergies between basic research and industrial research through crosscutting initiatives (the Large-scale Programmes).

The reorganisation also resulted in a sharper focus on international cooperation and participation in EU research, and the Director's staff was made responsible for the coordination of international affairs.

Figure 19 Developments in the RCN organisational structure
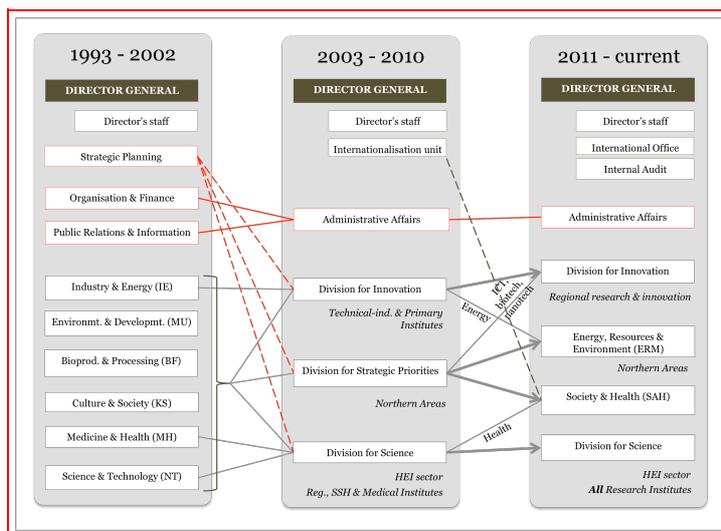
Source: RCN Evaluation, 2012 – Background report No 2: Organisation, Governance and Institutional Boundaries of the RCN, Technopolis

RCN undertook a significant restructuring in 2010, creating a mix of two priority-focused divisions and two divisions respectively reflecting RCN's functions as a research council and an innovation agency.

The most pertinent change involved the split of the Division for Strategic Priorities (SATS) into two divisions centred on the two main dimensions of national and international research priorities in relation to Welfare: the Division for Energy, Resources and Environment (ERM) and the Division for Society and Health (SAH).

Both divisions were to cover the entire range of research in their specific fields (from basic research to innovation) and the Division for Society and Health was additionally assigned responsibility for RCN's bi-lateral international cooperation agreements (previously under the Director's staff International Unit).

The Division for Innovation took on the responsibility for funding research tackling the national priorities in terms of Technologies, ie ICT, biotechnology and nanotechnology and the new materials. It was given more responsibility for strengthening the knowledge-based economy and research-based innovation and was also put in charge of RCN's contribution to regional research and innovation.

The Science division focuses on basic research (predominantly bottom-up) and was assigned overall responsibility for a well-functioning research system, with strategic responsibility for the universities, university colleges and all the independent research institutes.

In our view, the reorganisation of RCN in 2010 was useful. It addressed the need for thematic and disciplinary expertise at the Division Board level and allowed RCN the possibility to strengthen its position in relation to the generation of national research and innovation strategies that is increasingly taking place at the level of the Ministries. It strengthened line management by reducing functional overlaps among divisions and made the structure of RCN more transparent. Weaknesses of the new organisation structure are complexity (which to a small degree explains an increase in the number of staff employed) and the disappearance of an 'arena' specifically for new and strategic initiatives by locking the successors of the Strategic Priorities Division into specific themes.

The reorganisation was well conducted. While the impulse came from the Director General, staff and key external stakeholders were individually and collectively consulted and a broad consensus was reached that the reorganisation was desirable.

Key individuals were redeployed in a manner that appears to have caused little or no friction. Internal and external stakeholders are happy with the result.

Most large organisations are forced to choose some form of 'bureaucratic' organisation structure, with hierarchy ('line management') and delegation. Typically, similarities of process and the nature of the knowledge and technology needed to perform them tend to dictate how the boundaries are established between departments. Common functions and oversight may be provided by staff who sit outside the 'line' departments. Bureaucratic organisations tend to be good at doing a small number of things at large scale; they lend themselves to de-skilled rather than knowledge work; and they are often inflexible. They can benefit from using modern, small-scale organisational devices such as teams to accomplish particular tasks but these have to be organised within or across the bigger bureaucratic structure. The normal way to modify to bureaucracy in order to tackle its weaknesses is 'matrix' organisation and that is what RCN has adopted.

While the new structure represents an improvement on the previous one, it remains complex – and a deal of that complexity is externally imposed through limited coordination of research policy at the level of the 16 ministries. Coordination costs are therefore internalised at RCN. Half the staff (228 people) are involved in internal coordination groups. While each ministry is assigned to a division and an individual 'account manager', in total 60 people play a role in the ministry groups. There are also coordination groups for each of the nine national priorities, a Budget Forum of nine people, an Annual report Forum of 11 and 23 'portfolio groups', each dealing with a thematic priority or structural objective stated in RCN's strategy. In addition, there are functional coordination groups for funding processes (the R&D Committee), analysis, IT, communications and the Impartiality and Appeals panel (HAK) among others.

The budget process illustrates the complexity of coordination in RCN. The process involves two major phases: a preparatory phase where the underlying principles are defined and resulting in a proposal at the level of strategic priorities, and a finalisation phase during which the detailed budget proposal is developed. The entire process takes approximately 3/4 year and involves juggling national Strategic Priorities from the government's White Papers, internal portfolio groups, the interests of the sixteen ministries and the internal organisational structure. It is summarised in Figure 20, based upon the RCN internal Guidelines and input from RCN management.[41]

The diagram illustrates the important role of the cross-divisional Budget Forum, chaired by the Director's staff. The Budget Forum co-ordinates the input from the cross-working groups and senior experts in the Divisions, acts as facilitator for the discussions in the Directors' Meeting, and takes into consideration the feedback received from the Executive Board and the Division Boards for the development of the different versions of the budget proposal, in all phases of the process. There is opportunity for dialogues between the different Board levels; the Executive Board is responsible for quality assurance and the internal approval of the budget proposals.

In the preparatory phase, the different dimensions in the priorities that guide the budget proposal are defined and agreed upon in different steps: first the main priorities, then the other priorities, and finally the application of these priorities for the proposals to the different Ministries.

In the first step, the administration puts forward a first internal draft of the budget proposal - Version 1, covering only the 'main priorities'. These priorities are designed to follow up objectives set out in the White Papers and the Research Council's strategy and action plan.

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[41] Rådviseren – styrende dokumenter, B-2-01 v2 Budsjettforslag, RCN, 2010

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This version builds upon the input from the ministry groups, the Directors' meeting and the cross-divisional Strategic Priorities (FM) groups, which in turn have received input on the existing RCN portfolio from the cross-divisional portfolio (PG) groups. The Executive Board takes a preliminary decision in relation to the main priorities for the annual budget. The draft is then forwarded to the Division Boards for comments and alternative proposals.

Version 2 of the internal draft reports and discusses the Division Boards' input and includes also a draft budget for the other priorities so that the Executive Board has a view on the proposed overall budget framework. The Executive Board discusses and approves the final framework for all priorities, without establishing the sub-division of the budgets among the Ministries.

The next step consists in a merging of the internal draft Version 2 with the budget needs for specific programmes and instruments, setting it in the context of the overall Government funding framework (per Ministry) and taking into account the alignment with the other key research dimensions.

Figure 20 Process for drafting annual budget proposals
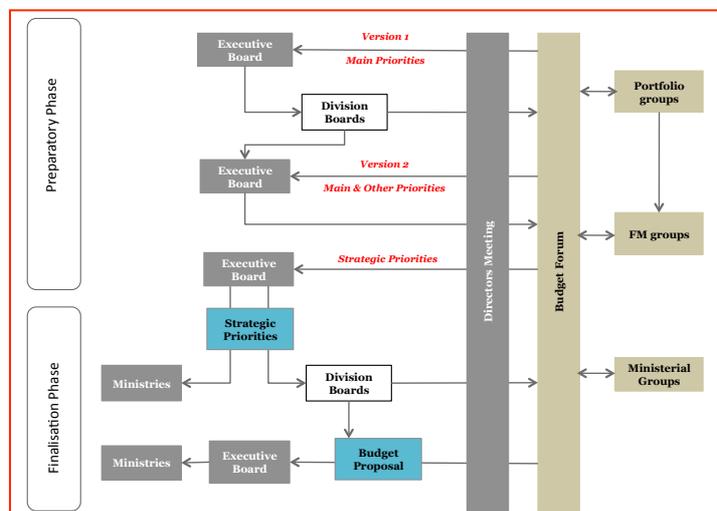
Source: RCN guidelines

The proposal at the level of 'Strategic Priorities' entails for each single Ministry a proposal for contribution to the main and other priorities' budgets, taking into account the state budget and the ministry shares of the previous year. The Division with key responsibility for a ministry drafts the section of the proposal related to that ministry. This proposal should account for the RCN's main priorities, but the analysis should be at a sufficiently detailed level for the Ministries to use it in their preparatory work for the state budget. On approval of this proposal by the Executive Board, the Budget Forum co-ordinates the drafting of the final budget proposal, which includes all programmes and activities, detailed at the level of each Ministry.

In its broad lines, it is difficult to find principles of organisation likely to reduce the level of complexity at RCN. In the detail, some issues appear to be overly decentralised. In particular, evaluation, analysis, statistics and the parts of IT associated with maintaining databases of projects and experts need to have strong and responsible leaders, in addition to the networks currently working across RCN. The lack of a strong, central strategic analysis group means that the centrifugal forces caused by RCN's multi-principal governance are not strongly opposed by a powerful, internal centripetal force that produces an independent national view. An analysis group recently set up in the Director's staff is intended to take on this role. International practice would argue for placing at least part of the analysis function at the centre and for caution in designing over-complex matrices.

RCN's administrative costs are paid partly by KD via a dedicated administration budget and partly by the other ministries, which earmark a small percentage of the money they spend through RCN to cover 'management' costs. Overall, the proportion of the budget spent on administration and management declined from 8% in 2000-2 to 7% in 2003-10. In the last few years there has been a reduction in the use of external contractors, who previously played a more significant role in programme management. This increasing efficiency has been accompanied by a rationalisation in the number of programmes or schemes offered (from 229 to 178) and an increase of about 10% in average project size. There has been substantial investment in IT systems and standardisation of proposal and assessment procedures (admittedly across a large number – 22) of funding instruments.

RCN data indicate that the increase in personnel, combined with the efficiency enhancing measures, more than absorbed the increase in workload (Figure 21). Since 2004, there has been a slight reduction in average workload per employee in terms of budget for which each employee 'accounted' (real prices) and of proposals, and from 2009 onwards there was a drop in number of 'live' projects per employee.

Figure 21 Research budget per FTE, 2004-2010

	2004	2005	2006	2007	2008	2009	2010
Total FTE	330	345	350	378	377	394	411
Total budget – in MNOK*	4061	3897	3914	4483	4362	4958	4843
Total nr projects	4130	4505	4654	5128	5198	4692	4754
Total nr proposals**	6135	6511	6661	7136	7207	n.a**.	n.a.**
Budget/FTE	12.3	11.3	11.2	11.9	11.6	12.6	11.8
Projects/FTE	12.5	13.1	13.3	13.6	13.8	11.9	11.6
Proposals/FTE	26.5	24.4	21.7	20.1	18.3	n.a.	n.a.

Notes: * Real prices – Fixed 2004; **data on proposals are to be considered proxies at a year-to-year level; data on 2009 and 2010 could not be included due to problems in the data

Source: RCN Evaluation, 2012 – Background report No 2: Organisation, Governance and Institutional Boundaries of the RCN, Technopolis; based on RCN data

The RCN staff is highly qualified (15% have a PhD), ageing (half are over 50) and disinclined to leave (staff turnover was only 4% in 2010). Overall numbers have risen from 330 in 2004 to 411 in 2010 and 455 today. The proportion of people at Special Advisor or Director level rose from 27% in 2004 to 37% in 2010. The proportion of women rose gently from 60.5% to 62.9% in the same period.

Timesheets have only recently been introduced and the reliability of the data collected so far is uncertain. In the aggregate, however, these data suggest that RCN personnel spend 25% of their time on programme management, the same on creating and sharing strategic intelligence, 15% on national 'meeting places' and 10% on internationalisation. This suggests that the 'core' funding function is efficiently done but also that other transaction costs in RCN are high.

The reduction in the number of programmes has been accompanied by a fall in the number of Programme Boards and scientific committees from 80 in 2004 to 45 in 2010 – and a faster decline in the number of members from about 700 to some 300 – half of them from the Norwegian research sector, 16% from abroad (mostly researchers), 16% from industry and the rest largely form the public service. The research community therefore has about two thirds of the places in RCN's committees. Industry is little represented outside the Innovation Division. The proportion of foreign experts has doubled since 2006.

Three levels of boards (or committees) govern RCN, mirroring the administrative hierarchical structure (Figure 22). Members of these boards comprise members of the stakeholder communities. For a small number of specific programme boards this may include Ministry representatives but ministry representation in RCN boards is declining as a matter of policy.

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Figure 22 The three-level hierarchy in the governance structure
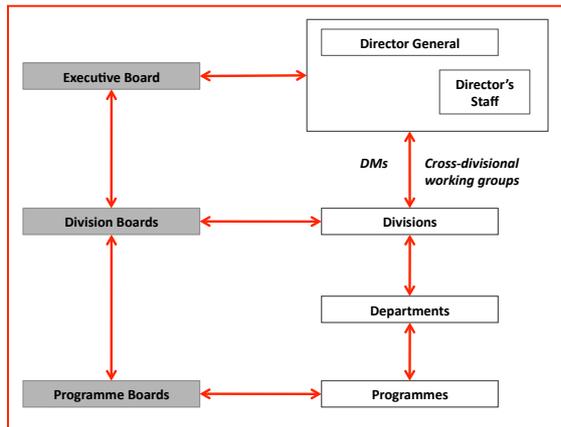
At Division (DS) and Executive Board (HS) level, relevant stakeholder groups appear well represented. Many of the DS and HS Board members interviewed were frustrated that the three-level steering hierarchy and the limits of their authority posed by the requirements of the funding ministries led to a lot of 'rubber stamping' of decisions. It was inconceivable to operate RCN without the HS and Programme Board (PS) levels; the DS were needed partly for span-of-control reasons and partly to give legitimacy to division operations. There seems to be universal admiration in the Boards for the quality and effectiveness of RCN administration, which was often able to use advice on implementation from the Boards. However, while the PS have real influence over programme design and composition, the higher levels were largely not empowered to take strategic decisions; members felt it was close to impossible to trigger significant changes in direction from within the Boards. Some Board members argued that greater influence than this would be unreasonable, in the context of public service and an organisation whose main remit is to implement policy.

The DS and HS Boards play a large role in the development of RCN strategy. However, this primarily involves overseeing the aggregation of the results of detailed initiatives taken at the level of the people in RCN who handle relations with the funding ministries. The Boards do not have a separate or independent source of analysis that would form the basis for proposing alternative strategies. In effect, their ability to set strategy is limited not only by the complex principal-agent governance system within which RCN lives but also by information asymmetry.

In our view all three levels (Executive, Division and Programme Boards) of RCN's three-level steering hierarchy are necessary. The new arrangement should increase the strategic value of the two upper levels – especially if better supported by independent analysis.

6.2 The funding process

RCN has significantly improved the way it processes applications in recent years – a fact reflected both in the researcher survey and in interviews with stakeholders. Procedures are documented and for the most part transparent. Each funding instrument has a defined process. The European Research Council (ERC) heavily influences the process for 'bottom-up' and thematically specified scientific proposals. Proposals to programmes are assessed via international scientific peer review as well as by the relevant Programme Board, which makes final decisions. Innovation projects are additionally assessed by the administration for likely socio-economic impacts before the Programme Board takes a final decision. Centres and research infrastructure proposals are administered in the part of RCN that has relevant domain expertise, peer reviewed and then prioritised by panels put together specially for that purpose, under the authority of the Executive Board of RCN. Applicants get feedback, comprising referees' comments and the scores allocated in the course of appraisal and have the opportunity to appeal decisions. Processing times are rapid. RCN has some

difficulty in handling interdisciplinary proposals – a feature common to all research funders. Current practice may obscure the extent of interdisciplinarity in proposals, making it hard to see whether these are assessed adequately. But more broadly, RCN assessment procedures are consistent with good international practice among research councils and innovation agencies such as those in the other Nordic countries and Austria.

Success rates vary widely across RCN's different instrument and programmes. Unsurprisingly, some specialised areas such as space research have high success rates. User-driven R&D projects also enjoy a high success rate. However, FRIPRO has a very low overall success rate and this is a matter of great concern to the research community since it is the national programme for competitive researcher-initiated project funding. Analysis of the overall scores allocated to FRIPRO proposals in 2011 shows that 30% were fundable (in the sense of having an overall score of 6 or 7 on the 7-point scale used), and that half of these proposals were actually funded. Overall success rates were lowest in the social sciences (12%) and highest in humanities (20%). However, the proportion of fundable proposals actually receiving funding was lowest in mathematics, natural science and technology (40%). RCN's aim of allocating money to broad discipline groupings in proportion to the amount of university research effort done in each supports existing capacity but can drive differences in the proportion of excellent proposals funded.

The universities and research institutes are the organisations that submit the highest proportions of fundable proposals. There is quite a long 'tail' of medium- and low-quality proposals. The proportion of low quality proposals is greatest among the universities and university hospitals, suggesting that these organisations do less quality control of outgoing proposals than the institutes.

Analysis of publications by RCN-funded researchers compared with those by researchers whose applications were rejected shows that at the overall level those funded are more highly cited than those whose applications were rejected – and the more highly cited authors tended to have had more applications to RCN accepted. There is a minority of individual fields where rejected applicants' average citation performance is better than those whose proposals succeeded. The differences were quite big in agriculture and food science, educational sciences and literature (a field where bibliometrics is not a very good indicator). RCN beneficiaries were much more visible than those who had been rejected in the top journals in their respective fields (Figure 23). Thus, the bibliometric evidence confirms our analysis that the quality of RCN's funding processes is good.

Figure 23 Visibility of RCN-funded and other Norwegian researchers in top journals, 2001-2007
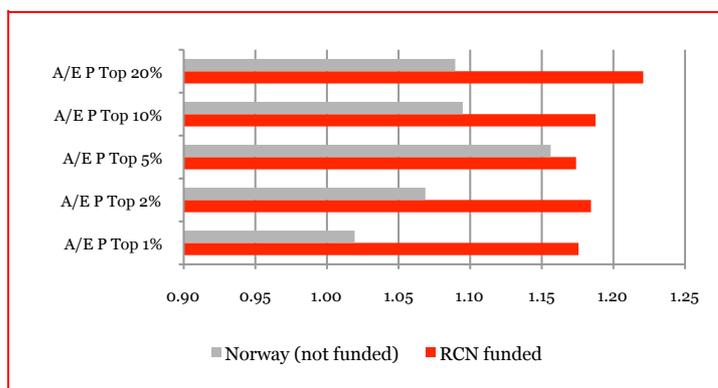
Note: Ratios of Actual to Expected papers in the top x% most highly cited journals in the respective field

Source: RCN Evaluation, 2012 – Background report No 6: Bibliometric Analysis of the Research Output of Norway in an International Context, CWTS

6.3 Ministry steering and the new management by objectives system

In theory, the relationship between principals and agents involves significant risks to the principal, owing to the information asymmetry between them: in the detail, the agent tends to know more about what is being done than the principal and therefore has various opportunities to cheat. The delegation styles used between ministries and research councils have evolved over time. 'Blind delegation', where the decisions about how to use the money are simply left to the council worked in many places until the 1970s, when the 'social contract' with science started to change and the state became much more interested in understanding the results of research and ensuring they were economically and socially useful. From that point on, ministries have increasingly tried to govern science using incentives and performance contracts, the latter in line with current thinking on the so-called 'New Public Management'[42].

However, effective governance appears to require a degree of decentralisation and use of local as well as central strategic intelligence. Effective governance styles rely increasingly on a degree of empowerment – giving the agent sufficient freedom to innovate and to invest in a class of solutions rather than individual potential solutions[43]. This allows agents to learn and add value to the instructions of the principal through programming. Correspondingly, if the agent is not empowered it is difficult for it to innovate and quickly to shift resources to support emerging ideas and risky research or to maintain sufficient diversity in the system to respond to emerging problems[44]. Research funding principals' market power as monopsonists creates strong incentives for agents to conform with their wishes, further tending to lock in the steering relationship. Using RCN in the year 2000 as a case in point, van der Meulen argues that having multiple principals causes further lock-in, as the principals strive to make sure their money is spent on 'their' research needs[45]. Empowerment relies in turn on trust and a level of shared values and social ties[46]. The risk of bad behaviour by the agent is expected to reduce where these contextual factors are in place.

