Tartu Ülikool
Filosoofiateaduskond
Filosoofia ja semiootika instituut

Teaduse kvaliteedi hindamine: filosoofiline vaatenurk

Magistritöö

Kairit Šor

Juhendaja dotsent Endla Lõhkivi, PhD
Kaasjuhendaja Ave Mets, PhD

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Sisukord

Sissejuhatus

Teadusel on inimeste elus järjest olulisem koht, me kasutame järjest keerukamaid tehnilisi vahendeid, mis on loodud tuginedes teaduslikule uurimistööle, meie mõtlemises on juurdunud teadlaste poolt pakutud arusaamad asjade ja protsesside olemusest, omadustest ja seostest. Teadusel on autoriteet ja me usaldame teadlasi, nende töö tulemusi. Teadusel on seega kohustus omalt poolt tagada uurimistöö kõrge kvaliteet. Kvaliteedikontrolliks on loodud hindamismehhanismid, mis rajanevad kokkulepitud kriteeriumitel. Teiselt poolt on teadus ja selle praktiseerimine muutunud aina kulukamaks, seadmed aina keerulisemaks ning uuringud ühelt poolt aina sügavamaks ja teiselt poolt aina laiahaardelisemaks. Teadus on kallis ettevõtmine. Teaduse rahastamine on enamjaolt projektipõhine, seda vähemalt Eestis (Eigi, Põiklik, Lõhkivi, & Velbaum, 2014), (Raudla, Karo, Valdmaa, & Kattel, 2015). Konkursid on aina pingelisemad ning teadlase elukutse ei olegi enam üksnes uurimuse läbiviimine, vaid ka rahastuse otsimine, meeskonna palkamine, meeskonna juhtimine, seega kokkuvõtteks pigem nagu tegevjuhiks olemine. Loomulikult ei pea kõik teadlased ja uurijad olema isiksuselt juhid ja tegelikult enamus teadlasi ei olegi juhtivteadlased vaid meeskonnaliikmed. Situatsioonis, kus teaduse tegemine on aina kallim ettevõtmine ja teadustööle rahastuse saamisega kaasneb aina suurem omavahel konkureerimine, on teaduse kvaliteedi hindamise juures saanud väga oluliseks hindamiskriteeriumites kokkuleppimine ja neist üheselt arusaamine. See hõlmab ka nende hindamiskriteeriumite tundmist, mis otseselt ei puudutagi teadustööd ennast, vaid hoopis juhtivteadlase võimekust tulevikus midagi murrangulist avastada või teadusasutuse võimekust tagada teadlasele vajalik füüsiline ja administratiivne infrastruktuur teadustöö läbiviimiseks. Kuna teadus muutub ajas, läheb oma uuringutega aina sügavamale ja sageli on selleks tarvis aina keerulisemaid ja kallimaid seadmeid, siis on väga oluline, et rahastuse saaks just see kõige motiveeritum, parima ettevalmistusega ja vajalike iseloomuomadustega teadlane, et teadus areneks ja ühiskonnal oleks võimalus teaduse tulemustest kasu saada. Seetõttu on paremate rahastusotsustuste langetamiseks oluline analüüsida hindamiskriteeriume ja nende võimalikke tagajärgi. Teisest küljest, kuna teaduse institutsioon on muutuv, on oluline analüüsida teaduse hindamise kriteeriume ka nö sisemiselt: kuidas teadlased ise teaduse hindamise kriteeriume enda ja teiste töödes tunnetavad.

Minu magistritöö eesmärk on välja selgitada, kas ja milles teadlaste ja rahastajate vaated teaduse kvaliteedile kattuvad ning kui ei kattu, siis kas see võiks olla probleem. Ja kui vaated kvaliteedile kattuvad, milles siis ikkagi on probleem, et nii üks kui teine osapool sageli ei ole otsuste või nende langetamise viisiga rahul?

Teadust on teadusfilosoofias uuritud mitmest vaatenurgast lähtuvalt. Teaduse mõistet on konstrueeritud, pidades silmas ideaali – mis peaks teadus olema ja kuidas see peaks funktsioneerima. Teadust on püütud ka kirjeldada ja nö tagantjärele konstrueerida selle struktuuri ja toimimise viise. Minu magistritöö teemast lähtuvalt on olulisimad teadusfilosoofid olnud Karl Raimund Popper, Thomas Samuel Kuhn, John Ziman ja Sergio Sismondo. Samuti ka sotsioloogid ja teised uurijad, nagu Loet Leydesdorff ja Sven Hemlin kui nimetada ainult mõnda. Nende kõigi töö on olnud väga oluline selleks, et mõista, mis on teadus, kuidas see toimib ja kuidas teadust nähakse ja vastu võetakse. Teadust on uuritud nii seesmiselt kui välispidiselt, uurides nii selle struktuuri ja käitumist kui ka teaduse kohta ühiskonnas ja teaduse rolli tavainimese igapäevaelus. Sealhulgas on teadust püütud allutada normidele ja reeglitele ning ka uuritud, millised on teaduse enda sisemised normid ja reeglid. Püüan oma magistritöös kokku viia teadusele väljastpoolt esitatavad nõuded ja teadlaste enda poolt teadusele esitatavad nõuded.

Milleks siis on tarvis taaskord arutleda teaduse kvaliteedi üle? Vastuse ilmselgus tuleneb uuritavast objektist endast: aja jooksul on teadus muutunud, on muutunud teaduse otstarve ja selle tegemise viisid.

Nõnda on muutunud ka kriteeriumid, mille järgi teaduse sisu ja kvaliteeti hinnatakse. Seni on uuritud, nagu ma ka eespool mainisin, teaduse kvaliteeti, ühest küljest, kas siis teadlaste arvamust sellest, milline peaks olema teaduse kvaliteet, või siis on, teisest küljest, püütud analüüsida ettekirjutatud kvaliteedinorme või muid ettekirjutusi.

Oma magistritöös rakendan võrdlevat meetodit, et kriitiliselt analüüsida teadlaste arusaamist teaduse kvaliteedist ja ühte võimalikku teaduse kvaliteedi hindamise normatiivi. Seetõttu ongi oluline, et seda teemat käsitleda nii otseselt, uurides juhtumiuuringuid, milles teadlased on avaldanud omi vaateid teaduse kvaliteedi hindamise üle, kui ka analüüsides väliseid ettekirjutatud norme. Mitmetes eelpoolnimetatud autorite töödes on käsitletud tegelikult mõlemat poolt, kuid siiski mitte otseselt norme ja kriteeriume kõrvutades vaid siiski välistele normidele sisemistest kriteeriumitest tuge ammutades ning vastupidi. Arvan, et minu magistritöö saab anda panuse teaduse kvaliteedi hindamisest arusaamisse, kuna kasutan eelpool mainitud kahe erineva teaduse kvaliteedi hindamise viisi võrdlemist.

Käesolevas magistritöös käsitlen ma 2007. aastal teaduses kehtivate sisemiste ja väliste normide näiteid. Võrdlen siseste normidena teadlaste endi arvamust hea teaduse kriteeriumitest väliste normidega. Selleks kasutan ma Rootsi sotsioloogi Sven Hemlini avaldatud uurimistulemusi. Hemlini uuringud on läbi viidud Rootsi teadlaste hulgas. Väliste normide näitena kasutan Euroopa Teadusnõukogu 2007. aasta tööprogrammi dokumendi teksti, millest leiab väga detailsed teadusprojekti rahastuse hindamiskriteeriumid.

Magistritöö jaguneb neljaks suuremaks peatükiks. Peatükis 2 annan ma ülevaate peamistest filosoofilistest vooludest, mis haakuvad käesoleva magistritööga ning on minu arutluskäigu aluseks. Peatükis 3 kirjeldan ma kahe võrdleva teksti sisu ja ülesehitust. Sealhulgas püüan ma ka selgitada mõlema teksti tausta. Peatükis 4 võrdlen mõlemat teaduse kvaliteedi tunnetamise poolt ning püüan neid ka kriitiliselt analüüsida. Mõlemast tekstist on selgesti võimalik välja lugeda hindamiskriteeriumid, seetõttu on neid ka hea kõrvutada. Peatükis 5 vaatlen ma Euroopa Teadusnõukogu 2007. aasta tööprogrammi dokumenti võrdluses hetkel kehtiva viimase, so. 2015. aasta tööprogrammiga. Sellest võrdlusest saab teha järeldusi teaduse väliste hindamiskriteeriumite arengu kohta.

2 Filosoofilised alused

Teaduse kvaliteeti on vajalik uurida just filosoofilisest vaatenurgast selleks, et mõista teaduse kvaliteedi tuuma, selle algupära. Kui me analüüsime teaduse kvaliteeti filosoofiliselt, saame aimu, millised on väärtused kvaliteedikriteeriumite taga ja millised väärtused ajendavad hindajat langetama teaduse kvaliteeti puudutavaid otsuseid. Filosoofiline meetod on teaduse kvaliteedi uurimiseks viljakas, kuna see pole lõplik ning, arvestades uuritava valdkonna muutlikkust, on just kasulik, et me ei saagi lõpuni määrata teaduse kvaliteedi kriteeriume, vaid seda tööd tuleb jätkata seni, kuni leidub teadusega tegelejaid.