Given the large number of RCN's principals, we concentrated on understanding steering by the five largest funders of RCN

- Ministry of Education and Research (KD)
- Ministry of Trade and Industry (NHD)
- Ministry of Petroleum and Energy (OED)
- Ministry of Health and Care Services (HOD)
- Ministry of Fisheries and Coastal Affairs (FKD)

Our interviews and review of documents suggest that the steering processes between RCN and individual ministries are cordial and based on trust – more so than was the case 10 years ago – and some ministries have increased the proportion of their research expenditure that they channel through RCN as a result. All the ministry people we interviewed are happy with the dialogue with RCN. They all find RCN to be expedient and competent and think that RCN understands their needs. They are also happy with RCN reporting, though reporting needs differ considerably among ministries. NHD and HOD require intensive monitoring and frequent data deliveries, while KD, OED and in particular FKD are less focused on data inputs.

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[42] Dietmar Braun, 'Lasting tensions in research policy-making – a delegation problem', *Science and Public Policy*, 30 (5), 2003, 309-322

[43] Elizabeth Shove, 'Principals, agents and research programmes', *Science and Public Policy* 30 (5), 2003, 371-381

[44] Benedetto Lepori, 'Coordination modes in pubic funding systems', *Research Policy*, 40 (3), 2011, 355-367

[45] Barend van der Meulen, 'New roles and strategies of a research council: intermediation of the principal-agent relationship', *Science and Public Policy*, 30 (5), 2003,323-336

[46] Lepori, *Op Cit*

The dialogue appears to be more two-way than before. Allocation letters have overall developed positively and become more instrumental and distinct. The number of guidelines has generally not increased and the ministries say they listen more than before to RCN when drafting allocation letters. While detail tends to lock RCN in, the ministries do not uniquely cause it – RCN also has an interest in detailed instructions that commit ministries to working through it. Unlike in some foreign systems, the 'unit of analysis' in the steering dialogue tends to be programmes or other activities rather than higher-level objectives. Thus, while the new MBO system represents an ambition to steer at a higher level, the real negotiations remain activity-based. RCN has developed a practice of 'selling' multi-ministry programmes as a way to coordinate at this level so the ministries are increasingly buying into joint programmes.

Steering at the activity level involves a risk of detailed interference by ministries at the level of selecting individual projects or steering the details of individual programmes. However, we saw no evidence that this is the case – rather, ministries tend to maintain a greater distance from programme committees than before. Where ministries need to be more involved at the project level, they are likely to do this through their captive research institutes. By implication, they see RCN as the appropriate arena for competitive funding.

The general idea that each ministry should take responsibility for research in its sector is almost universally agreed in Norway. That is a view that we share. Indeed, while the Norwegian principle is perhaps more explicit than that abroad, most countries organise their research funding and governance around this idea. The alternative of centralising responsibility for research in a science ministry or something similar is unusual. While there is no clear proof, the argument that it is better to have 16 ministries supporting the idea of research than to have one fighting the other 15 to maximise the national research budget is attractive.

Our discussions with both RCN and the ministries made it clear that despite a useful discussion[47] in 2004, there is not a uniform understanding of the 'sector principle' in research. We can think in terms of two kinds of sector principle for research. One is a 'narrow' principle that each ministry should pay for and secure or procure the knowledge it needs to run its daily business of regulation and making policy. The other is a 'wide' principle that gives each ministry in addition the responsibility to make sure Norway has research capacity (in terms of a lively community of applied and pure researchers) working in and for its sector. Without this, there is no guarantee that the narrow sector principle can be followed in future. Ministries varied in the extent to which they see the wide principle as applying to them but in general, sector ministries tended to feel that KD's responsibility for basic research implied that they themselves did not need to play a role in funding the growth of fundamental knowledge or research communities relevant to their own sector. (This contrasts, for example, with US practice.)

RCN's relationship with KD has an importance that goes beyond ownership. KD, the Fund and the budget line that has replaced it represent the major opportunity to tackle systemic failures such as the need for restructuring, capacity building and research that falls into the 'grey zone' between ministries. The nature of that relationship must also in part depend upon an understanding about the degree to which sector ministries have responsibility for basic research of relevance to their own sector and therefore how 'wide' the sector principle is held to be.

A new Management by Objectives (*Mål- og resultatstyrning* – here abbreviated to MBO) system for RCN was implemented in the steering and reporting process between the funding ministries and RCN in 2010-11. It represents an attempt to integrate ideas from the New Public Management into that relation, supporting the

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[47] *Departementenes sektorsansvar for forskning, Slutrapport fra et arbeid utført av Utdannings- of Forskningsdeartementet,* Oslo: UFD, 2004

ministries in the exercise of their sector responsibility with respect to research while at the same time enabling coordination and a streamlined process of instruction and reporting. It also provides an opportunity to review the degree of specificity in ministry instructions and the dialogue with RCN about particular activities and therefore the room RCN has to manoeuvre in trying to optimise its activities at the national level while still making sure that sector needs are met.

The MBO system involves three high-level goals, broken down into a total of 13 sub-goals. The group that designed the system suggested over 70 quantitative indicators that could be used in conjunction with it. (The 'research barometer' proposed by the Fagerberg Committee seems to a degree to be a reaction to this. The barometer aims to diagnose the state of health of the research and innovation system in Norway, which is what RCN should aim to optimise.) In its reporting, RCN has carefully broken down its activities and budgets, allocating each to a unique sub-goal. This allows it to report and use some output indicators at the overall level but also to describe how money from individual ministries has been used and to some degree to connect that to sub-sets of outputs.

In 2011, most of the ministries adopted the system. It is largely overlaid on previous practice, with letters of allocation providing an indication of which MBO sub-goals ministries want RCN to pursue on their behalf in addition to a traditional set of tasks and guidelines. Ministries vary in the extent to which they specify what performance indicators RCN should use; in any case, they do not tend to set target values. Goals are therefore high level and not quantified. NHD has partially overlaid the system on its own one and asks for reporting following its own budget lines. Ministries take on sub-sets of the 13 goals according to their own needs.

Our discussions with the 11 ministries willing to be interviewed suggested that while two felt the new system improved the steering and reporting process, the remainder felt it added length but little value to the process. In the absence of specific targets or significant variations from plan, RCN itself judges in its 2011 Annual Report that its performance against all 13 goals is "satisfactory". The complexity of RCN's steering relationships with 16 ministries makes it a unique case, but it is noteworthy that foreign systems tend to be simpler, more aggregated in their reporting and use a small number of indicators. Some countries emphasise assessments of impacts more than RCN and other Nordic agencies do. Simplification would significantly improve the readability of RCN's reporting.

6.4 RCN's organisational boundaries

SIVA, Innovation Norway and RCN are the three main players in the national research, development and innovation industry and business support system. The three agencies have different roles, responsibilities, and tasks, but are required to cooperate in areas of common interest where there are risks of overlap.

In particular, the three agencies work together in local and regional environments, and through the programmes ARENA[48], which supports regional business clusters, and the Norwegian Centres of Expertise (NCE). There is also routine cooperation, especially between RCN and Innovation Norway, at the working level For example, proposals for innovation projects are sometimes shared in order to find the best fit with the combined set of funding instruments offered by the two organisations.

In short, the contrasting roles of the agencies could be described as follows

- SIVA's investments are geared towards physical and virtual centre and incubator investments aiding innovation, while RCN's focus is on creating commercial and social value via research grants. Innovation Norway works largely through loans

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[48] www.arenaprogrammet.no

and is geared towards creating socioeconomic benefits from entrepreneurship, business development and innovation but without having a research funding role

• In contrast to SIVA, Innovation Norway and RCN both base their support in individual enterprises and projects, which are in turn encouraged to create networks. SIVA, on the other hand does not support individual undertakings, focusing instead on the development of physical and organisational infrastructure.

RCN's links with Innovation Norway are mainly through the its Innovation Division.

There are regular activities around the inter-agency cooperation, and as such, goodwill towards a coordinated national research and innovation system. Recent evaluation studies of SIVA and Innovation Norway have looked at the relationship between the two agencies and RCN[49] but not identified significant problems.

Our interviews with Innovation Norway SIVA, industry, industry associations and research-performing institutions suggest general satisfaction with the division of labour. There is little sense that beneficiaries are confused about which agency to go to for which kind of support. Nor is it reasonable to expect that all potential beneficiaries will maintain a clear understanding of the agencies and the support opportunities they provide. It is at the stage of search that transparency matters, so that beneficiaries can find what they are looking for. In this respect, our view is that the Innovation Norway web site is unhelpful, owing the organisation's desire to bring companies into a personal dialogue before informing them of the opportunities on offer.

Several interviewees pointed out that the regional mission of Innovation Norway means there is the biggest gap in innovation (as opposed to research) support for industry in the capital region, which has the highest concentration of innovative firms. That seems unfortunate to us, but it is a matter of policy and formally beyond the scope of this evaluation.

Our assessment of RCN's institutional boundaries with SIVA and Innovation Norway suggests that RCN boundaries with SIVA are overall clear and well understood. Small areas of overlap exist with Innovation Norway and there the two organisations cooperate. This does not seem to cause problems for beneficiaries. Collaboration between the two agencies is long established and is increasing. It could be improved in relation to information sharing and there may be potential to make better common use of the organisations' international networks.

6.5 Conclusions

• Multi-principal agencies are particularly susceptible to governance lock-ins. The need to provide RCN with a degree of strategic freedom beyond that provided by its principals was recognised already in 1999 and led to the creation of the Fund for Research and Innovation. It has been replaced by budget-line funding from KD. The intention appears to be to continue to use this money as a strategic resource

• The 2010 reorganisation was useful and well executed. The organisational philosophy at RCN today appears to be to drive the organisation as far as possible through the 'line'. The structure is a line organisation with a staff that is operated as a functional matrix. There are inevitably substantial coordination costs because there is no unique logical place to put things that affect multiple divisions. There is a high degree of internal and external satisfaction with the organisation and in the absence of evidence that it is broken there seems to be no point in proposing that it should be fixed rather than monitored and if necessary tinkered with over time. In this respect the change in the statutes that allows the Director General to

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[49] The NCE and Arena programmes have also been evaluated, however these studies have not included agency management aspects, but focused on the progression of the actual projects

decide the organisation structure is a great improvement on the original statutes that effectively forbade change

- RCN administration is increasingly transparent, respected and efficient but the costs are driven up by the complexity of RCN's context
- The three-level steering system works reasonably well and the 2010 reorganisation makes it possible better to use expertise at the level of the Division Boards in developing RCN's strategy and practice. A two-level system would create an unmanageable span of control. The existing structure should be retained
- Funding processes at RCN conform to good international practice and favour good researchers over bad ones. Closer attention is needed to interdisciplinary and high-risk proposals
- The steering relationships between ministries and RCN are close and trust-based but continue to involve a lot of detail. The unit of analysis is activities rather than goals and this constantly risks lock-in
- The lack of clarity about how 'wide' the sector principle for research is tends to mean that 'basic research' is seen as the responsibility of KD. This may lead to a deficit where – as with the Large programmes – there is an intention to increase and focus national research capacity
- The new MBO system clearly offers an opportunity for a process of improvement in the quality, clarity and specificity of steering and reporting while enabling better coordination among ministries and giving RCN opportunities to serve their needs using common programmes and other instruments as far as possible. So far, the new MBO system has changed the form but little affected the content of the steering relationships. The ministries need greater incentives to adopt it. At the moment it is probably more useful to RCN and to KD than to the other ministries. The ministries should now collectively review their experience together with RCN and move towards a steering RCN through more general high-level goals, set more specific performance expectations and implement a shorter and more transparent reporting system.
- The organisational boundaries between RCN and respectively SIVA and Innovation Norway are not problematic. Where relevant, the organisations cooperate in a friendly way. There may be opportunities better to use data and international networks in common but we found no grounds to 'improve' something that already works rather well

7. Implementing and adding value to national priorities and developing the national research and innovation system

In this chapter we refer back briefly to RCN's role in developing national and ministry strategies for research. This was already discussed at greater length in Chapter 5.

In the second section, we focus on RCN's research spending. We first discuss the overall pattern, most of which is funding of competitive research. Second we look within that category of competitive research at the policy mix – what kind of research is funded. Third we look at RCN's systemic interventions, where one of the purposes of funding is to generate organisational changes and changes in the way research is done. Fourth, we look at the beneficiaries: Who got the money? Fifth, we look at the way RCN has shifted its programming towards national priorities. We then examine funding for internationalisation and the surprisingly poor representation of women as leaders of RCN-funded projects.

In the third section, we look at those effects on the research and innovation system that are visible in the changing pattern of funding by field and discipline, the effects reported by the various stakeholders we have surveyed and interviewed and available evidence from RCN's evaluations.

7.1 Research strategy

RCN translates, complements and provides input to the national strategies by means of its own strategy papers. Discipline evaluations constitute an important source of strategic intelligence, feeding into RCN's input to the national strategies as well as its own actions and programmes.

RCN's programmes have become increasingly cross-sector and are ore often funded by multiple ministries (especially the large-scale programmes).

There was an increase in funding of RCN's activities in 2004-2010, spread over the various ministries, but it was particularly marked for the Ministry of Education (in 2004) and for the Ministry of Industry and Trade, Agriculture, Fisheries, and Oil & Energy (from 2006 onwards). The Ministries of Agriculture, Local Government & Regional Development, Foreign Affairs, and Fisheries increased the share of their R&D funding budget that was allocated to the RCN.

The national strategy of most importance for the period under assessment (2004-2010) is in the White Paper *Commitment to Research* 2004-2005. This established a range of thematic and technological priority areas (energy and environment, food, oceans and health; ICT, biotechnology and materials and nanotechnology), as well as crosscutting systemic priorities for basic research, research-based innovation and internationalisation.

7.2 How RCN used the budget

In this section we focus on the research budget. The information presented is based on analysis of the database provided to us by RCN (in January 20, 2012). We have subsequently 'cleaned' some of the data. Financial figures are generally turned into real prices, most often fixed-2000, in order to identify trends in funding behaviour.[50] RCN's database is essentially a finance-management database. RCN has made a considerable effort to structure its activities and define indicators that would facilitate the analysis of its funding activities from a policy perspective – especially from 2006 onwards. The Council divides its research budget into management costs, research

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[50] Details on the modalities for these calculations are provided in a separate background report

programmes, infrastructural and institutional measures, independent projects and networking measures.

For this study, we re-structured RCN's funding activities from an intervention logic perspective, ie the rationale of the activity in relation to R&D policy, wherever possible. First, we grouped the budget lines into three major **funding categories**: management costs, competitive funding, and non-competitive funding. The latter includes core funding to the research institutes and the semi-competitive funding for strategic institutional projects that is channelled through RCN (the SIP, SUP, SHP, and ISP). For each of these funding categories we defined **'intervention categories'**, focusing in particular on competitive funding, within which we defined 2 intervention categories

- Research, Development and Innovation, encompassing research performed in the programmes and independent projects – including the measures for international cooperation
- Systemic initiatives, including the Centres programme, measures fostering network development or funding infrastructures and scientific equipment, regional innovation, commercialisation of R&D results etc

The intervention categories are sub-divided into **policy mix categories**, reflecting the focus of the funding. For this categorisation we took into account the combination of proposal types and types (or content) of programmes or measures.

The policy mix for **Research, Development and Innovation** consists of

- Innovation-oriented research, including both bottom-up innovation (BIA) and programme-steered innovation – the latter in all other user-directed innovation programmes and in the Large-scale & policy-oriented programmes. Included in this category are the User-directed innovation projects (IPN), the 'Competence-development with user-involvement' projects (KPN), and the Industry PhDs
- Basic research, grouping bottom-up basic research (FRIPRO – which includes *Storforsk*, and YFF) and programme-steered basic research (in the other basic research programmes), listed in the RCN database as 'basic research'. As RCN does not define proposal types for basic research, we could not identify basic research funded in the Large-scale & policy-oriented programmes.
- Mission-oriented research, encompassing basic or applied research (all 'non-innovation oriented' research) in the Large-scale programmes and policy-oriented programmes. It also includes some research projects that were listed as independent projects but had a programme name (projects from 2000-2003)
- International cooperation in research, grouping the projects focusing on research as well as 'network development', which are listed separately in RCN's categorisation, as well as the international cooperation projects/measures funded in specific programmes – wherever identifiable. We distinguished participation in EU programmes/initiatives or Nordic initiatives based on programme or project descriptions (in the titles). This was done manually

In the category of **Systemic interventions**, the policy mix included

- The Centres programmes, including the Centres of Excellence and the Competence Centres
- Support for Competence development, which includes support for infrastructures & equipment, network development, institutional measures (not further specified), dissemination (ie scientific publications), research competence (projects listed as independent with no further explanation), and (competitive) institutional funding. The latter includes support for strategic projects in institutes that were more competitive in nature
- Support for Innovation capacity building, such as the schemes fostering the commercialisation of research results (FORNY), industry mobilisation (MOBI programme & similar) or regional innovation (VS-2010 & VRI)

- <u>Support for internationalisation</u>, including international dissemination activities (conferences, publications, etc) related to EU programmes/initiatives, Nordic initiatives or other cooperation initiatives, as above

According to the RCN database, the Council involved ~3000 stakeholder organisations in its activities during 2000-2010.[51]

In line with common practice, we made a major distinction from a '**sectoral' perspective**, ie identifying the key actors in the RD&I system: <u>universities</u>, <u>university colleges</u>, the<u> industry sector</u>, <u>research institutes</u> and<u> 'institutes with research'</u>. University hospitals are ranked under the main category 'university'; industry associations are listed under the main category 'industry'.

'Institutes with research' include research institutions that do *not* have research as their key activity and/or are not officially recognised as 'research institutes'. These are government labs (whether owned by ministries or autonomous), museums, or institutions such as the Statistical Office.

We also grouped another set of stakeholders under '<u>other research'</u>. This includes especially individual researchers for which the database did not give us clear 'sectoral' indications; other organisations included in this category are research foundations, inter-institutional centres, and (disciplinary) research associations.

We called a final category '<u>Public Sector/Society'</u>. This category contains citizens' organisations, public administration (at national, regional or local level), public agencies, and public services, including museums, libraries and (non-university) hospitals.

7.2.1 Funding overall

In 2000-fixed real prices, RCN's budget rose from 2,843 MNOK in 2004 to 4,470 MNOK in 2010 (Figure 24). The budget growth went almost entirely into competitive measures, in line with the government's intention to make the research performing institutions more autonomous and to steer using incentives.

Figure 24 The main components of the research budget
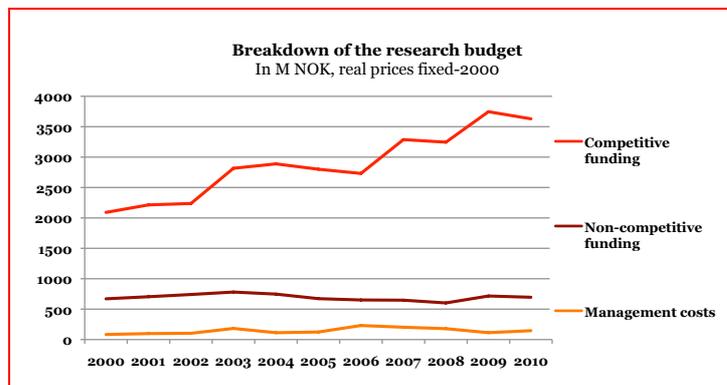
Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

Within total **competitive** funding, RCN spent more money over time on both R&D projects and on systemic interventions intended to induce structural changes (Figure 25). In 2010, the budget for RD&I funding was 3,935 MNOK; funding for the systemic initiatives was 1315.7 MNOK (current prices). The share of the money spent on

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[51] This number is an over-estimate: it is based on the total of organisation IDs in the database. Numerous organisations had more than one organisation ID and there were a large number of individual researchers for which no organisation ID number was provided. This number includes only organisations that were 'project leaders' and researchers benefitting of individual grants.

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systemic initiatives rose to some 30% in 2004 and remained at that level for the rest of the decade.

Figure 25 Intervention categories for competitive funding

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

At the overall level, competition-based support for the innovation system has risen faster than that for the research system (Figure 26) – driven by the rising contribution to the budget from innovation-orientated ministries, especially NHD, OED and LMD.