Filosoofiat appi võttes püüan ma arutleda küsimuste üle nagu: mille alusel ja kuidas mõõdetakse teaduse kvaliteeti? Kellel on õigust ütelda, et just selliste hindamiskriteeriumite järgi tuleb hinnata (tehes nõnda normatiivseid ettekirjutusi) teaduse kvaliteeti ja millised väärtused nendele kriteeriumitele omistatakse? Selleks, et teadusest filosoofiliselt mõelda ja teaduse kvaliteedist filosoofiliselt aru saada, vaatlen mõnda peamist teadusfilosoofilist voolu. Nendeks vooludeks on: a) **teadus institutsionaalses käsitluses**, b) **empiristlik teaduskäsitlus**, c) **kriitiline ratsionalism teaduses** ja d) **naturaliseeritud teaduskäsitlus**. Mainitud filosoofilised voolud on olulised, et mõista teaduse käsitlust laiemalt ja aru saada juba tehtud tööst teadusfilosoofia vallas. Need ja ka mitmed teised käsitlused on kujundanud ühiskonna ja teadlaste endi ettekujutust teadusest ning samas läbi oma sisu ka määranud teaduse kvaliteedi tunnuseid. Iga vool määrab ära, kuidas ta teadust tunnetab, mis määrab tema jaoks teaduseks olemise tuuma.

2.1 Teadus institutsionaalses käsitluses

Teaduse kui institutsiooni käsitlus tähendab uurida teaduse efektiivset toimimist ja selle toimimise mõõtmist. Teaduse kui institutsiooni käsitluse näitena vaatlen Robert K Mertoni töid. Merton väidab, et “teaduse institutsiooniline eesmärk on tõendatud teadmiste ala laiendamine” (Merton, The sociology of science: theoretical and empirical investigations, 1973). Selleks, et institutsioon saaks tõendatud teadmiste (ja mitte mingit muud laadi teadmiste) ala laiendada, kehtivad sellele normid: universalism, kommunalism, erapooletus ja organiseeritud skeptitsism. Need normid on pigem moraalsed kui kognitiivsed. Merton omistab need normid teadlastele pigem kui käitumisjuhised. Ta eeldab, et vastavalt nendele normidele käitudes saavutatakse teaduse areng ning selle aina tõe poole pürgimine. Olenevalt sellest, kuivõrd teadlased nendest normidest kinni peavad, teadlasi kas kiidetakse selle eest või karistatakse.

Universalism on teadusliku väite hindamisel kasutatav kriteerium, mille puhul ei tohi teaduse kvaliteedi hindamine sõltuda väite esitaja isikust ega temale omistatavatest välistest tingimustest nagu rass, rahvus, usk, klass ja iseloomuomadused (Merton, The sociology of science: theoretical and empirical investigations, 1973). Nõnda on oluline vaadelda iga teadustulemust, lähtudes ainult teadustulemusest saadavast informatsioonist ja mitte arvesse võtta, kes on selle tulemuse saavutanud ja kuidas temasse suhtutakse või kuidas tema teistesse suhtub. Universalism teenib ühelt poolt objektiivse teadmise saavutamise püüet, teisalt käsitleb ta teadust mõneti steriilsena ja oma sotsiaalsest kontekstist väljakistuna.

Kommunalism tähendab seda, et teaduslik teadmine ehk teaduslik tulemus[1] (praegu siin tähendab see teadmist, avastust) on kõigi oma. Teadlane, kes on teadmise loonud, ei tohi omada ainuõigust seda kasutada ja teiste eest varjata, vaid teaduslik teadmine peab olema kõigile kättesaadav, et seda saaks kasutada teaduse edasiarendamiseks. Mertoni järgi sünnib iga uus teadmine eelnevate (sh ka kellegi teise loodud) teadmiste ja kogutud andmete põhjal. Nõnda toidab teadus teadust.

[1] Edaspidi tähendab teaduslik tulemus artiklit, raamatut, peatükki, patenti vms ja mitte enam ainult teadmist, mis on saadud teadusliku töö tulemusena.

*Erapooletus*ena käsitleb Merton (Merton, The sociology of science: theoretical and empirical investigations, 1973) väärikust, mille järgi peavad teadlased jätma kõrvale oma isiklikud huvid uurimistöö otsustustest ja tegevustest. Katsete tulemused tuleb fikseerida täielikult, sealjuures jättes kõrvale selle, millise teooria kasuks tulemused kõnelevad. Selline toimimine peaks välistama pettuse ja katsetulemuste fabritseerimise, selektiivsuse ja oma parema äranägemise järgi tõlgendamise, mingile teooriale allutamise jne. Samuti teenib erapooletuse nõue objektiivse teadmise saavutamise püüet ning samal ajal eeldab see teadlastelt avatust, et uutest tulemustest võib olla midagi ootamatut välja lugeda. Erapooletus on oluline kriteerium, et teadusele sünniks uut teadmist juurde ja et seda ei pärsiks tulemustest eeldatavate ootuste olemasolu.