Figure 26 Focus of support to the RD&I system – competitive funding
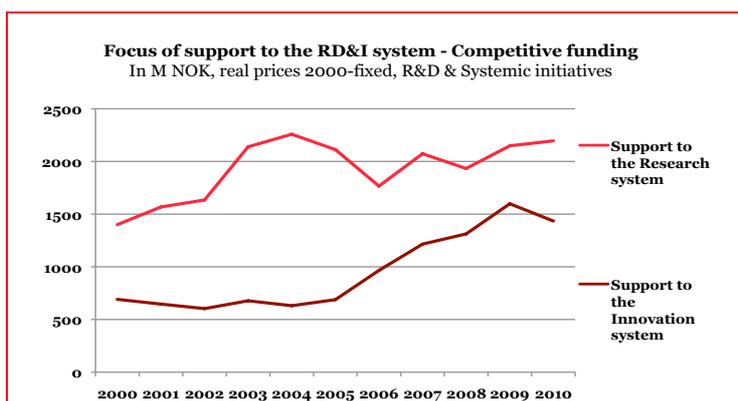
Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

7.2.2 The policy mix in competitive funding

Within the category of competitive finding, innovation-oriented research showed the strongest growth, in particular since 2006, followed by mission-oriented research (Figure 27). Basic research (in the relevant programmes or as 'free' projects) stagnated, receiving a stable level of funding throughout the decade (real prices). (A limitation of this analysis is that we cannot look into the Large programmes and see how much of the research done there is in effect fundamental.)

In 2010, innovation-oriented research accounted for ~40% of the funding for R&D, compared to ~25% in 2004. The strong growth in innovation-oriented research meant that mission-oriented research and basic research jointly counted for ~55% in 2010, compared with ~70% in 2004. International cooperation accounted for some 5% in 2010.

Figure 27 Policy mix for the competitive funding of RD&I

Policy mix for the competitive funding of RD&I
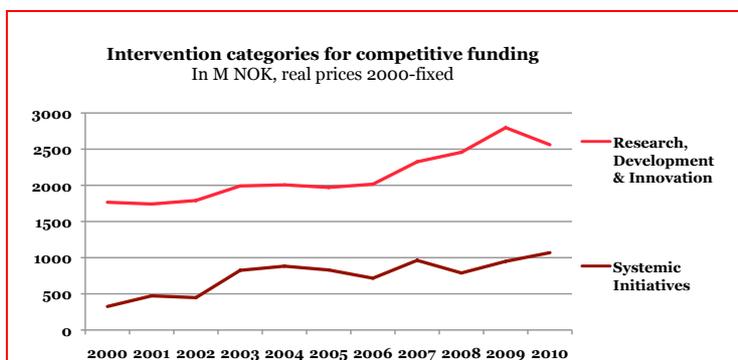In M NOK, real prices 2000-fixed

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

Our approach is unable to distinguish basic from other kinds of research within the Large programmes. The RCN database is partly coded to permit such analysis but it has not proved possible fully to clean the data. Figure 28 is not therefore fully consistent with the rest of our analysis but probably provides the best view possible of this issue.

Figure 28 RCN view of basic research content in Large programmes

Competitive funding of basic research in the Large-scale programmes
In shares of R&D funding in the programmes - excl. Int'l coop.

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on RCN data

The Policy Mix adopted in the research divisions quite obviously reflects their mandates (Figure 29). The Science Division focuses on basic research and invests ~35% of its budget in systemic interventions for research, the Innovation Division focuses on innovation-oriented research (increasingly bottom-up), and the Strategic Priorities covers (basic and applied) mission-oriented research.

Figure 29 The policy mix of competitive funding in RCN's three divisions
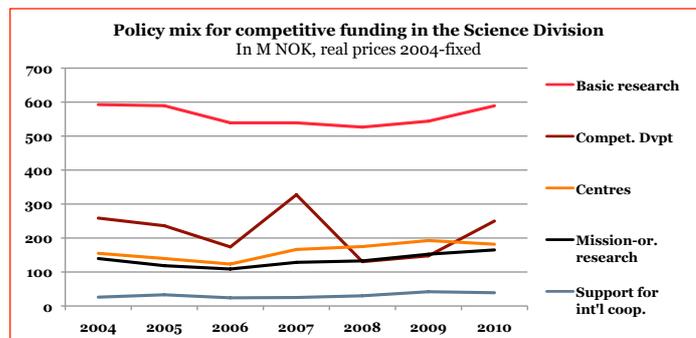
Policy mix for competitive funding in the Science Division
In M NOK, real prices 2004-fixed

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Policy mix for competitive funding in the Innovation Division
In M NOK, real prices 2004-fixed

Policy mix for compet. funding in the Strategic Priorities Div.
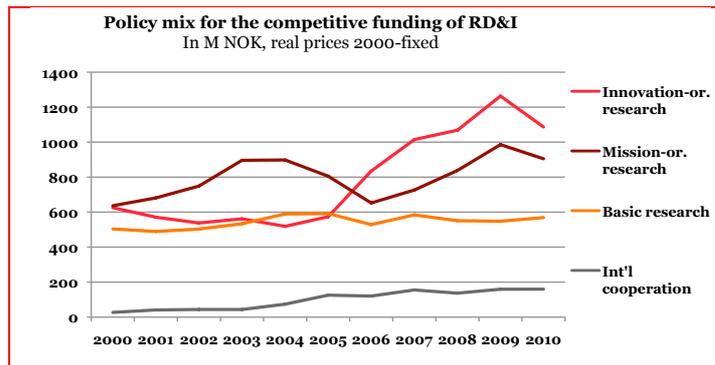In M NOK, real prices 2004-fixed

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

It is particularly noticeable that the Strategic Priorities Division shifted its spending somewhat from mission-orientated work towards innovation, under the influence of the evolution in the strategies of some of the programmes (Figure 30).

Figure 30 Policy-mix for competitive funding in the Division for Strategic Priorities (2004-2010)

Trend in policy mix for competitive funding in the Strategic Priorities Div.
In shares of the comp. funding budget

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

7.2.3 Systemic intervention

Throughout the decade, RCN spent a fairly stable share of ~20%/25% of its competitive funding budget on the delivery of support to the RD&I system, beyond the direct funding of research.

In the beginning of the 2000s, one fifth of this budget (~20%) went to support the innovation system ('innovation-capacity building'), while the remaining 80% went to the research system ('competence development'). This balance changed with the launch of the two Competence Centres schemes (SFI and FME). As a result, funding of support for research competence development accounted for ~40% of the systemic initiatives funding in 2010, compared with 80% in 2000.

technopolis |group|

The **Centres programmes** currently constitute the core of the systemic initiatives policy mix, accounting for 40% to 45% of the funding for systemic initiatives (Figure 31).
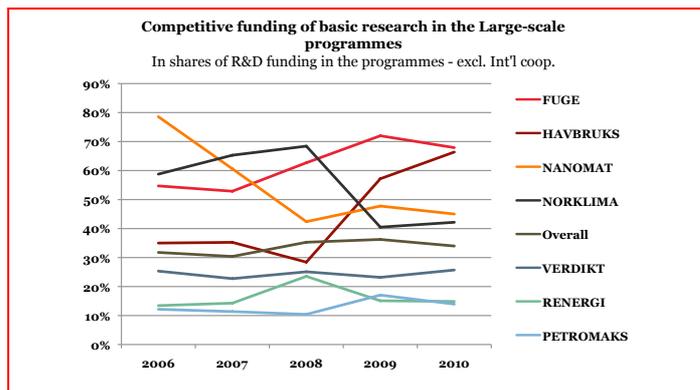
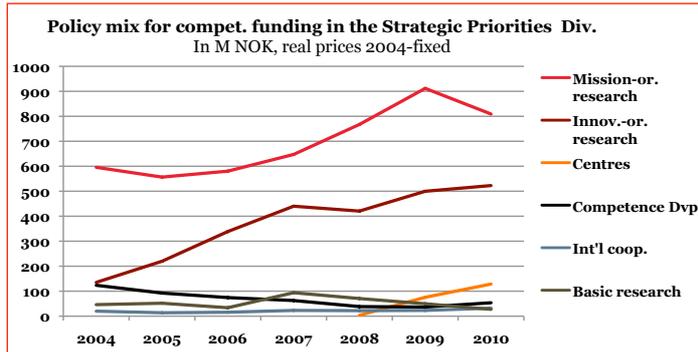Figure 31 Policy-mix for the systemic initiatives
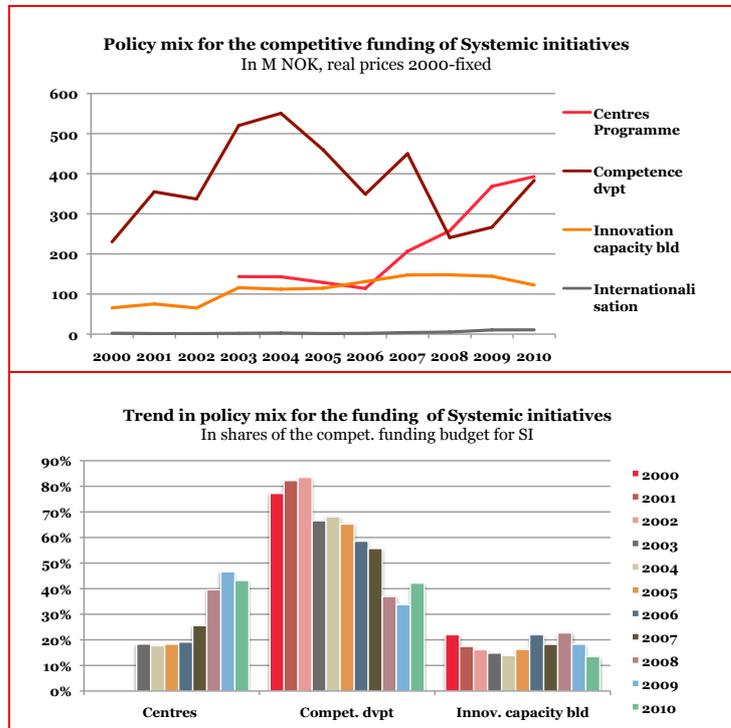
Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

Support for infrastructures and scientific equipment is a constant theme in the field of **competence development**, while the focus of institutional support changed from support for individual, small strategic projects to support for the creation of (inter-institutional) research groups and centres (Figure 32). The Centres of Excellence account for ~35% of the budget for systemic initiatives focusing on the research system.

In the field of **innovation capacity building**, a historical major focus is raising the awareness of industry about research-based innovation. Regional innovation is another major - and returning - focus of the initiatives. The Competence Centres are the major instrument, accounting for ~60% of the funding related to the innovation system.

Figure 32 Trend in systemic initiatives for the research and innovation system
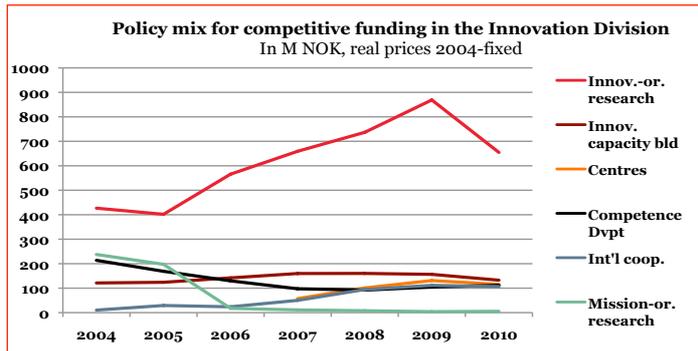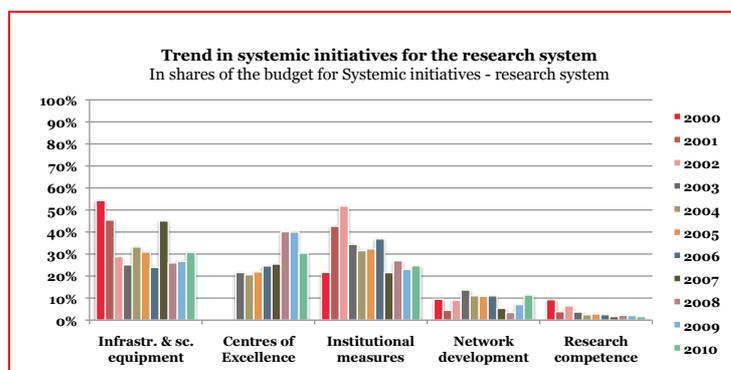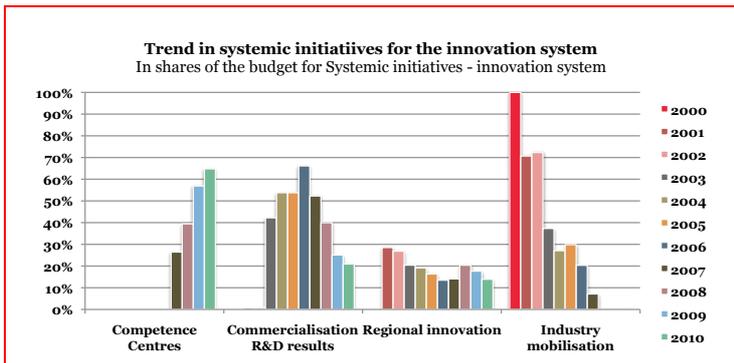
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Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

Figure 33 shows that the major focus of the systemic initiatives has been on changing the behaviour of the universities but with the institutes becoming increasingly drawn in through the decade.

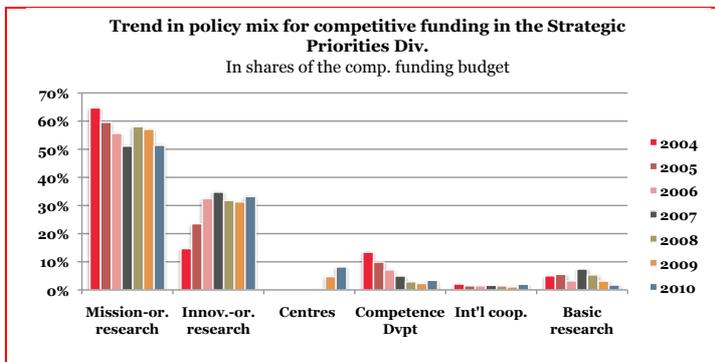Figure 33 Stakeholder involvement in the Systemic initiatives

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

From mid-decade, RCN has increasingly focused on fostering collaborations within and between the different 'sectors' in the RD&I system. In 2010, collaborative research accounted for 56% of the competitive research funding for 'national' initiatives, i.e. excluding research abroad. Most of this funding was focused on innovation (Figure 34) but collaborative mission-orientated and basic work also grew.

Figure 34 Funding of collaborative research

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

There is growing collaboration within Norway, especially between organisations in the regions and in Oslo (Figure 35).

Figure 35 Inter-regional research collaborations – project 'owners' versus partners, 2010

| Region project 'owner' – base (nr. of interregional collaborative projects)		Partners						
		Hoved staden	Midt-Norge	Vestlandet	Oslofjorden	Nord-Norge	Innlandet	Agder
Hovedstaden	429		41%	27%	12%	12%	8%	4%
Midt-Norge	276	65%		39%	18%	14%	11%	7%
Vestlandet	197	54%	30%		6%	13%	2%	4%
Oslofjorden	75	67%	33%	23%		1%	11%	1%
Nord-Norge	69	61%	38%	25%	1%		1%	0%
Innlandet	34	50%	56%	6%	12%	12%		0%
Agder	25	36%	36%	36%	16%	8%	8%	

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

Starting in 2008, a new core funding system for research institutes was put in place, comprising a performance-based reallocation of a small part of the core funding and a new system for the strategic projects. Neither has been fully implemented.

The data show a considerable rise in core funding for the research institutes from 2008 onwards, partly compensating for the drop in funding for the strategic projects in these institutions (Figure 36). The funding of other institutional strategic projects, instead, remained at a fairly stable level overall. However, at a more detailed level, there was a change in focus, with increased funding for strategic projects in university colleges (SHP) and for the funding of ISP, ie projects funding the development of strategic international inter-institutional collaboration.

Figure 36 Institutional funding channelled through RCN
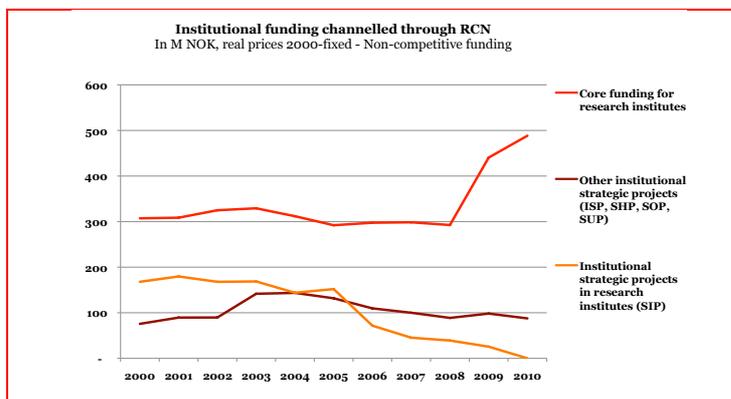
Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

Another important structural influence is RCN shifting resources away from individual grants and towards projects that involves more than one person with the intention of reducing fragmentation in the research community. The exception is that YFF (excellent young researcher) grants have grown against the trend of general decline in grant funding, underlining RCN's increasing focus on excellence.

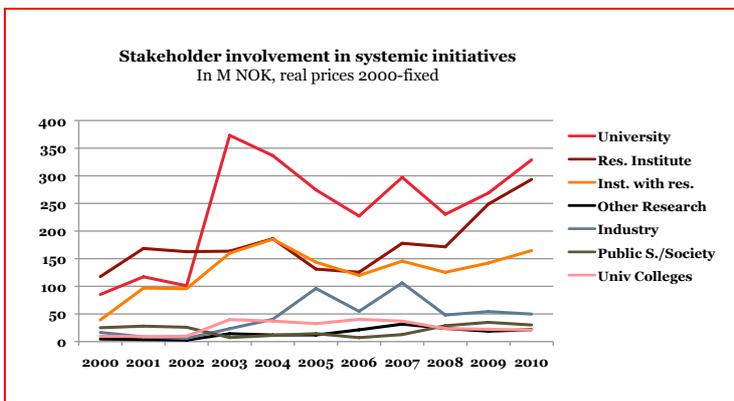Figure 37 Instruments for competitive funding
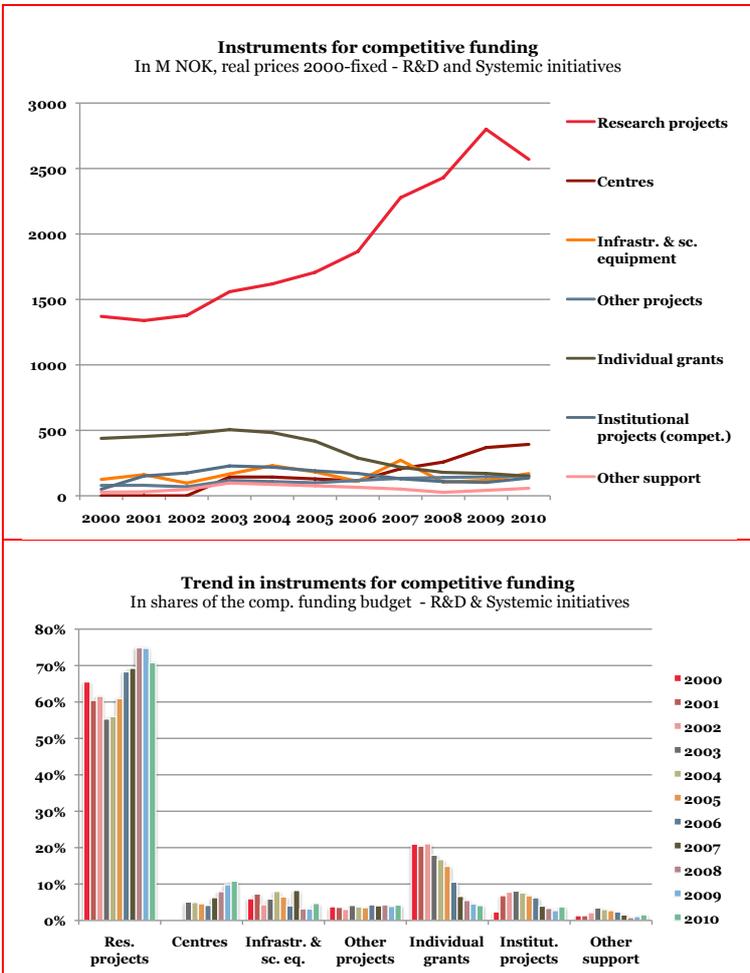
Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

7.2.4 Who got the money?

In terms of the stakeholder groups benefiting from the projects (Figure 38), a lot of the growth went to the universities and the research institutes and there was a recovery in industrial involvement from the trough in the early-mid 2000s. Growing industry involvement further benefits the institutes because a lot of the funding to industry is user-directed R&D – where companies get R&D subsidies to which they add their own money and then spend at research institutes. University colleges and the public sector rarely led such projects.
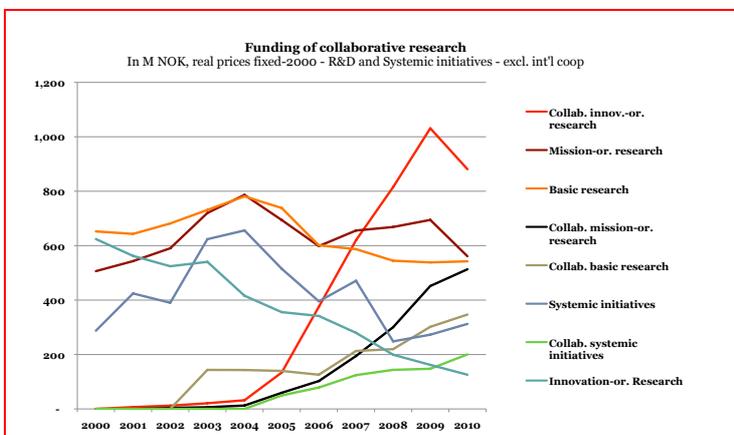
Figure 38 Stakeholder involvement in competitive-funded measures

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

The breakdown of the industry stakeholders involved at the level of the major industry sectors shows an increasing involvement in the second half of the decade of **manufacturing** companies (as leaders of research projects). Since 2004, the service sectors accounted for ~45% of RCN funding for industry; since 2007, the manufacturing sectors had a share of ~40%. The Primary sectors slightly increased their involvement in 2008 and a positive trend is equally visible for the 'other' sectors, which includes the energy sector. The Mining & Quarrying sector (including services for the petroleum industry), instead, reduced its involvement from 2007.

Figure 39 shows that industry is the major beneficiary of innovation-orientated research funding but that the institutes' share has been growing. Remembering that most of the money that goes to industry is then spent at the institutes, this confirms the major role the Norwegian institute sector plays in innovation-orientated R&D. The institutes are also central in mission-orientated work, but here the relative importance of the universities has increased. Unsurprisingly, the universities dominate the basic research activity.

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Figure 39 Stakeholder involvement in innovation-orientated, mission and basic research

Stakeholder involvement in innovation-oriented research
In M NOK, real prices 2000-fixed - R&D

Industry, Res. Institute, University, Inst. with res., Univ Colleges

Stakeholder involvement in mission-oriented research
In M NOK, real prices 2000-fixed - R&D

University, Res. Institute, Inst. with res., Univ Colleges, Public S./Soc., Other Research

Stakeholder involvement in basic research
In M NOK, real prices 2000-fixed - R&D

University, Inst. with res., Other Research, Res. Institute, Univ Colleges

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

The mix of research funded under competition moved towards technology during the decade (Figure 40). There are also clear shifts in the funding mode of different fields

- For research in *Agriculture & Fisheries*, there is a clear shift notable from mission-oriented (basic/applied) research to innovation-oriented research, and an end to funding basic research
- In the field of *Maths & Natural sciences*, we see fairly stable mix of basic & mission-oriented, with a start of innovation-oriented programme-based research in the more recent years
- Research in *Humanities* is close-to-uniquely basic research funded
- Research in *Social sciences* is strongly mission-oriented funded; there was some basic research funded in the field (but in decline) as well as some innovation-oriented research (also in decline)

- For research in *Medical sciences* there was a shift from basic bottom-up research to mission-oriented research; we also note the beginning of some innovation-oriented research funded
- Research in Technology is strongly innovation-oriented and increasingly bottom-up. There is close-to-no basic or mission-orientated research funded in the field

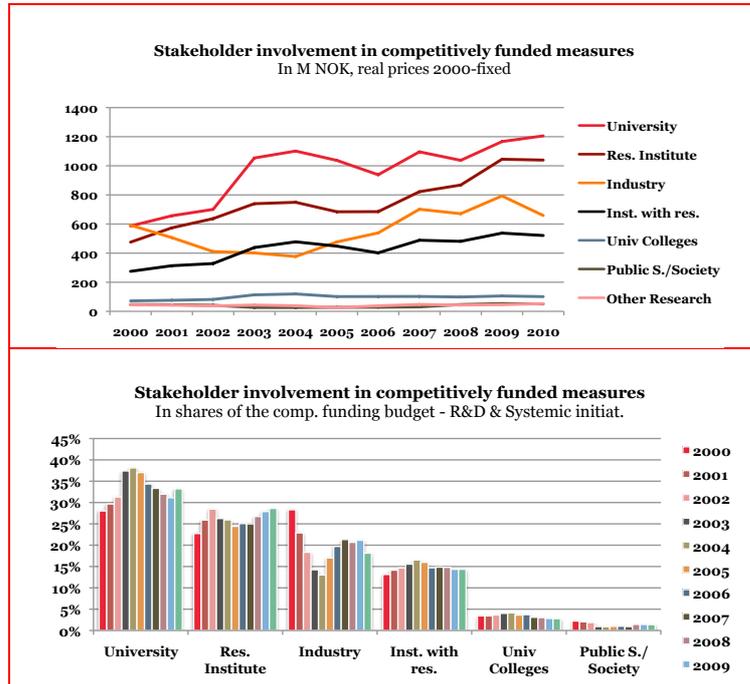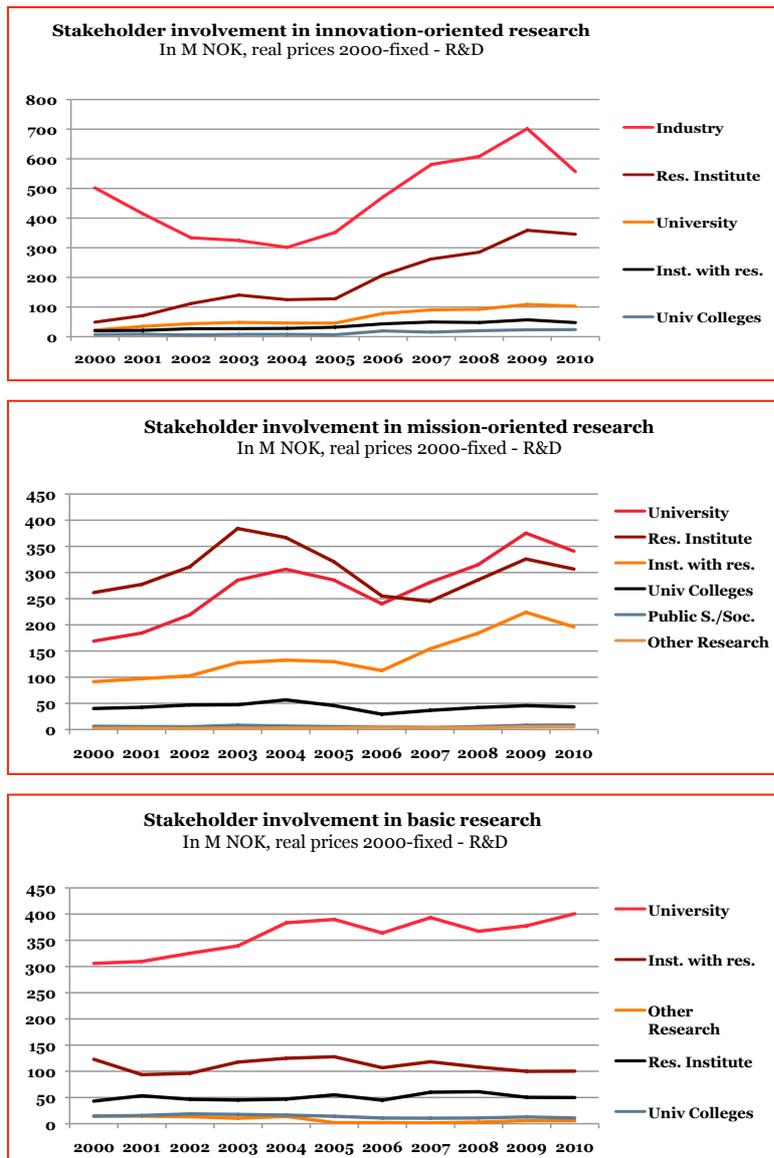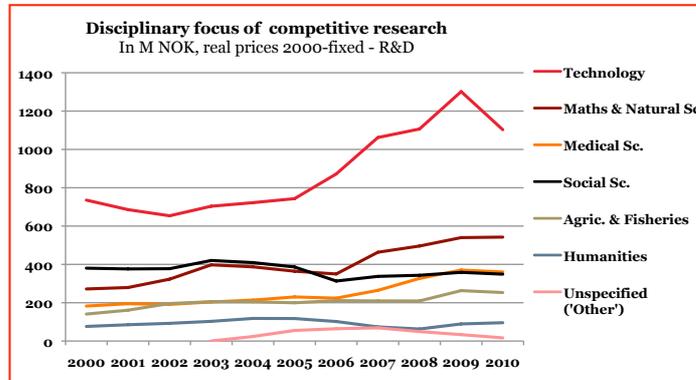Figure 40 Disciplinary focus of competitive research

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

Figure 41 shows the disciplinary focus and level of interdisciplinary research in the different types of programme. Maths and natural sciences dominate the basic research programmes and – together with medical sciences – are a major part of the bottom-up basic research effort. Technology dominates the Large and User-directed programmes, while social sciences provide the biggest element in policy-orientated research programmes.

Major trends within fields are:

- In the *Agriculture & Fisheries* area, an increase in share of funding for agricultural sciences, aquaculture & interdisciplinary agriculture/fishery sciences, accompanied by a decrease in plants, fish health sciences, and fishery technologies
- In the field of *Humanities*, an increase in research in history, archaeology, architecture & design, and a rise in share for interdisciplinary research within humanities but decrease in interdisciplinary between humanities and other sciences
- In *Math & Natural Sciences*, an increase for interdisciplinary, both within maths & natural sc. area and between the area disciplines and others; there was less funding for research in basic biosciences and chemistry
- In *Medical sciences*, more funding for research in medical molecular biology and health sciences, less for medical biochemistry
- In *Social sciences*, an increase in funding for interdisciplinary research between disciplines in the area and with other sciences, economics, pedagogical sciences, social geography, international politics, clinical psychology and development psychology. Sociology and media sciences/journalism received less funding
- In *Technology*, more funding for machine technology for energy/environmental technology, rock and petroleum sciences, ICT, interdisciplinary within and with other disciplines, marine technology, nanotechnology, chemical process technology; less funding for research in biotechnology
- Throughout the decade, RCN dedicated a fairly stable share of ~20%/25% of its competitive funding budget for the delivery of support to the RD&I system, beyond the direct funding of research.

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Figure 41 Disciplinary focus & level of interdisciplinary research in the programmes

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	% in average
Basic research progr.												
Agric. & Fisheries		6	5	4	2	0						1%
Humanities	20	16	12	25	39	39	28	11	7	17	26	12%
Maths & Natural SC.	88	75	88	104	95	72	51	117	109	101	86	50%
Medical Sc.	13	0	1	0			6	9	11	21	16	4%
Social Sc.	49	44	32	38	40	56	35	32	27	27	28	21%
Technology	40	25	27	28	39	37	27	17	5	0	1	12%
Total	**210**	**166**	**164**	**199**	**215**	**203**	**147**	**186**	**158**	**166**	**156**	
of which Interdisciplinary	45.2	20.0	19.0	27.5	37.5	39.9	29.2	27.1	38.3	43.1	45.2	
	22%	12%	12%	14%	17%	20%	20%	15%	24%	26%	29%	19%
Bottom-up basic research												
Agric. & Fisheries	1	1	1	3	2	1	0.5					0%
Humanities	44	52	59	55	62	57	57	51	48	52	51	15%
Maths & Natural SC.	88	89	98	101	103	124	148	166	165	153	170	35%
Medical Sc.	98	107	104	102	124	130	113	114	113	106	108	30%
Unspecified							2					0%
Social Sc.	47	59	61	59	64	60	50	57	58	59	65	16%
Technology	16	15	16	15	19	17	11	11	9	12	19	4%
Total	**294**	**323**	**339**	**335**	**375**	**389**	**381**	**398**	**393**	**382**	**413**	
of which Interdisciplinary	7.0	13.7	23.4	30.5	30.0	30.0	25.3	29.9	35.4	39.1	51.3	
	2%	4%	7%	9%	8%	8%	7%	8%	9%	10%	12%	8%
Large-scale programmes												
Agric. & Fisheries	51	55	72	74	75	79	98	89	81	110	107	21%
Maths & Natural SC.	0	0	1	5	7	6	5	8	12	16	23	2%
Medical Sc.	29	30	34	58	77	73	71	82	105	141	127	20%
Social Sc.	0	0	0	0	0	5	4	18	48	61	50	4%
Technology	2	10	16	15	131	206	301	387	362	381	377	52%
Total	**82**	**95**	**122**	**152**	**291**	**370**	**479**	**584**	**609**	**709**	**684**	
of which Interdisciplinary	1.5	4.6	4.7	4.8	11.9	17.0	25.1	29.4	38.6	52.9	46.9	
	2%	5%	4%	3%	4%	5%	5%	5%	6%	7%	7%	12%
Policy-oriented programme												
Agric. & Fisheries	86	97	117	122	121	113	13	12	10	10	6	12%
Humanities	8	9	10	11	12	13	14	15	16	17	18	2%
Maths & Natural SC.	49	62	82	115	92	73	60	71	85	97	93	15%
Medical Sc.	64	70	71	87	86	97	93	118	142	171	177	21%
Social Sc.	251	229	216	247	230	193	152	172	189	187	173	39%
Technology	75	96	101	97	82	69	6	5	3	3	3	10%
Total	**532**	**563**	**597**	**679**	**623**	**558**	**339**	**394**	**445**	**485**	**471**	
of which Interdisciplinary	49.7	65.6	79.4	118.4	124.0	116.9	89.6	114.1	111.7	120.1	144.5	
	9%	12%	13%	17%	20%	21%	26%	29%	25%	25%	31%	20%
User-directed innov. Progr.												
Agric. & Fisheries	0				1	1	97	104	112	132	128	9%
Humanities			1						0			0%
Maths & Natural SC.	5	4	0	0			2	4	7	13	13	1%
Medical Sc.	6	12	12	14			7	10	13	16	15	2%
Social Sc.	14	16	33	50	51	35	46	31	16	16	11	5%
Technology	591	527	477	464	303	293	368	458	531	674	507	83%
Total	**616**	**558**	**522**	**528**	**355**	**329**	**521**	**607**	**679**	**851**	**674**	
of which Interdisciplinary	9.4	20.4	43.3	60.9	53.4	41.1	40.4	31.3	30.2	45.2	46.3	
	2%	4%	8%	12%	15%	13%	8%	5%	4%	5%	7%	7%

Notes: In M NOK, real prices 2000-fixed

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

Interdisciplinary work is most important in the basic research and policy-orientated programmes. It is surprisingly small in bottom-up basic research and in the large-scale programmes, suggesting that some of the work done there may be rather traditional. The low level of interdisciplinary research in the Large-Scale programmes – on average 5% of the funding, with a slight growth in the last years up to 7% – is especially surprising given their problem-solving orientation.

In the specific Large-scale programmes, research was indicated as being interdisciplinary only in some programmes (Figure 42):

- In the RENERGI programme, interdisciplinary research was conducted in the areas of Technology, Maths & natural sciences, and Social sciences, accounting in total for ~15% of the funding
- In the PETROMAKS programme, the disciplinary research was in the area of Social sciences, accounting for ~5% of the funding
- In the NORKLIMA programme, in the Maths & Natural Sciences area, accounting for 8% of the funding

Figure 42 Funding of mono- versus inter-disciplinary research projects in the specific Large-scale programmes

Notes: Funding for research only, excl. international cooperation
Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

7.2.5 Reprogramming towards national priorities

Within the overall pattern of growth in the money awarded under competition, it is striking that those for bottom-up basic research (essentially FRIPRO and YFF) remain flat. The growth is in the programmed mission-oriented and innovation research funding.

Figure 43 Bottom-up versus programme-based competitive research
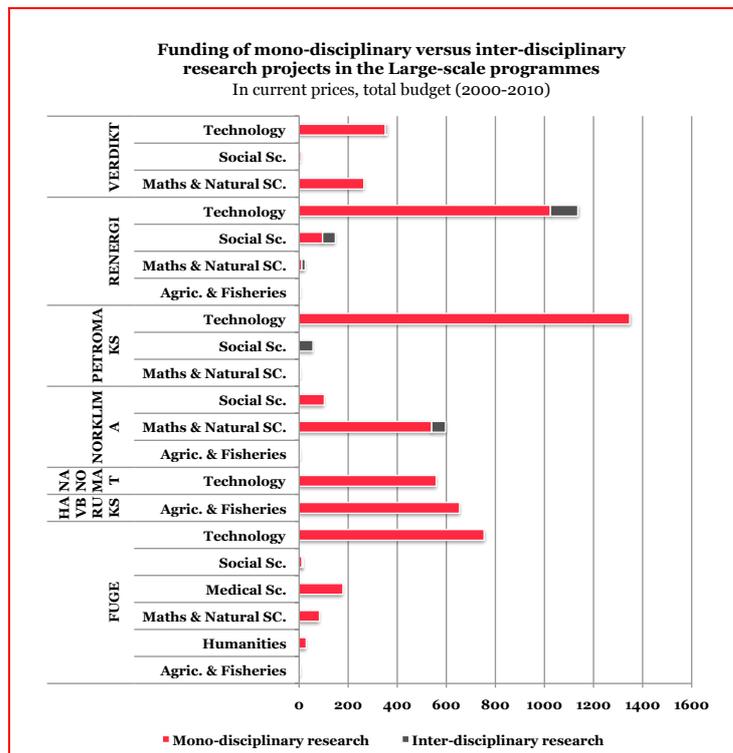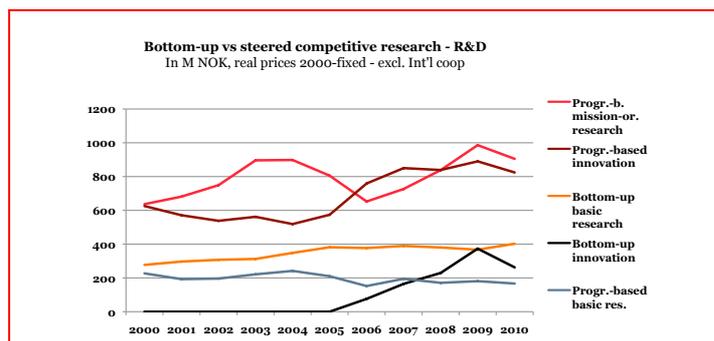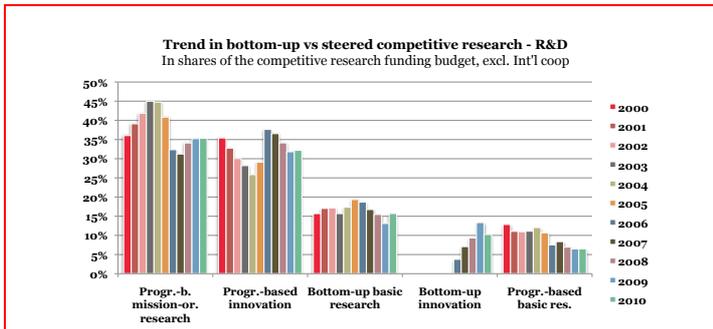
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Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

Through the decade, there is a clear pattern of substitution where the Large programmes' share of industry-orientated projects rises and the share of the traditional user-directed innovation programmes falls. The decline of the user-directed innovation programmes was further accelerated from mid-decade when BIA was set up as a 'branch-neutral' competition arena for user-directed projects and competence development with user participation projects. The pattern is of focusing resources towards the Large programmes and therefore the national priorities while to a considerable extent 'de-programming' the rest of the innovation effort.

In the Science Division, there is a similar pattern of substitution where the share of the basic research programmes goes down and the resources 'de-programmed' are moved into the bottom-up FRIPRO activity.

There was a sudden shift of focus in 2005 from policy-orientated programmes to Large programmes. In 2001-5 policy-orientated programmes took about one third of RCN's R&D investment; after that, their share fell to 17-18%. Large programmes showed a steady growth in share from 6% of research expenditure in 2001 to 31% in 2006 and have since remained at about that level. To some extent this involves a redefinition of policy-orientated work into the Large programmes – but it clearly shows RCN's increasing focus on the national priorities.

Figure 45 shows for the second half of the decade how RCN's spending on the national priorities split across different types of funding programmes. Biotechnology and health involve a considerable amount of work funded through typical basic research instruments. Health and Welfare are both tackled through policy-orientated programmes while most of the remaining activity focuses on the large programmes. Only in food is the largest part of the funding spent on user-directed innovation programmes.

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Figure 44 Focus on the national priorities in RCN programmes (current MNOK and %)

		Basic research	User-directed innov progr	Large-scale programmes	Policy-oriented programmes	Total
Biotech	2006	41%	17%	33%	9%	367
	2007	37%	18%	38%	7%	426
	2008	30%	18%	49%	3%	430
	2009	26%	25%	44%	5%	589
Energy & environment	2006	3%	18%	73%	5%	656
	2007	11%	23%	62%	4%	865
	2008	10%	27%	60%	4%	974
	2009	7%	29%	61%	3%	1054
Oceans	2006	3%	19%	54%	24%	345
	2007	13%	25%	41%	21%	409
	2008	10%	30%	39%	21%	464
	2009	6%	30%	43%	20%	482
Health	2006	38%	14%	14%	34%	430
	2007	33%	15%	17%	35%	529
	2008	28%	14%	23%	34%	694
	2009	25%	21%	21%	33%	785
ICT	2006	30%	36%	29%	6%	331
	2007	17%	34%	45%	4%	365
	2008	12%	35%	51%	2%	422
	2009	11%	39%	49%	1%	479
Food	2006	1%	47%	39%	13%	346
	2007	2%	53%	40%	5%	374
	2008	2%	56%	39%	3%	419
	2009	1%	54%	43%	2%	441
New mat., nanotech	2006	13%	15%	72%	0%	148
	2007	15%	18%	67%	0%	169
	2008	14%	19%	67%	0%	206
	2009	14%	25%	61%	0%	191
Welfare & social challenges	2006	18%	1%	0%	81%	163
	2007	17%	1%	0%	82%	212
	2008	17%	1%	1%	80%	226
	2009	17%	2%	4%	77%	214

Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on RCN data

7.2.6 Internationalisation

A new **Project Development** instrument was launched at the beginning of the 2000s, open to all research actors, which provided support for setting up project teams and proposals – in particular proposals for EU Framework Programmes - or for the establishment of strategic collaboration networks ('Network Development').

Figure 45 illustrates the importance of this instrument for the fostering of participation in EU programmes in 2003 and in the case of the project proposals, the renewed importance from 2007 onwards.[52]

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[52] In this context, individual grants refer to the co-funding of grants in ESF programmes and the Marie Curie programme.

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Figure 45 Instruments for the funding of participation in EU programmes/initiatives
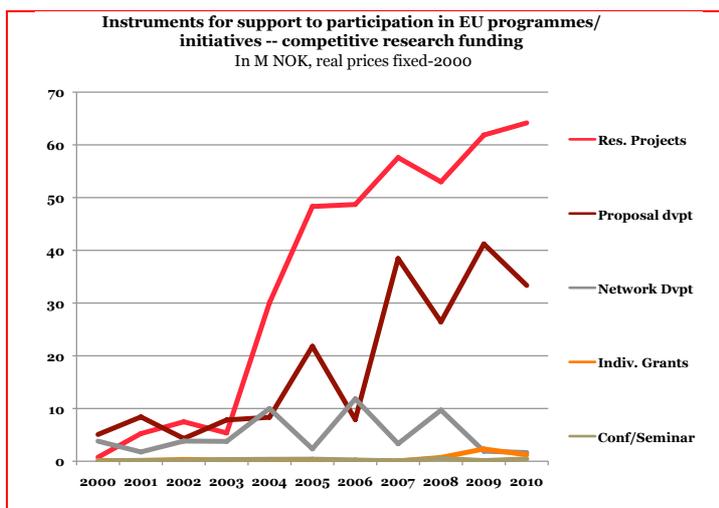
Source: RCN Evaluation, 2012 – Background report No 10: Internationalisation, MIoIR; based on the RCN database, Technopolis analysis

The major change related to the support for participation in EU programmes, however, was the increase in co-funding of research projects. In 2004, this was predominantly linked to the launch of the SAM-EU scheme, exclusively for the benefit of the research institutes.[53] This scheme was intended creae a 'level playing field' for the Norwegian research institutes so as to allow them to participate more in the Framework Programme. It topped up the EU funding in order to compensate for the higher operating costs of Norwegian institutes compared with their EU competitors in the FP6 Integrated Projects (IP) and Specific Targeted Research Projects (STREP). This scheme was limited to FP6 and was therefore winding down from 2008 onwards.

In 2004 we also see co-funding for participation in EUROCORES, a collaborative research programme of the European Science Foundation.   Co-funding for participation in more industry-oriented programmes started in 2009 with the participation in the EU JTIs and the EUROSTARS programme. The latter is a joint programme between EUREKA member states and the European Union, launched in 2008. It offers support for transnational bottom-up research by R&D performing SMEs.

International collaboration has focused on basic and mission-orientated research – not on innovation (Figure 46) and is focused in mathematics and natural sciences, medicine and social sciences.

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[53] RCN funded 25% of the project costs (provided that RCN funding together with Commission funding did not exceed 75% of the overall R&D costs), compensating for the fact that Norwegian research institutes, by law private entities, were entitled to Commission funding for only 50% of their project costs.

Figure 46 Involvement of foreign partners in 'mainstream' collaborative research programmes

	Foreign share – 2008	Foreign share – 2009	Foreign share – 2010
Other independent projects	5%	6%	10%
User-directed innovation programme	8%	9%	12%
Free projects support	38%	47%	55%
Basic research programmes	2%	5%	14%
Policy-oriented programmes	29%	29%	42%
Centres of Excellence (SFF/SFI/FME)	0%	0%	2%
Large-scale programmes	8%	12%	14%
Overall	10%	12%	17%

Note: Percentages in terms of share of total number of participations by partners in that given year; 100% = all partners excluding coordinators
Source: RCN Evaluation, 2012 – Background report No 10: Internationalisation, MIoIR; based on the RCN database, Technopolis analysis

7.2.7 Gender

While women got about 40% of the individual grants, they led only 20% of the projects. The major driver for gender inequality here seems to be the disciplinary mix. Women are much less likely to be leaders in mathematics, natural science or technology projects – and these tend to be the biggest fields (Figure 47).

Figure 47 Gender equality in project leadership
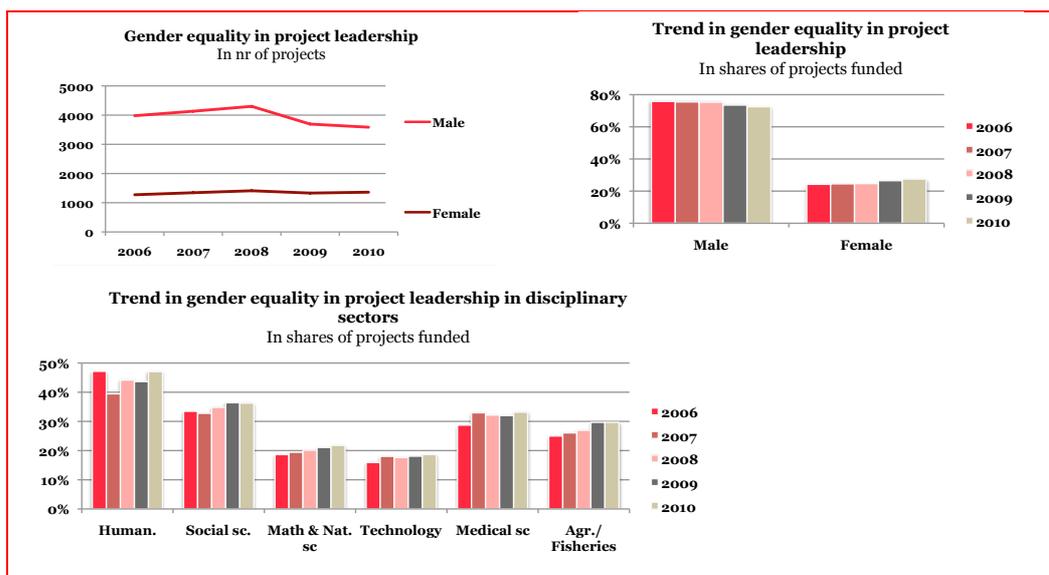
Source: RCN Evaluation, 2012 – Background report No 5: Implementing and Adding Value to the National Priorities and Developing the NRIS, Technopolis; based on the RCN database

7.3 Other effects on the research and innovation system

RCN funding has had several effects on the way the research and innovation system operates.

7.3.1 The university system

The universities are slowly engaging in more innovation-related research projects from RCN than before – especially (KMB) projects that link research capacity building to a user. International cooperation is increasing (even if it remains at a rather low level). Survey responses and interviews confirm that increased project sizes and RCN's centres programmes enable the creation of bigger research groups and more cooperation within the universities, so these are having the intended 'defragmenting'

effect. The policy-orientated and basic research projects in which the universities engage are often interdisciplinary.

Increases in RCN funding means that the university hospitals are increasingly involved, bringing research council style quality control to funding in that area. While university researchers generally said that RCN funding helped increase their scientific outputs, they were almost universally critical of what they saw as the low level of 'free research' funding and the over-use of programming. RCN funding did not help them do more interdisciplinary, risky, long-term or disruptive research than they would have done without it, so it seems that from their perspective RCN funds business as usual rather than adding value.

7.3.2 Research institutes

The research institutes' behaviour has clearly been affected by the introduction of the performance-based research funding system. Research is being managed so as to obtain rewards from that system, with special attention to increasing scientific publication rates. And there is a distinct increase in such publications by the institutes since the new system was advertised. The growth in innovation funding through RCN has been of substantial benefit to the institutes, especially in technology but more recently also in mathematics, natural sciences, agriculture and fisheries. It has further intensified the institutes' cooperation with industry. 'Top-up' funding from RCN enabled the sector to participate in the Framework Programme much more than before. While RCN offered the chance to do more interdisciplinary work, it did not allow the institutes to take on more scientific and technological risk. It did, however, let them tackle more fundamental and long-term research questions than was possible with industrial funding.

7.3.3 Business

Business was almost exclusively engaged in user-directed R&D projects (where industry defines the problems, which are usually solved through the help of a research institute) and as partners in the (KMB) capacity development with user participation projects, where the leadership comes more from the research side and business participates as a potential user. Companies mainly sought RCN funding in order to reduce technological risks and solve technological problems, so the projects tended not to lead directly to innovations but were needed so that the companies could use the results in their own innovation projects. Unlike in the Framework Programme, where powerful coalitions of companies can sometimes reduce commercial risks through cooperation, the RCN projects did not address commercial risks much. This can be either because the firms lack market power or because they focus on incremental innovation within established markets (which is what the CIS data suggest is what Norwegian innovators tend to do). In industry, then, RCN funding appears to focus on supporting incremental innovation.

Small technology-based firms often benefited from improved links with the higher education or institute sector. Big companies used schemes like the Industry PhD programme as ways to identify and recruit good people. Several companies pointed to a need for pilot and demonstration projects, in addition to RCN's traditional focus on earlier stages of R&D. Comparison of industry R&D expenditures by branch with those of RCN suggests that there are funding gaps in ICT and mining and quarrying.

7.3.4 Effects of funding programmes

Evaluations provide some evidence about the impacts of RCN programmes.

The FRIPRO evaluation[54] confirms our university survey findings that RCN funding helps researchers develop their careers but also that 'free' research funding largely lets them do more of the same rather than enabling significant change, risk-taking or interdisciplinarity.

The SFF centres of excellence increased agglomeration and research ambition levels in the research community, affected the division of labour among Norwegian research-performing organisations and increased researchers' international collaboration. They clearly affected university strategy: they were sufficiently large that universities had to fit them into their current activities and to make plans for how and whether to continue the centres at the end of their funding period. In this sense, they have had a positive influence on universities' research management capabilities[55].

The SFI mid-term evaluation[56] (2010) was intended to feed back to RCN about the progress of the centres and their continuing fundability, rather than to assess impacts. It nonetheless concluded that the SFI programme "demonstrably has benefited supported industries and organisations in the public sector by providing ideas for enhancement of processes and development of improved and new products". The evaluators are people with considerable international experience with similar 'competence centre' schemes, so their general approval of the SFI centres and their continued funding implies that they expect the normal benefits of competence centres to result.

RCN asked a Nordic panel to evaluate the large programmes at mid term (2009)[57]. These had been conceived in dialogue with the Executive Board after the 2001 evaluation. The panel observed that the large programmes were agglomerations of earlier, smaller efforts and that their funding was a "patchwork" from many sources, though the Fund for Research and Innovation was generally a leading, early contributor, with ministry funding of the programmes growing over time. A consequence of the multi-principal nature of the programmes was that only incremental changes could be made during their life. Industry does not greatly differentiate between user-directed projects in the big programmes and those done in other arenas, so it seemed to be hard to get additional value from the large programme idea at the industrial level. On the other hand, there was development and capacity building in the knowledge infrastructure. The evaluation had little to say about wider impacts.

Four of the programmes have since been evaluated: FUGE (2011), NANOMAT (21011), PETROMAKS and RENERGI (2012). These evaluations illustrate the importance of links to users and applications even in designing programmes that are intended to have a 'technology push' element, developing key technologies ahead of commercial demand.

FUGE[58] started out as a basic research programme and was transformed into a Large one mid way. It originally set up a large number of 'technology platforms' in the academic community to enable functional genomics research, some of which were clearly sub-critical and became out of date, with those that had been located using regional allocation criteria faring worst. The strategy was first to build academic

[54] Liv Langfeldt, Inge Ramberg, Gunnar Sivertsen, Carter Bloch and Dorothy S Olsen, *Evaluation of the Norwegian scheme for independent research projects (FRIPRO)*, Report 8/2012, Oslo: NIFU, 2012

[55] Siri Brorstad Borlaug, Magnus Gulbrandsen and Liv Langfeldt, T*he Norwegian Centre of Excellence Scheme: Evaluation of Added Value and Financial Aspects,* Science Division, Oslo: RCN, 2010

[56] Eric Fercher, Silke Stahl-Rolf, Per Stenius and David Williams, *Midway evaluation of the Centres for Research-based innovation (SFI)*, Division for Innovation, Oslo: RCN, 2010

[57] Ragnhild Sohlberg et al, *SATS på forandring: Midtveis evaluering av Store programmer,* Oslo: Forskningsrådet, 2009

[58] DAMVAD and Econ Pöyry, Evaluering av FUGE: *Forskningsrådets Store program innen funktionel genomik*, Oslo: Forskningsrådet, 2011

capacity and then to link to innovation. The evaluation confirms that FUGE did increase research capacity and output, though (perhaps not surprisingly) not enough to catch up with Sweden or Denmark in scientific output or productivity. It increased the degree of specialisation and division of labour within the research community. While it succeeded in spending 10% of the budget on user-directed R&D, academic-industry links remained poor – in no small part because of the relative weakness of relevant industry in Norway. There are few industrial effects. The evaluation concludes that FUGE's limitations result from academic dominance of the programme design.

NANOMAT[59], like FUGE, involved significant infrastructural investment to enable Norway to 'catch up'. It was redefined from being a basic research programme into a Large one in 2004. It led to a rapid increase in scientific publication and a strategic concentration of effort within the knowledge infrastructure. It established PhD education in the field and increased the amount of international collaboration. Relevant industry is mostly weak and small. While the evaluators say that NANOMAT involved about 100 industry collaborations they also point out that it has produced few commercialisable results, arguing that this results from a lack of suitable funding instruments. They also point out that industry was not adequately involved in programme design or the choice of themes and hence that there was little academic-industrial linkage.

PETROMAKS and RENERGI were evaluated together[60]. Both built research capacity in areas of national priority within the knowledge infrastructure and industry. They served as ways to focus research attention, effort and capacity on areas of industrial need and developed researchers' international and end-user linkages. The economic payback from Petromaks is very high, in the form of increased yields from oil and gas reservoirs. Some of this benefit has already been realised but the majority is yet to come. Renergi makes a significant contribution to addressing a global challenge. Both increase the amount of 'early stage' R&D in industry, which is likely to increase the innovation rate. (Inherently, of course, early stage research in industry should have high spillovers.) User participation in Renergi is lower than in Petromaks. The evaluators argue that this is because the economic returns to industrial R&D are lower in renewable energy than in oil and gas. The user community is also likely to be less well defined. It is a pity that the evaluation was unable to tackle industrial and economic impacts more clearly – we would expect these to be very large, especially in the case of Petromaks.

The latest surveys monitoring the effects of user-directed R&D in industry[61] show that there is a good overall return on investment from user-directed R&D projects – measured as monetary benefits to the participating companies – but that returns are extremely skewed, with a handful of projects accounting for the great majority of them. Over the five years studied, 10 of the 110 projects able to quantify benefits accounted for 90% of the returns. The study shows there is high input additionality. That is, the funding tends to 'trigger' the company to invest in the project. There is also considerable 'behavioural additionality', where companies learn the benefits of doing more R&D, collaborating with others, linking to the knowledge infrastructure and so on. The study therefore clearly shows that there are not only short term private returns to user-directed R&D (which are useful to society in the sense that they trigger increased employment, more payment of tax and so on) but more important that there are significant externalities that benefit Norwegian industry and society.

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[59] DAMVAD and Econ Pöyry, Evaluering av NANOMAT: *Forskningsrådets Store program innen nanoteknologi og nye materialer*, Oslo: Forskningsrådet, 2011

[60] Universitetet i Nordland and Ramböll, *Evaluering av Petromaks og Renergi,* (forthcoming 2012)

[61] Arild Hervik, Lasse Bræin and Bjørn G Bergem, *Resultatmåling av brukerstyrt forskning 2010*, Molde: Møreforsking and Høgskolen i Molde, 2012

The **Skattefunn** scheme offers companies the chance to offset R&D costs against corporation tax and was introduced in 2002. RCN's role is to decide whether projects meet the criterion of being 'R&D'. Skattefunn is intended primarily to get companies to **start** doing R&D. Once they have learnt the benefits, schemes like RCN's BIA and the large programmes are available that intensify their contact with the knowledge infrastructure, generate larger than normal externalities and encourage R&D relevant to national priorities.

The Skattefunn evaluation[62] (2008) found that the 'input additionality' of Skattefunn is very high. There is international evidence that incentives for small companies involve greater input additionality than those for large ones[63]. Or, to put it another way, that larger firms more easily free ride on tax incentives than small ones. The Skattefunn evaluation found that the companies doing the least R&D experienced the greatest behavioural additionality, so the idea that using a tax incentive will 'teach' small firms the value of doing R&D seems to be right.

The evaluation shows that use of RCN funding and Skattefunn are complementary – companies that get one tend to go on to get the other. But Skattefunn causes little change in companies' relationships with institutes or other companies, so it brings fewer externalities than RCN funding. If we recall that the input additionality of tax incentives also goes down as the volume of the tax incentive goes up, then the division of labour between Skattefunn and the RCN programmes seems reasonable. Moving resources from RCN programmes to a Skattefunn scheme with a higher ceiling would decrease the input additionality of the fiscal incentive and sacrifice the externalities associated with RCN funding.

Another very interesting finding of the Skattefunn evaluation is that it makes little difference to the private returns to innovation whether the investment is made privately, with Skattefunn money or with the support of RCN. The best returns are to private money followed by Skattefunn and then RCN – but the differences are small. On the other hand the **social** returns probably rank in the opposite order.

It is perhaps also useful to recall that while the statistical calculations involved here **look** precise, they are far from being so. We can see this in the wide ranges of estimates given not only in the Skattefunn evaluation but also in the international literature on the subject. The skewed economic effects of innovation described in the user-directed R&D evaluation may provide one explanation among others of why different studies (and approaches within studies) produce such widely differing estimates.

The component of this evaluation of RCN that deals with the added value of RCN funding in the company sector[64] adds two crucial pieces of evidence to our understanding of the effects of RCN funding in industry. It shows that RCN does not 'crowd out' private investment; and that we can expect the same high rates of private return from all kinds of R&D. Societal returns to RCN-subsidised R&D have not been analysed but there are no reasons to believe that RCN-funded R&D have lower societal returns than non-RCN-funded R&D when private returns are quite similar. On the contrary, the Skattefunn evaluation suggests that social returns are higher in the RCN case than with other funding.

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[62] Ådne Cappelen, Erik Fjærli, Frank Foyn, Torbjørn Hægeland, Jarle Møen, Arvid Raknerud and Marina Rybalka, *Evaluering av Skattefunn – Sluttrapport*, Rapport 2008/2, Oslo: SSB, 2008

[63] Christian Köhler, Philippe Larédo and Christian Rammer, Fiscal Incentives for Business R&D: Compendium of Evidence on the Effectiveness of Innovation Policy Interention, MIoIR, Manchester niversity: 2012

[64] Ådne Cappeln, Arvid Raknerud and Marina Rybalka, *Returns to R&D in Norway: The role of public grants and subsidies*, Oslo: SSB, 2012

The FORNY evaluation (2009)[65] explores the effectiveness of this programme in the latest phase but also looks back to its origins, in the 1990s. Since 1996, FORNY has supported some 300 start-ups, which by 2009 collectively employed about 700 people. Like the user-directed R&D evaluation, it finds that the successfulness of innovation is highly skewed, with employment concentrated in a small number of larger firms. Most FORNY-supported firms have survived, but often as 'one-man-bands' with turnover of 1 MNOK or less and often no formal employment (ie the entrepreneur is still working on it in her or his spare time). The focus on Technology Transfer Offices in the second phase of FORNY needed to be reconsidered as this was not an especially effective channel for knowledge transfer. The knowledge infrastructure should engage in a much broader range of cooperative knowledge transfer activities in order to play its role in spreading as well as producing knowledge. This conclusion is consistent with what we see in the literature about technology transfer from public research organisations and our recent survey of such organisations[66].

7.4 Conclusions

RCN's contributions to the development of national and ministry strategies were discussed in Chapter 5.

Our analysis shows that RCN has successfully worked with the ministries to shift funding towards the national priorities and made use of instruments that reshape and modernise the research system.

- RCN's funding pattern has been strongly orientated to change and development in the national research and innovation system.
- It has followed through the reforms giving research-performing institutions more autonomy by increasing the use of competitive incentives.
- It has addressed systemic failures such as the fragmentation of research via centres programmes, increasing funding for collaboration and raising the average project size by reducing the use of individual grants in favour of largerprojects where more than one person benefits
  – Increasingly focusing on funding bigger research projects, stimulating collaborative research and the strengthening of industry-institute strategic partnerships for research as well as the constitution of research groups in the research institutions
  – Awarding individual grants close-to-exclusively on the basis of excellence (the YFF and postdoc grants)
  – Fostering international cooperation in the Norwegian institutions through a variety of instruments and schemes, including the co-funding of FP6 projects inthe research institutes and the funding of project development instruments for the preparation of FP6 proposals, as well as the increasing focus on 'inward' international mobility of individual researchers and a mainstreaming of international cooperation within RCN's national programmes
  – Increasing funding for the development and modernisation of research infrastructures and scientific equipment
  – Funding bottom-up initiatives that constitute the starting point for a re-structuring of the RD&I system, ie creation of inter-institutional research groups, research schools, the centres of excellence and the competence centres

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[65] Siri Brorstad Borlaug, Leo Grünfeld, Magnus Gulbrandsen, Einar Rasmussen, Lars Rønning. Olav R Spilling and Evgeni Vinogradov, *Between entrepreneurship and technology transfer: Evaluation of the FORNY programme*, Rapport 19/2009, Oslo: NIFU, 2009

[66] Erik Arnold, Paula Knee, Neil Brown, Zsuzsa Jávorka, Flora Giarracca and Sabeen Sidiqui, *Knowledge Transfer from Public Research Organisations*, IP/A/STOA/FWC-2008-096/LOT8/C1/SC9, Brussels: STOA, European Parliament, 2012

- The attention dedicated to future recruitment, incorporating in several instruments or schemes the obligation to incorporate in the project the launch of specific educational or training programmes
- It has focused funding on the national priorities, especially via the Large programmes, and reduced the use of programming in other areas.
- More resources have gone to innovation and to the research performers doing industry-related work, notably industry and the research institutes
- There is an increasing division of roles among the Large-scale and policy-oriented programmes, the former focusing predominantly on the more technological and industry-oriented priority areas/challenges, the latter working with societal areas such as health, education, welfare and other social challenges
- Most important, a similar division of labour is emerging between the user-directed innovation and basic research programmes – the only exception is research in biotechnologies where the basic research programmes continue to play an important role
- The university sector was still the main beneficiary of competitive project funding in 2010 (~30%, similar to the level at the beginning of the 2000s) but in particular since 2006, a more wide-spread and – from a policy perspective, more balanced - funding distribution is visible for the three major research-performing sectors: the research institutes and industry sector both accounted for ~25% of the research-funding budget in the most recent years.
- The expansion of funding for the industry sector and the thematic priorities covered implied an increased breadth of industry sector coverage. The Service sector was the industry sector most involved, accounting for close to 50% of the research funding for industry actors; manufacturing companies were more directly involved especially as of the second half of the decade, accounting for a share of ~40% in 2010. We note especially a stronger involvement of high-tech service providers; in the manufacturing sectors, instead, there is a more limited growth in involvement of high-tech manufacturing companies
- The research institutes benefited more from the systemic initiatives launched by RCN than was previously the case. Both the institutes and the industry sector significantly increased their involvement in international cooperation. For the former this was facilitated by a specific supporting scheme launched by RCN; for the latter, the increase was due to Norway's participation in the EU JTI and Eurostars programmes
- Basic research levels (at least in terms of 'free' projects and the basic research programmes) stagnated in real terms through the decade and fell as a share of RCN's overall activity. However, there is additional basic research in the Large programmes

Effects on the research and innovation system

- RCN funding has helped 'de-fragment' university research, promoting bigger groups and a clearer division of labour in the university sector. However, it tends to fund research similar to what the universities would in any case have done, suggesting that RCN should aim to increase its efforts in interdisciplinary, risky, long-term and disruptive research
- RCN funding, combined with the new performance-based core funding system increases scientific output from the institutes, strengthens their links to users and enables better international linkage through the Framework programme. However, there are opportunities to fund more technologically risky research
- Business benefits financially and technologically from participation in RCN programmes. However, activities tend to be incremental so there are opportunities to fund more radical and disruptive changes that could address new markets
- Some of the Large programmes' economic and social effects have been limited by the weakness of domestic industry and its limited participation in programme design. Others with better user linkage seem likely to have significant economic effects

- More broadly, the Large programme and FORNY evaluations suggest caution about 'technology push' activities. These are important – and may be essential to achieve restructuring – but need good linkage to demand
- RCN's innovation funding and Skattefunn are not alternatives but complements. Both provide good economic returns to the firms. Skattefunn helps companies get started with R&D, focusing on internal benefits. RCN projects have greater externalities, as they tackle bigger and more common problems. RCN funding 'crowds in' private money to R&D rather than crowding it out, where it produces similar private returns to private or Skattefunn money but greater societal returns or externalities – including strengthening of the national thematic priority areas

8. Internationalisation

RCN's internationalisation strategy was launched in 2010. It is not however the first recognition of the importance of internationalisation of research for Norway nor the first statement of policy in this area. Initiatives to link Norwegian research to other countries have been in existence for many years, the North America Foundation (non-governmental) has existed since 1919[67], and internationalisation has been a continuous aim of research policy in Norway for many decades. The current internationalisation approach however places new emphasis upon internationalisation and encourages the systematic use of international links – mainstreaming them through virtually the whole portfolio of Research Council funding instruments.

8.1 Strategy

RCN's Internationalisation Strategy of RCN aims to capitalize upon and realize the benefits for Norway of greater international cooperation in research. The Strategy has five main objectives and five main action points to help realize Norway's Visions for 2020 as outlined in the Strategy document. Those objectives are to

- Help to address global challenges to society
- Enhance the quality and capacity of Norwegian research
- Secure Norway access to international knowledge production
- Boost the competitiveness of Norwegian trade and industry
- Promote Norway as a leading research and innovation nation in selected research areas

The main action points for the Internationalisation Strategy are

- All of the Research Council's activities, -programmes, open competitive arenas, special initiatives, institution-oriented measures and other forms of support- must include clearly-defined objectives and plans for international cooperation;
- The Research Council will encourage Norwegian participation in joint programmes across national boundaries when this is crucial to addressing common challenges or strengthening Norwegian research and knowledge-based industry
- The Research Council will develop financial instruments to support the establishment of long-term cooperation between Norwegian institutions and corresponding institutions in other countries.
- The Research Council will refine and strengthen stimulation measures to encourage Norwegian researchers, companies and research institutions to participate more actively in international collaborative and competitive arenas.
- The Research Council will focus greater attention on international cooperation and researcher mobility in its internal grant application review processes

An essential feature, or principle of the Strategy is *mainstreaming*. This means that the Research Council now requires virtually all its funding instruments and programmes to have targets for international engagement, and that the Council's funding instruments will seek, wherever possible, to facilitate international engagement with researchers and organisations, including companies, outside Norway, and reimburse their costs, subject to certain limits. The combination of a common strategy and mainstreaming means that RCN combines a top-down and bottom-up approach to internationalisation.

The research community is already highly internationalised in the sense that science is a global endeavour. There has been growing attention to EU cooperation and

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[67] The Norway-America Fund was in fact the founding organisation.

especially the Framework Programme during the past decade. RCN's information and grants supporting proposal-writing and 'topping up' FP money are highly appreciated by the research community. Nordic cooperation has had declining visibility – partly because a lot of it happens 'under the radar'; partly because – despite the growing influence and visibility of NordForsk – there is not much money available for it; and partly because at least parts of the research community view it as rather bureaucratic.

The Ministry of Foreign Affairs makes the bilateral agreements, once a choice of priority countries has been made by the government. Currently the *Council* has agreements with US, China, India, Japan, South Africa, Argentina, Brazil, Canada, Russia and Chile. There is great consideration given to the question of whether these were the right countries and if the agreement is set at too high a level.

Norwegian researchers by and large assess the RCN support for internationalisation as positive. The majority of respondents confirmed that RCN

- Support for international mobility helps the career development of individual researchers (difference between the group agreeing to the group not agreeing 28.5%),
- Provides adequate support for international mobility (diff 18.7%),
- Schemes are useful in terms of attracting foreign talent to Norway (diff 18.1%),
- Provides adequate support for international research collaboration (diff. 16.9%)
- Internationalisation policies support research excellence in Norway (diff 16.1%)
- Provides adequate support for access to, and coordination of, international research infrastructures (diff 6.9%)

However, a slight majority of researchers is negative as regards

- The accessibility of information on how various RCN schemes may be used for internationalisation purposes (diff: -2.4%),
- The adequacy of the concrete schemes that are developed to support their needs
- The adequacy of support for collaboration with partners outside the EU (diff: -8.0)

Across the board, more senior researchers and leaders of research organisations are more positive than researchers.

The Strategy has indicated that the Council is obligated to develop financial instruments to support long term cooperation. These have yet to be developed. The FP support system in RCN seems to be well organised and connected to the other core programmes in RCN. The amount of resource devoted to this function is smaller than in some other countries, such as Austria and The Netherlands. The Council already has a range of measures that can be used to promote internationalisation and we have received a large range of responses and information about their operation. The schemes which we have examined and on which we have evidence are

- Project Establishment Support
- Top-up funding for Marie-Curie grants
- Funding of Starting Grant Applications
- Grant Schemes for Collaboration with US Africa Asia South and Central America

Survey responses and interviews suggest that these mechanisms were operating with some success; they were professionally administered and well supported by the Council. However, there were some limitations in that researchers believed that such measures were not well enough promoted by the Council. In particular measures to promote links with countries outside Europe were very little known (63% of all respondents did not know them), and very little used and not rated as being overly useful. This should be of some concern.

There was a general consensus amongst our interviewees that overall Norway is successful in recruiting overseas PhD students, post-docs and researchers through the Council funded schemes. However, when it comes to attracting Norwegian researchers to participate in exchange schemes with countries outside Norway a

somewhat different picture emerges – Norwegians are not very outwardly mobile, and many explained this as a result of the higher wages and welfare experienced at home than abroad.

The Strategy of the Council also foresees that its grant money will flow overseas to non-Norwegian research actors. However, there seems to be no common principle for *how much* of the budget could or should do so.

8.2 Findings

The Norwegian research system is highly internationalised and internationalisation is a key goal for Norwegian science policy. Through various strategic means, the RCN has strongly increased the meaning of internationalisation in its funding and support activities. The share of international actors that are funded has sharply risen, offering broader cooperation opportunities for Norwegian researchers and firms.

All research and policy actors involved clearly see the net benefits of international activities. Internationalisation increases the impact of Norway's science, raises the likelihood of excellence, gives access to knowledge and supports innovation activities.

While the current RCN strategy can potentially reap the maximum benefit out of internationalisation for the Norwegian system, it needs careful implementation and entails two risks: (1) certain internationalisation activities may become sub-critical especially within small programmes or initiatives and (2) there is a consequent strong requirement for transparency and coordination of all these mainstreamed international activities, without which, efforts will become fragmented and suffer from duplication or gaps.

Opening programmes up to international participation introduces a new dimension to decide Norway's priorities for research. Because no country has unlimited resources with which to fund research, choices must be made about which countries to work with and why Norway's own programmes should work with them. This is more important because Norway is a small country and has limited scientific coverage. Norway's interests must drive this process and choices will need to be made. Our view is that in this new framework for research policy prioritization of partners, research topics and resources need far greater attention. The current position is an "emergent strategy", where there is uncertainty at all levels on the question of how open and at what levels Norway should be. Criteria for the added value of international cooperation are not fully developed.

The existing spread of countries and country links that Norway possesses is a strong platform to be exploited further. Norwegian scientists are often working on topics of interest to other funding bodies outside Norway. However, there appears to be some gap in offering collaboration opportunities with countries outside Europe and North America.

In relation to the FP and Norwegian involvement, our view is that the Council has a strong and effective process for aligning its priorities with that of the FP. However, a consequence of this is that other opportunities including bilateral links have as yet insufficient emphasis when choices are made about the topics for internationalisation and which countries should become partners.

The study found that RNC funding schemes play a strong role in supporting internationalisation and are widely accepted in the system. Figure 48 illustrates the rapid take-up of RCN incentives for EU participation in the early-mid 2000s. The support the RCN offers to internationalise is valued, especially when it comes to EU preparation and mobility. However, supporting schemes are not known broadly enough and a majority The visibility of internationalisation support schemes should be increased through awareness and information campaigns, with a focus on early stage career researchers. Doing so would also enable the RCN to be more responsive to specific needs of researchers.

technopolis|group|

Figure 48 Involvement of stakeholders in international cooperation activities
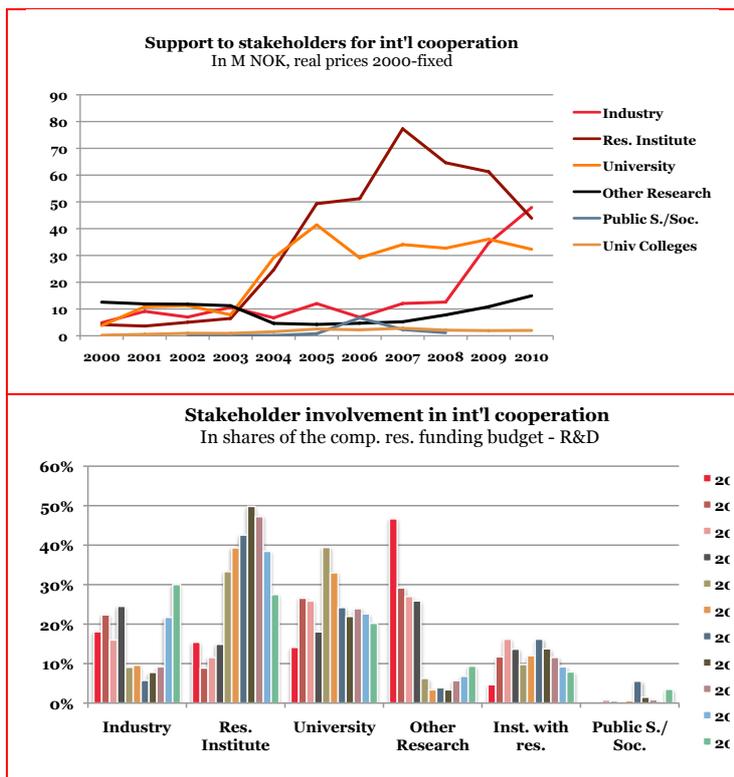
Source: RCN Evaluation, 2012 – Background report No 10: Internationalisation, MIoIR; based on the RCN database, Technopolis analysis

Measured by the acknowledgements in published articles to EU funding, the influence of the EU as funding source is less pronounced in Norway than in benchmark countries (Sweden, Denmark). The success rates of Norwegian researchers are slightly lower than with most benchmarking countries, while Norwegian SME do comparatively better.

Compared to other supporting systems, the RCN support, through NCPs, is functioning well, even if slightly less staffed. However, there is no strong emphasis in the advice to advise strategic leaders in organisations and the EU support in NCPs does get less prominence than in other comparator countries.

There is a high awareness of the benefit of inward mobility, but less propensity to see the advantages of outward mobility. The attractiveness of Norway as a place to work supports one part of the internationalisation policy: it brings non-Norwegian researchers of high calibre to Norway to study, mainly to build their scientific careers. But not enough Norwegian researchers are moving abroad to develop their careers and not enough high calibre researchers remain within the Norwegian system. There is insufficient movement out of and back into the Norwegian research system of scientists of the high calibre needed to maintain and strengthen Norway's scientific strength.

In general there is not enough understanding in the system as to the nature, scale and scope of internationalisation and thus on the impact and gaps of international activities and the necessary modifications in support and financing.

Giving complete discretion to grant awarding committees and programme boards to set the limits to internationalisation involves some risks of missing synergies between programmes, and reaping the full benefit for the RCN remit more broadly. However, driving internationalisation top down with indicators based on the count of foreign personnel or count of outside countries involved, or through a set budget, is not a better option.

While, in many respects, the cooperation between the RCN and ministries is working fine, not all ministries follow a transparent and strategic approach when it comes to prioritising partner countries and supporting activities. This causes inconsistencies and is a potential for inefficiencies across the system.

There is a lack of a broader, cross-system debate about the merit and form of internationalisation. The dual role of the Council as (1) advising the system (other ministries etc.) and 2) being a strategic player with budget decisions and priority setting cannot be without tension. A systematic, informed cross-system debate on internationalisation is missing

8.3 Recommendations

- The strong focus on internationalisation in the RCN strategy should be maintained given the preferences of the actors, the overall political goals of Norwegian policy and the overall positive net benefit of international research and innovation activities. The policy of opening up of programmes should be continued.
- The Council should examine quickly what administrative burdens will arise from greater internationalisation. At the current rate of growth of foreign partners in RCN funded schemes, one third of all of the Council's project participation will be with foreign partners by 2015. This is likely to have major impacts upon administration of schemes and cost implications.
- Making internationalisation a central feature of the science system through mainstreaming is nonetheless essential and should be continued. However, mainstreaming should be coupled to a clear set of principles to determine what internationalisation contributes to the various goals and programmes of the RCN and which forms and levels of internationalisation are sensible and realistic, given organisational and budget constraints. Also, it needs transparency and coordination in order to avoid duplicated efforts and sub-critical, costly activity.
- The Council should formulate a clearer process for determining where internationalisation is in the national interest so that all actors in the research system understand the scale and scope with which internationalisation should be pursued in the various programme areas, and to what limit. There is a strong need for the development of internationalisation priorities – e.g. collaborating with China needs to be focused on key themes and areas where Norway can benefit (rather than just collaborating to keep an eye on a competitor) – similarly, collaborating at such a broad and general level with the EU programmes (just to gain a 'seat at the table') is an inefficient strategy.
- Some additional attempt should be made to broaden the opportunities to collaborate with actors outside the EU and North America should be explored and systematically implemented. In addition, the EU/Nordic/3rd country balance needs an in depth investigation and study – it should form the focus of either/both of the two bodies suggested below.
- Greater resource should be allocated to promoting the bilateral links with other countries on the basis of strategic processes to select topics and partners for optimal cooperation – rather than broadening without strategic focus.
- The Council should play a greater role in defining the scientific benefits for Norway that emerges out of bilateral links and then support to create those bilateral links with selected countries.
- The visibility of internationalisation support schemes should be increased through awareness and information campaigns, with a focus on early stage career researchers. Doing so would also enable the RCN to be more responsive to specific needs of researchers.
- A very detailed analysis as to the nature and quality of participants in EU programmes vs. other national and international funding schemes should be undertaken in order to understand if the lower success rate of Norway is due to a bias in participation, given the generous funding conditions of Norway, or lower quality of Norwegian researchers.

- The NCP system should focus more on advising strategic leaders and should – in case Norway decides to put more emphasis on EU research – play a stronger role in linking to the discourse at EU level.
- The Council's offering of opportunities abroad for its researchers should broaden in scope. Currently there is too much emphasis placed on long term stays in other countries. Researchers wishing to have research stays at foreign institutions should be able to stay abroad for shorter periods as well as for longer periods.
- There is a need for RCN to develop a more robust and routine process for the identification of strengths and weaknesses of the position of Norwegian S&T – either in house or from specific commissioned studies. This should be supported by a routine bottleneck analysis to understand how support should be modified. Equally, greater monitoring and more frequent and tailored evaluations of the implementation of internationalisation and its impact, particularly on country coverage, quality and the contribution to Norway's national interest should be undertaken.
- The RCN should introduce an internal high level, multi-domain advisory body, which could represent both top-down considerations and bottom-up (researcher driven) demands. This would also enable to better integrate and consider industry needs within the science portfolio. It would also lead to an enhanced ability and role in influencing ministries when it comes to internationalisation.
- In order to a systematic and informed cross system discourse and to enable the RCN to better listen to respond to the needs of the Norwegian research community, a *Forum* on internationalisation should be established with key ministries, the RCN, representatives of large research organisations and researchers should be established. This should allow for an open and transparent debate about what the policies are and also be the locus of reporting about monitoring and evaluation of internationalisation activities.

9. Policy conclusions and recommendations

The preceding chapters handle a lot of operational and organisational questions about RCN operations and draw conclusions. Rather than repeat them, we focus in this Chapter on conclusions and recommendations that affect policy.

9.1 Challenges

Since 2000, Europe has been telling itself that it needs to become better at research and innovation, building bigger and more powerful entities within a 'European Research Area' (ERA) that can compete with the world. For the past decade, it has been pouring billions of Euros into R&D to support this vision, which involves increasing specialisation and building areas of knowledge strength to support it. With about 1% of Europe's population, Norway has to work hard to find a place in this landscape and in the global picture that is appearing as a result of rapid development in China, Brazil, Russia, India and elsewhere. With very few resources, Norway will have to play a clever game to succeed in global competition.

The Norwegian research and innovation system faces significant challenges over and above the 'grand challenges' of climate change, ageing and so on that preoccupy many research and innovation policymakers internationally. These challenges arise from the Norwegian oil and gas fairytale, which has had a wonderful effect on living standards and welfare. But this in turn makes Norway and Norwegians very expensive so that – even more than other rich, developed countries – Norway must increasingly compete by using knowledge to add value to its natural endowments. erformance in both research and innovation must improve. At the same time, the oil wealth means that there is no sense of crisis or urgency, which is unfortunate because the needed performance improvements cannot be achieved instantaneously when some crisis does arise.

On the innovation side, the overall rate of innovation is modest and declining and there are signs that industrial renewal is happening at too slow a pace. Despite some high points – and it is not hard to identify individual successful innovations and companies in Norway – the business sector's research and innovation effort is simply too small. Too much of it is about incremental changes in existing markets. In a globalising world where Norway increasingly experiences both cost- and knowledge-based competition, this is not good enough. If we believe the evidence presented here, industry's participation in RCN-funded projects has too much a similar character of 'business as usual'.

On the research side, our bibliometric evidence shows that Norway's performance is solid but – again with exceptions – not leading enough to meet the needs of what has become pretty much the most expensive country in the world. Here, too, the evidence is that RCN-funded research lets the universities and institutes do 'more of the same' – both sectors miss the chance to do more interdisciplinary, risky, potentially disruptive work. What RCN funding **does** do is to focus more resources on the national priority themes, helping to gather strength in areas where generally Norway has advantages on which to build.

Of course, it is easy to undervalue the day-to-day, incremental work through which most of science and industry advances – what Schumpeter called[68] "the accustomed circular flow of economic life". But Schumpeter also pointed out – rightly – that significant progress is driven by a "gale of creative destruction" where the old gives way to the new. That is why, as we said at the start of this report, RCN needs to find a way both to be an 'aggregation machine' that smoothly administers the day-to-day and

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[68] Joseph Schumpeter, *Capitalism, Socialism and Democracy*, London: Routledge, 1942

A Good Council?

a 'change agency' that disrupts the system and encourages innovation in research and industry. In our view, RCN has succeeded admirably in the first role but done less well in the second. And just as RCN's successes that we discussed earlier are 'coproduced' with others, so is this weakness. In particular it is coproduced with the governance system it inhabits. The change agent role has tended to focus on structural change. However, the clear signals that RCN predominantly funds 'business as usual' in both research and innovation suggest that it has been less proactive in supporting change in science and the innovation system.

9.2 Getting the balance right

It would be simplistic to think that these systemic challenges can be met by following a simple policy mantra. Most of the policy choices involve finding an appropriate balance between alternatives, such as the need to be orderly and disruptive at the same time.

RCN itself is a very special construction that spans the research and innovation system in the hope of integrating and combining its elements in ways that are had to achieve in separate organisations. It has demonstrated that it is possible to balance the needs of a wide range of sectors into a coherent policy and a set of programmes and to a fair extent to mix up the funding of different types of research in order to tackle specific needs. The coordination costs are perhaps higher than we would like, but RCN provides a clear demonstration that where needed a single organisation can provide an holistic approach to research and innovation policy. The Large programmes are the major success here, even if some of the individual programme designs have weaknesses.

All research and innovation funding systems face a problem of 'dynamic inconsistency' between the short-term needs and incentives of the political system on the one hand and the long time constants that are relevant in research and the coupling between knowledge generation and use. Two mechanisms are available for tackling this. One is to isolate a part of the state budget from the normal short-term budgeting process and to devote it to longer-term needs, as Norway did with the FFN Fund for Research and Innovation or as Chile has done by imposing a special tax (the FIC) on the profits of the copper mines. Finance ministries dislike such mechanisms, for good reasons. In particular, they limit government's budgetary freedom and tend to exempt the funds from the level of question and scrutiny to which other parts of the state budget are subject. In reality, both the FFN and the FIC pass through the annual state budget process. However, legitimising long-term action in an otherwise short-term environment is nonetheless important.

The second mechanism involves creating a high-level research and innovation council (like the Research and Innovation Council in Finland) that involves and commits government to longer-term action. This has the additional advantage of explicitly being able to coordinate aspects of national research and innovation policy. Chile, interestingly, created a national council for innovation for competitiveness (CNIC) originally to advise on how to use the FIC tax money. Subsequently, the CNIC (which involves key government ministers) took on the wider role of research and innovation strategy. When it works well (and of course it does not always do so), such a council can effectively make the longer-term policy commitments needed to resolve the dynamic inconsistency problem, making a special fund unnecessary. In Norway, the absence of a high-level council means there is a greater need for a mechanism that has the function of the Fund than would otherwise be the case.

A second advantage of a council is that it can provide strong coordination of ministries. The Norwegian system has made several evolutionary adaptations in the past decade to the lack of a council. The FFN Fund is one such. A second is the integration of FFN into KD's responsibilities. As the Fund has grown so KD has become more of a 'research ministry' in the sense of handling far more than basic research. It has deployed Fund money to launch and sustain several key systemic interventions, including the centres programmes, infrastructure investment and the

Large programmes. A third is RCN's practice of reducing the number of programmes it runs and signing up more ministries to each programme. A fourth is the growing practice of multiple ministries getting together to design common research strategies, as has been the case with climate change, biotechnology, nanotechnology and shortly ICT. These are all useful adaptations – but they appear inherently costly compared with the alternative of key people getting together round the council table and making decisions. Further, especially given the strength of the sector principle in Norway, the lack of a strong council imposes significant internal coordination costs on RCN.

We strongly agree with sector principle – not least because it embeds research and innovation across the ministry system and means that all ministries become advocates for research, rather than one or two ministries effectively having to battle the rest for research and innovation money. Nonetheless, the sector principle is also a powerful force for lock-in at RCN. This is not a matter of bossy ministries limiting RCN's freedom to act but a result of RCN's parallel dialogues with sixteen ministries where the ministries say what they want and RCN does its best to serve its ministry customers. As long as RCN does not have more freedom than the sector ministries will grant it, or some sort of 'strategic' budget, RCN will be locked in to ministry requirements. This was known when RCN was created.[69]

A success of the past decade has been the creative use of budget by KD together with RCN that has effectively generated some strategic 'space' to launch important new initiatives. This has involved dramatic growth in budget through the mechanism of the Fund – effectively growing from nothing to 1.2 BNOK over a decade – something that is hard to envisage without the context either of a device like the Fund or the influence of an authoritative and powerful research and innovation council. Despite these successes, however, the evidence suggests that the disruptive element of RCN's activities is still too small – there is too much business as usual and not enough risk taking – either in RCN's advice function or in its funding. (To use a scientific analogy, the research community normally expects that if research is sufficiently ambitious to be interesting it will from time to time fail. It may seem like an odd evaluation conclusion, but perhaps RCN should fail more often!)

One way to improve the balance between RCN's aggregation machine and change agent roles would be to raise the level of abstraction in the way it is steered by the ministries. The new MBO system aims to do this and while it seems so far to have added little value to the steering of RCN it does provide an arena in which the ministries and RCN collectively could work on finding a better balance between sector and national needs.

We mentioned in Chapter 2 the idea of thinking about research funding in two 'programmes'. Programme 2 creates and sustains research capacity across most if not all disciplines, supports the development of human capital and is often rather focused on basic research. This is the focus of research councils in most countries. Programme 1 builds additional capacity in areas of national importance such as providing the knowledge and people to run the hospitals or to run competitive companies in sectors of actual or potential national strength. This tends to be more the work of innovation agencies. In a dynamic research and innovation system, we would expect both Programmes to be in constant change.

We can think of much of the work of RCN's Science Division as focusing on Programme 2.   The Large programmes and national priorities clearly tackle Programme 1. Is the approach sufficiently dynamic? The large programmes are agglomerations of previously smaller programmes and are now moving into a second generation. During their lifetimes, they are said to be hard to change in more than an incremental way in so far as they address the needs of multiple ministries. There seems to be sufficient risk of lock-in here that it should at least be monitored.

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[69] Innst. S. nr. 192 – 1992–93, p 5

RCN and the ministries have together managed to increase the share of RCN's budget that goes to the national priorities and RCN has been 'deprogramming' other resources in the Science and Innovation divisions. On the Science side, there is bottom-up funding through FRIPRO and a mechanism (the SFF centres) that permits evolution. New fields and ideas that move to scale can get centre money, which the evaluations show gives them the power to affect their organisations' strategies, so there is an RCN-supported route to evolutionary change (notwithstanding the criticism that there is in practice too little risk taking). Deprogramming in the Innovation Division, however, is removing the potential for agglomerating and strengthening clusters of firms and opportunities because it leads to funding innovation at the project level but not at the programme level. Unlike, say, Finnish or Swedish programming practice – which is to identify (sometimes proactively, sometimes reactively) clusters of opportunity and to tackle them through 'technology programmes' – RCN is choosing no longer to provide an evolutionary mechanism between the bottom-up project level and the priority level. In this sense, while Programme 2 is potentially dynamic, Programme 1 is inherently static. In the context of Norway's need to promote industrial innovation and renewal, that seems to us to be a weakness. Indeed, given the tendency towards incremental innovation and 'business as usual' R&D aimed at existing markets in the Norwegian innovation system, we would expect to see an agency like RCN being much more proactive in developing mid-sized programmes and the externalities that they bring over and above the value of participation to the individual companies. This aspect of change agency needs strengthening.

The Norwegian research community complains very vocally that the amount of 'free' research money for basic research at RCN is low. Our analysis suggests that free projects plus basic research programme money have been fairly constant in real terms over recent years. There **was** growth in basic research in the earlier years of the Large programmes but their overall content has shifted towards innovation. In the meantime, the cost of the universities has almost doubled in current terms over a decade, driven by rising student numbers. This automatically increases demand pressure for FRIPRO as the number of eligible university teachers rises while the universities choose not to manage the allocation of internal research resources or the quality of the proposals the academics submit to RCN.

Basic research is an important component of a research and innovation system. In many advanced countries including Norway, the OECD statistics show that it is 20% or so of the total R&D effort. From an economic perspective (which is of course not the only relevant one), basic research tends to support the development of the rest of the research and innovation system through developing human capital as well as knowledge. Thus the USA has about the same proportion of basic research in the total mix as Norway but this supports much more business activity. Business expenditure on R&D in the USA is almost 2% of GDP, compared with less than half that in Norway. To put it another way: Norway has more basic research than is economically necessary, given the low R&D performance by business. However, this can be justified if the state is investing in basic research ahead of the growth in industrial R&D – and that is precisely the pattern we normally expect to see in the course of industrial development.

Given the high proportion of research money in Norwegian university funding, an unusually high proportion of Norwegian basic research is done in the universities – which are also the main users of FRIPRO. Our argument that Norway needs to improve the quality of its research also implies that it would make no sense to reduce funding for basic research. One option would be to reallocate money from the General University Fund to fund more basic research via RCN, in order to improve quality. Another would be to encourage the universities to manage the allocation of research time and other resources in a more stringent manner. What can be done at the RCN level is to augment the FRIPRO resources in a way that is more demanding of quality and change than FRIPRO is today. That would imply measures such as a special high-risk research instrument and increased funding to complement ERC grants.

9.3 Recommendations

- The lack of a high-level research and innovation council that sets policy makes it hard to coordinate research and innovation policy at the national level. We understand the difficulties of creating such a council in the Norwegian governance system but recommend that as a minimum the government investigate constitutionally acceptable ways to increase the strength of research policy coordination at a level above the ministries

- A national strategy and policy for research and innovation is more than the sum of what sixteen ministries want. The Fund for Research and Innovation was an important mechanism for providing 'strategic' resources to induce change in the research and innovation system – acting as a 'countervailing force' to the tendency of sector requirements to lock in RCN and inhibit necessary change in the research and innovation system. While the government had good reasons to close the Fund, it is vital that the funding mechanism replacing it should be able to address the long-term research and structuring needs of the system

- The quality of Norwegian research is on the average good but in the light of increasing knowledge-intensity as a key requirement for competitiveness, it is probably not good enough. Increasing quality should be even more strongly emphasised as a goal for RCN

- RCN should have some strategic resources and freedom to explore and fund new opportunities on its own initiative, ahead of collective demand from its principals, in order to avoid problems of late entry and catch-up

- RCN's responsive approach to basic research means that the existing pattern of activity plays a large role in determining the pattern of future activity. There is no provision for high-risk research and some evidence that Norway has moved slowly into key generic technologies. RCN should therefore establish mechanisms that promote disruptive change in basic research as well as in more applied areas

- Raising business expenditure on R&D is an important policy objective, which is addressed through a tax incentive, thematic programmes and the bottom-up BIA funding arena. This leaves a gap for smaller-scale, time-limited programme initiatives responding to the needs of a sub-sector or cluster at a significantly larger scale than BIA consortia. RCN should review at the micro level the opportunities from time to time to involve stakeholders in starting such technology programmes and eventually create a larger-scale instrument for doing so

- Bottom-up, researcher-initiated research is an important component of any healthy research system – especially in a rich country that needs to operate at or near the scientific and technological frontier. FRIPRO funding should be strengthened, especially to tackle more interdisciplinary and higher risk research aiming to drive up quality. This could be complemented by mandating the addition of a more explicit fundamental research component to Large programmes

The Summary of this report contains these recommendations, together with a small number of other important but more operational recommendations arising from earlier Chapters of this report.

Appendix A Terms of reference

A.1 Introduction

The Research Council of Norway is an essential tool for the development and implementation of Norwegian research and innovation policy. Its terms of reference cover all academic fields, from basic to applied research, and it has at its disposal a range of instruments. The Council receives allocations from 16 different ministries, and in 2010 it provided funding totalling almost NOK 7 billion for research and innovation purposes.

The Research Council was established in 1993, and since then has been evaluated once, in 2001. As a consequence of the evaluation the Council was reorganised in 2003, and its six thematic areas were replaced by three divisions. A further reorganisation was implemented in autumn 2010.

Developments in recent years in the national and international research system have increased the need for up-to-date knowledge on the Research Council's activities and working methods. This was discussed in the white paper *Climate for Research* (Report No. 30 (2008–2009) to the Storting, cf. Recommendation S. No. 37 (2008–2009)), which states that the Research Council will be evaluated during the parliamentary term 2009–2013:

> *The Government will therefore ensure that an evaluation of the Research Council is undertaken during the present parliamentary period. The evaluation should provide an overall assessment of the Council on the basis of the overarching objectives that have been established for the Council's activity. The evaluation should be based on the Council's three roles in the research system, which should be examined in the context of recent developmental trends, including the development of more independent research institutions with clearly defined strategic responsibilities, and the internationalisation of research. The distribution of responsibility between the Research Council and the other research and innovation policy agencies should be emphasised. Terms of reference for the evaluation will be drawn up.*

The evaluation should consider both the progress made from 2003 up to and including 2010, and the potential for improvement in the light of significant developmental trends. It will also be important to capture the main cooperation processes and the potential for learning and development in the research system. One of the main premises for the evaluation is that the Norwegian model, with a single council for all the different research fields, should be retained. Among the main reasons for the single-council model is the sector principle[70] in Norwegian research, which creates a need for coordination mechanisms; the increasing emphasis on a cross-disciplinary approach; and the closer links between basic and applied research. However, the model must be evaluated in relation to how well it fulfils its function in the Norwegian research and innovation system, and possible options for further development and adjustments to the Council's activities should be indicated. Experience from other countries may be used where appropriate to illustrate various development options for the Research Council in the time to come.

Section 2 below provides a short description of the Research Council with an emphasis on its organisation and main tasks. Section 3 deals with the main focus for the

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[70] According to this principle each ministry has a specific responsibility to ensure that research is conducted in its sector.

evaluation, and describes a number of central issues related to the Council's function in the research and innovation system. Section 4 describes the main themes for the evaluation: the Council's advisory and financing functions. Section 5 presents an overview of documents relevant to the evaluation and other planned and ongoing evaluations addressing the Research Council's functions. Sections 6, 7 and 8 set out the reporting, progress and delivery requirements and list the points to be included in the tender.

A.2   About the Research Council of Norway

The Research Council of Norway is a public administrative body under the Ministry of Education and Research that has been granted special powers of authority, cf. section 8 of the Council statutes of 20 December 2002.[71] The Executive Board, which is the Council's highest authority, is appointed by the King for four years at a time. The statutes are established by Royal Decree.

The Research Council of Norway serves as a national strategic and executive body that is responsible for increasing the general knowledge base and for helping to meet society's research needs by promoting basic and applied research and innovation. The Research Council also promotes international research cooperation and advises the government authorities on matters of research policy (section 1 of the Statutes).

Under section 4.2 of the Statutes, the Executive Board is responsible for the overall activities of the Council. It follows up the research policy guidelines drawn up by the government and the Storting and in its advisory capacity to the government it provides input to future research policy. The Board has the primary responsibility for drawing up the Research Council's strategy and for ensuring that it operates as an integrated body. This involves among other things ensuring close internal cooperation within the Council, delegating tasks and ensuring that the organisation remains optimal. The Board submits annual budget proposals to all the relevant ministries, and distributes the funds allocated to the Council.

In 2003 the Research Council was organised in three divisions, for science, strategic priorities and innovation respectively. In autumn 2010 the Council was reorganised; the division for strategic priorities was closed down and two new divisions were set up. The divisions are administered by division research boards appointed by the Executive Board. In order to ensure close cooperation between the divisions, the chairs of the division research boards are also members of the Executive Board. Each division provides funds for research activities by means of various instruments, the most important of which are the programmes, each headed by a programme board. Over 800 representatives of research institutions, the private sector, the government administration and other social sectors participate in the various management boards, which are thus important meeting places as well as advisory bodies and allocators of research grants.

The day-to-day management of the Research Council is the responsibility of the Director General. In addition to the research divisions, the Research Council consists of the Director General's staff and the Division for Administrative Affairs, which supports the research divisions and coordinates and develops the Council's activities.

Section 2 of the Statutes sets out the Research Council's main tasks. These are to:

• Support basic research and seek to encourage development within the various research fields and disciplines as well as to ensure inter- and multidisciplinarity in research;
• Support research that encourages public debate and contributes to the development of democracy and the formulation of policy;

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[71] In a Royal Decree of 17 December 2010 new statutes were established for the Council, which included a new divisional structure. The present evaluation should be based on the statutes for the evaluation period 2003–2010.

- Promote innovation in public and private sectors in all parts of the country;
- Promote coherence and interaction between basic research, applied research and innovation;
- Fulfil national responsibilities with regard to dissemination of research and work to promote the uptake of research results;
- Promote international research cooperation;
- Work to ensure the highest possible quality in Norwegian research activities;
- Work to achieve cooperation and cohesiveness between public agencies within the research and innovation system;
- Work to achieve constructive distribution of tasks and cooperation between research institutions, and take strategic responsibility for the research institute sector;
- Ensure the evaluation of Norwegian research activities;
- Provide advice to government authorities as a basis for the formulation of research policy.

The Research Council also follows political guidelines set out in white papers on research and other subjects and the annual budget propositions. Goals and guidelines are also specified annually in the steering documents from the ministries that finance the Council's activities.

A joint system for management by objectives has been developed under the leadership of the Ministry of Education and Research in cooperation with the Council itself and the ministries concerned. A set of common objectives was established based on the Council's statutes and the priorities set by the ministries in their research allocations, and in 2010 these objectives were adopted by most of the ministries and set out in their steering documents. Parallel with this process, the parameters used by the Council in its reports to the ministries were reviewed and adjusted. These objectives and the reporting parameters are to be further developed.

## A.3   A single research council in a diverse research system

The purpose of the evaluation is to examine the Research Council's role in the Norwegian research and innovation system and to consider whether the goals established for its activities are being achieved effectively while maintaining a high standard of quality. The evaluation will be used as a basis for further learning, and attention should be paid to the relations between the Research Council and other institutions. This means that a focus must be trained on decision-making processes in the Council, patterns of participation, objectives and instruments. The changes made since the previous evaluation must also be evaluated.

The evaluator must adopt an ex-post perspective on the period from 2003 up to and including 2010. He must also take an ex-ante perspective and suggest further possibilities for development that will improve the Research Council's ability to perform its tasks.

The evaluator is expected to use other relevant evaluations and descriptions of the current status of research as a basis for his work, cf. section 5.

It is important that the evaluation can be used as a basis for strategic decisions on how the Research Council should be further developed in a way that will strengthen the Norwegian research and innovation system in the years to come.

Main focus – the Research Council's functions in a diverse research system:
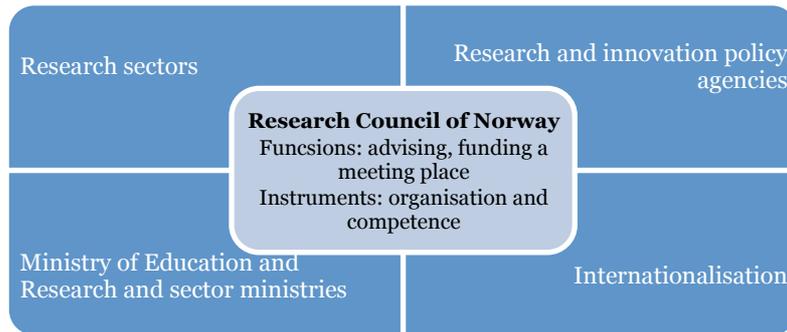
The above figure shows the systematic perspective for the evaluation. It should concentrate on the relations between the Research Council and the sectors that conduct research, the other research and innovation policy agencies and the ministries, and on the Council's activities in the context of the internationalisation of Norwegian research.

An overall review of the status of Norwegian research has been started by a government-appointed committee of experts (the Fagerberg Committee). According to its terms of reference the Committee will examine the relationship between the goals, resources and results of publicly funded research and advise on whether the public funding system needs to be altered, with particular emphasis on the relevant funding mechanisms. The aim is to raise the quality of research and improve the use of resources. The Committee's recommendations will be submitted to the Ministry of Education and Research in May 2011, and its report will be circulated for comments before further processing in Ministry.

A.3.1 The Research Council of Norway as the subject of the evaluation

The subject of the evaluation is the Research Council. The focus must be on the Council's functions and on its organisation and competence in relation to the performance of its tasks. The evaluation should have two main themes. The first should be an evaluation of the Council in terms of its *advisory function* and how this function should be further developed. The second theme should be a detailed review of the Council's function as a *funding mechanism*, with an emphasis on its use of instruments and its ability to make use of its room for manoeuvre. The Council's advisory function and its ability to develop and manage instruments for promoting research that is highly relevant to our society requires it to have a good understanding of society's future needs. The Council also needs to develop sound insight into the ways in which research interacts with other social, cultural, economic, political and environmental processes. The evaluation should therefore consider to what extent the Council has managed to adapt its research and innovation policy advice and instruments to this larger context. The issues relevant to these two main themes will be set out in more detail in Chapter 4 below.

The Research Council also functions as a meeting place for user groups and for disseminating information. This function is intended to support the other two functions mentioned above, and must therefore also be evaluated. Points to focus on are how the Research Council has defined and fulfilled this function during the relevant period, and whether it needs to be further developed and modernised in order to provide optimal support for the advisory and funding tasks.

The quality of the Research Council's organisation and competence is a decisive factor for the quality of the services it provides, and the advisory, funding and meeting-place functions should be examined in this light. It is especially important to determine whether the Council's internal organisation and competence-building measures are appropriate for addressing the new research policy challenges. The Research Council's

model of organisation, which is based on a three-level hierarchy of boards that is also reflected in its administration, has not previously been externally evaluated. The cooperation and interfaces between the three board levels and between the boards and the administration, and the horizontal coordination between the divisions, should be reviewed. The evaluator should also conduct a process evaluation of the internal reorganisation carried out in autumn 2010.

A.3.2 The Research Council's general function in the research system

As the figure shows, the relations between the Research Council and the various research sectors – the university and university college sector, the institute sector, the business sector and the regional health authorities – will be key elements of the evaluation. The Norwegian research system is developing in the direction of greater autonomy for research institutions, more strategic management and increasing competition for national and international funding. The impact of these trends on the Research Council's activity should be examined.

Another important element is the Research Council's cooperation with the other research and innovation policy agencies, which represent the system of government policy instruments intended to channel funds to research and innovation activities. The cooperation and interface between the Council and this system have a strong influence on all the Council's tasks and functions. The evaluation of the Council and those of the other research and innovation policy agencies (Innovation Norway and the Industrial Development Corporation of Norway (SIVA)) will together provide a broad knowledge base for decisions on adjustments to these organisations.

The ministries have the overall responsibility for financing research in their own sectors. This principle is intended to encourage the ministries to invest in research, to ensure that research is conducted within its sector, and to promote socially relevant research. This ensures that research and knowledge are developed as an integral part of policy and social development. The Ministry of Education and Research is responsible both for coordinating research policy and for research in its own sector. As the figure shows, the evaluation should include an examination of the Research Council's relations with the ministries providing funds and of the importance of the sector principle for the Council's activity. Similarly, the steps taken by the Council to achieve research policy goals during the evaluation period (cf. the white papers *Commitment to Research*, Report No. 20 (2004–2005) to the Storting, and *Climate for Research*, Report No. 30 (2008-2009) to the Storting) are important reference points.

Another perspective for the evaluation as a whole is that of internationalisation. This is a major trend in the research sector and the responsibility for promoting international research cooperation is laid down in the Research Council's statutes. In recent years the Council has been allocating an increasing proportion of its budget to internationally oriented activities and projects. The scope, complexity and speed of change in the international research arena have increased the need for up-to-date information on the steps taken by the Council to address the issue.

The evaluation should pay great attention to the efforts to increase Norwegian participation in EU research framework programmes and initiatives related to the emergence of the European Research Area. The question of whether the Research Council is taking steps to ensure that multilateral and bilateral cooperation complement each other should also be examined. The success of the Council's efforts to promote international research cooperation during the evaluation period should be assessed and specific recommendations made for measures to equip the Research Council to address the challenges and developments in this area.

A.4 Thematic areas of the evaluation – the main issues

The two main themes of the evaluation are presented below, with an emphasis on the general questions that need to be addressed. The evaluator is requested to propose a plan and a set of questions for the evaluation that will effectively address these issues.

If possible the evaluation should suggest criteria for measuring successful goal achievement. The criteria must be based on broad empirical knowledge and be derived from relevant literature. The international perspective must be maintained throughout the evaluation (cf. the figure in section 3).

A.4.1 Advisory function

The Research Council provides advice on general research policy and more specific advice to sectors and institutions. The Council's advice is important input to the government's work of drawing up research and innovation policy documents and on the ministries' work on their budgets, as well as the work of the authorities and the research activities of academic institutions. The Council is expected to provide sound analyses of research needs and to propose measures for all relevant sectors based on systematised knowledge and the Council's autonomy as a specialised institution.

The Research Council has a statutory responsibility for evaluating Norwegian research and for providing sound advice based on such evaluations. The experience and expertise that the Council gains from its funding activities and its function as a meeting place for key stakeholders in the research system also place it in a good position to provide advice. The Council has a complex organisational framework with a wide range of governing boards representing the various stakeholders. Close cooperation between the various management levels and research divisions is essential for ensuring that its advice is of a high quality. The evaluation should consider how the Council's tasks, functions and management system have defined, limited and institutionalised its advisory function, and whether this has contributed to the provision of independent expert advice.

The ministries make use of advice from the Research Council when formulating research and innovation policy in white papers, strategies and so on, and in making decisions on research investments in the annual government budget. The Research Council's annual budget proposal is one of its main advisory documents. In addition the Council must be able to meet the ministries' need for advice and guidance at all times. However, the Council does not have a monopoly on advising the ministries. The various directorates, research institutions, trade and interest organisations and the other research and innovation policy agencies also advise the authorities on research policy. Given the large number of bodies providing advice, the evaluation should investigate how much weight is given to the Council's recommendations compared with that of other bodies and to what extent its recommendations are taken into account in users' decision-making processes.

The Council's cooperation and interface with other policy implementation agencies, and how this affects its advisory function, should also be examined.

The university and university college sector, the institute sector, the research institutions in the business sector and the regional health authorities also make use of advice from the Research Council in the development of their activities. At the same time these bodies provide essential information on which the Research Council can base its own advisory activity. National and international development trends (see section 3.2) present new challenges that the Research Council must address if it is to fulfil the function expected of it by its users. The evaluation must consider whether the Council has the organisational capacity and expertise necessary to meet these expectations and to what extent the Council influences these institutions' own priorities and decision-making processes.

Given the increasing internationalisation of research, an assessment of the Research Council's ability to supply its users with advice on international cooperation is an essential part of the evaluation. The evaluator must identify the challenges in this area, especially those related to the links between national and international initiatives, and propose measures for improving the advisory function to equip the Council to address new developments.

Another important point that needs to be examined is whether the establishment of meeting places and learning arenas serves to promote the application of research-based knowledge and to inform different user groups about such application. The evaluator must examine the Council's ability to document research results by means of performance indicators and reporting systems, and whether its organisation allows it to effectively monitor its own activities and instruments.

A.4.2 Funding function

In 2010 NOK 22.4 billion was allocated to research and development in the government budget, approximately 30% of which is administered by the Research Council. In that year the Council received approximately NOK 6.7 billion from the ministries. The Council also receives funds from various organisations, donations, administrative grants, etc, which in 2010 amounted to a budget of just over NOK 7 billion.

As the national competition arena for research in all fields, the Research Council is a strategic instrument for implementing national research policy. It is expected to provide added value in comparison with other sources of funding by bringing together different research institutions and academic fields through joint allocations. The aim is to ensure that funds are awarded to the best research activities.

The Research Council is responsible for targeting its instruments so as to meet research policy priorities. It has a wide range of instruments, including open competitive arenas, initiatives directed toward strategic priority areas, policy-oriented programmes, basic funding and the launching and implementation of various centre schemes. The balance between, and the organisation and composition of, the various instruments should be examined, and also whether these are adequate from an overall perspective for achieving the Council's goals. It is particularly important to examine how the increasing importance of international research cooperation will affect the organisation of national policy instruments and of the Council's own organisation, priorities and activities in the time to come. The evaluation should also examine whether the Council's portfolio of instruments has provided additionality in terms of for example input, results and behaviour, whether adjustments should be made, and if so, what kinds of adjustments. The effectiveness and transparency of the Council's treatment of applications should also be examined.

In addition to the competition-based allocations awarded by the Research Council, funds are channelled directly over the government budget to research and development at universities and university colleges, the regional health authorities and research institutes. The larger universities in particular have substantial resources for research at their disposal in the form of the basic allocations they receive from the Ministry of Education and Research. In order for the research system to function properly it is essential that the institutional resources and the funding measures used by the Council should complement each other. The evaluation should therefore describe the relationship between the various institutions' autonomy, national priorities as implemented through the Council, and the organisation of the instruments in the context of the roles and tasks of the various institutions.

Since the Research Council is not the only institution whose main task is to channel funds to research and innovation, we are particularly interested in information on the interfaces and cooperation between the Council and other research and innovation policy agencies, cf. section 3.2, including how such cooperation should be further developed. We are also interested in an evaluation of how the funding function of the Council is perceived by user groups.

Another question to be considered is whether the Research Council has captured and met the research and development needs of the various user groups through the meeting places and learning arenas it provides, and whether this could be improved. The views of user groups on the Council's efforts are also relevant here.

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Appendix B The evaluation questions

We chose not to use all the evaluation questions set out earlier as a way to structure this report as it would make it complex and difficult to read. For the sake of order, here we briefly set out to answer those questions.

B.1 Formative questions

B.1.1 Create and provide strategic intelligence on research and innovation to stakeholders in the National Research and Innovation System (NRIS), including itself

RCN maintains knowledge bases about its own funding activities and beneficiaries, monitoring and indicator reports and contributes to the national availability of a level of information abut the research and innovation system that is of a high standard by international comparison. It is closely linked to the European Union programmes and other sources of intelligence about international research and innovation activity and policy such as TAFTIE. Its advice to government is used in the development of research White Papers, whose priorities are in turn reflected in RCN's own budget proposals and strategies. Its 'meeting places' provide it with needed information but offer participants limited influence over RCN activities. Its evaluation strategy is, however, not well developed though evaluation results are used in process and design improvement. Evaluation and performance indicators do not focus sufficiently on impacts.

B.1.2 Operate effective organisation structures and processes within a national division of labour among government authorities

RCNs budget dialogues, the use of multi-ministry programmes and support to ministry strategy processes makes RCN both responsive to sector ministry demands and gives it influence over them. Internal structures work effectively, even if they are complex in order to cope with the high coordination load, and RCN is itself able to reorganise to good effect, as in 2010. The institutional boundary is clear and rational within the division of labour with Innovation Norway and SIVA. Research funding process have been improved to reflect good international practice.

B.1.3 Implement and add value to national research and innovation priorities and policies

RCN has successfully focused funding on national priorities, to the apparent satisfaction of the ministries. Cross-sector programmes and strategies and RCN structural interventions add value to sector ministry priorities. However, impacts of RCN funding are insufficiently explored.

B.1.4 Play a developmental role in the NRIS, supporting the needs of the various component communities and institutions

RCN funded Norwegian research is of higher quality than that funded from other sources, based on bibliometric indicators. The performance-based research funding system for the institutes appears also to have increased their output of scientific papers. RCN has funded a growing volume of research, suggesting that capacity is being built. There is an implicit division of labour between the performance-based core funding systems (which drive quality and output within research performers' existing fields of activity) and RCN thematic funding, which additionally steers the direction of research. The distinction with 'free' research projects is not clearly articulated. However, the higher performance of RCN-funded researchers suggests RCN may still have a more significant effect on quality (though that appearance could usefully be explored in more detail). RCN instruments address both systemic and market failures.

B.1.5 Embed Norway in the changing international Research and Innovation System

Participation in the Framework Programme, certain other multilateral programmes and bilateral agreements all embed Norwegian researchers in the international science system. The high average quality of joint publications with foreign authors suggests that Norwegian researchers are able to work with successful people abroad. Inward and outward mobility remain at low levels, however. The internationalisation strategy needs clearer goals.

B.2 Summative goals

B.2.1 Goal 1: Increase quality, capacity and relevance in Norwegian research nationwide

1.1 *Strengthened research in nationally prioritised areas.* RCN spending in the priority areas has increased. There is at least one RCN centre (SFF, SFI or FME) associated with each of the national priorities. The priorities do not map easily onto the discipline categories used in the bibliometric study for this evaluation. In most fields, impact factors for RCN-funded researchers are higher than for non-funded ones. However, in the following disciplines relevant to the priorities the reverse is true: basic medical sciences; biomedical sciences; Computer sciences; electrical engineering and telecommunications. In economics and business, RCN-funded researchers do better but their impact is low. Much more detailed analysis would be needed to understand whether these apparent mismatches are of importance. Research performers say RCN funding has strengthened their strategies.

1.2 *Strengthened breadth of long term, fundamental research and concentration of resources on the best research.* Structural instruments (centres, infrastructure), increased project sizes and a modest increase in FRIPRO have supported this goal. The SFFs attract further resources, so there is some evidence of concentration. At the aggregate level, the impact of Norwegian research is not rising.

1.3 *Strengthened breadth of research-based innovation and concentration of resources on the best research and innovation milieux.* RCN spending has increased its focus on innovation and industry-linkage instruments. Centres of excellence and large programmes exist in priority areas. The SFIs attract further resources, so there is some evidence of concentration. Some innovation-relevant disciplines have poor impact performance (see 1.1, above).

1.4 *More research in business, both in terms of breadth and excellence.* CIS data show declining Norwegian innovation performance. BERD has risen some 15% in real terms between 2001 and 2010. While Skattefunn began in 2002, BERD stayed flat at around $1.8 bn[72] between 2001 and 2005 then rose sharply to a new plateau of about ¢2 bn from 2007 to 2010.

1.5 *Strengthened research to serve the knowledge needs of the sectors and the administration.* The amount and proportion of ministries research money spent through RCN has been rising. RCN maintains programmes that the ministries fund. Ministry feedback about RCN performance is positive. Centres have been created in areas where ministry and national priorities overlap and that are clearly relevant to KD, NHD, OED, FKD, LD, HOD, BFD and UD.

1.6 *Increased returns from international research cooperation.* RCN has supported national participation in the Framework Programme. Norway has been involved in 56 ERA-NETs, ESFRI and is very present in ERA instruments, including all 10 JPIs. It also participates in multi-lateral arrangements such as CERN and NordForsk. The rate of return from the Framework Programmes is comparatively

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[72] In constant 2005 US $ at PPPs. Source: OECD Main Science and Technology Indicators

low but this is mostly due to the contribution being high because of Norway's high GDP.

B.2.2   Goal 2: Good use of resources and appropriate division of labour, cooperation and structure in the research system

2.1 A good relationship between the national research effort and international cooperation. A growing proportion of RCN projects have foreign participants. There are high levels of international co-publication among RCN-funded researchers, often with N America and countries outside as well as inside the EU. Researchers value international links. RCN has an internationalisation strategy of mainstreaming; current programmes are developing specific strategies. On RCN's analysis (Annual Report, 2011) there is good correspondence between FP7 and national priorities.

2.2 Value added through efficient use of research funds. Funding processes have been improved, standardised and codified to a greater extent than before and resemble good international practice. Larger project sizes reduce administration costs. Programmes covering multiple sector interests have increased in scale and number. Some measures are in place to promote gender equality but the proportion of projects led by women remains low (20%).

2.3 Dynamic, efficient and effective cooperation and division of labour in the research system. Centre programmes have tended to increase effective research group sizes and influence strategy. Research performers say this is leading to increased thematic specialisation. RCN funds research infrastructure and channels core funds to the institutes in ways intended to improve cooperation and division of labour. Large programmes are intended to focus effort.

2.4 Assuming strategic responsibility for the research institutes. RCN monitors and reports on the institutes individually and by sector. It operates the performance-based core funding system and the strategic projects intended for capacity building in the sector. It has largely stopped evaluating individual institutes and does not play a role in developing the strategy of individual institutes or groups of institutes. There is a slow process of restructuring in the sector, in which RCN plays little role. The institute sector is well regarded and continues to grow.

B.2.3   Goal 3: Research results are used by business, society and administration throughout the country

3.1 Good and appropriate communication of research to society and good learning arenas among companies, institutes and the higher education sector, the health sector and the administration. The primary channel for communicating research results is scientific publications but RCN also maintains a considerable communications activity both centrally and decentralised in the programmes. There are dedicated activities aimed at children of various ages. RCN's web site is a major communications channel, where the main audience is researchers. The small role of impact evaluation means RCN under-exploits opportunities to demonstrate the value of research and its own role.

3.2 Increased commercialisation of research results. RCN maintains indicators of actual and potential take-up of results from the research it funds. However, these say little about socio-economic impact. The FORNY evaluation suggests that activity's direct economic impacts have been modest but the growth of technology transfer companies associated with the research performing sector means it has probably contributed less directly to a growing commercialisation activity.

3.3 A strengthened knowledge base in RCN's research policy and advisory work. RCN plays an important role in assembling and publishing a rich body of strategic intelligence and advice to government about research and innovation policy. It has recently launched a research programme in the area, after a gap of some years. Evaluation is being strengthened but still needs further to be integrated into RCN processes.

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Appendix C List of background reports

The background reports for the evaluation are available at
http://www.regjeringen.no/dep/kd

1. Production of Strategic Intelligence and Advice

2. Organisation, Governance and Institutional Boundaries of the Research Council of Norway (Report plus appendix)

3. Ministry Steering of the Research Council of Norway

4. RCN's Management by Objectives System

5. Implementing and Adding Value to the National Priorities and Developing the National Research and Innovation System

6. Bibliometric Analysis of the Research Output of Norway in an International Context: Analysis of the Research Output of Norway and the Funding Effects of the Research Council of Norway

7. Users' experiences of and interaction with the Research Council of Norway: Results from surveys of researchers, research institution leaders and participants in RCN meeting places

8. Company Survey

9. Returns to R&D in Norway. The Role of Public Grants and Subsidies

10. Internationalisation