Organiseeritud skeptitsism on teadlastele ühiselt omane käitumisviis mitte võtta omaks uusi ideid, kuni need pole kindlalt kehtestunud. Uusi ideid kritiseeritakse tugevalt ja avalikult. Samas eraviisiliselt (ehk üksikteadlaste tasandil) ei pruugita üldse võtta uute ideede suhtes mingit seisukohta. Organiseeritud skeptitsism teenib "tõendatud teadmiste ala laiendamise eesmärki" ja mitte iga uue mõttega pimesi kaasa jooksmist.

Institutsioonilised normid, nagu need neli eelnevat, toimivad teaduse vallas koos tunnustuse ja sanktsioonidega. Tunnustatakse neid, kes normidest kinni peavad ja vastavalt toimetavad ning sanktsioneeritakse neid, kes seda ei tee. Teaduse kvaliteedi hindamise seisukohast käituvad need normid väärtustena, või õigemini nende normide järgi käitumine eeldab teadlastelt hea teaduse väärtuste hindamist. Hea teadus on kvaliteetne oma sisult ja mitte selle poolest, kes selle teadustulemuse loonud on. Hea teadus on kõigi oma, see tähendab avalik ning seda võib avalikult nii kritiseerida kui edasises teadustöös kasutada. Hea teadus ei ole seega midagi varjatut ja salajas tehtut. Sellele peab osaks langema avalik kriitika ja diskussioon. Kvaliteetne teadmine on saavutatud erapooletuse kriteeriumit rakendades, see on järelduste tegemine, võttes arvesse kõiki katse- ja vaatlustulemusi, püüdes neid mitte allutada mõnele teooriale. Ja viimaks on hea teadus see, mis peab vastu avalikule kriitikale ja analüüsile. Seda, kas ja kuidas teadlased Mertoni eetilistest normidest kinni peavad või neid üldse väärtustavad, vaatlen ma peatükis 4.

Samuti on teaduse kui institutsiooni uurimine eelkõige teadmist tootvate institutsioonide produktiivsuse ja efektiivsuse uurimine ning mõlema mõõtmine. See tähendab hinnata teaduse kvaliteeti, võttes aluseks peamiselt arvulised andmed – kui mitu kõrgema või madalama taseme artiklit on toodetud konkreetses institutsioonis (ülikoolis, teadusinstituudis, eralaboris, arhiivides, raamatukogudes, muuseumites jne). Robert Merton (Merton, The Matthew effect in science, 1968) on näidanud, et mida rohkem üks institutsioon toodab suhteliselt head teadustööd, seda rohkem edu ta ka saavutab, eeldatavasti nõnda ka eraldatakse neile rohkem grante ja stipendiume: sellist nähtust kutsub Merton Matteuse efektiks (inglise keeles *the Matthew effect*, Mt 13:12). Lühidalt on Matteuse efekt sõnastatud nõnda: kus on, sinna tuleb juurde. Edukust on mõõdetud ja analüüsitud mitmete meta-distsipliinide poolt nagu kvantitatiivne historiograafia ja teadussotsioloogia, teaduspoliitika alused ja samuti ka uue ja hiljuti tekkinud distsipliini saientomeetria[2] poolt, mis kasutab bibliomeetrilist meetodit, uurides teadlaste kirjalike tööde mõjukust. Eesti kontekstis saab vastavad andmed välja võtta Eesti Teadusinfosüsteemist[3] (ETIS). Näiteks võib institutsioonipõhiselt võtta ETISest välja võrdlevad andmed Tartu Ülikooli (TÜ) ja Tallinna Tehnikaülikooli (TTÜ) kohta (vastavalt siis aastal 2007: TÜ publikatsioone 4 182 (28.04.2015) ja tööstusomandit 10, TTÜ publikatsioone 1 907 (28.04.2015) ja tööstusomandit 19). Omakorda võib need saadud tulemused peenemalt ära lahterdada publikatsioonide ja tööstusomandi klassifikatsioonide kaupa ning nõnda igale saadud arvule veel omakorda mõjukuse koefitsiendi määrata.

Harry Collinsi (Collins, 2007) järgi hinnatakse teaduse kvaliteeti samuti institutsiooni loodud teadmispõhiste tulemuste põhjal, seega

[2] Eesti keeles kasutatakse ka sõna *stsientomeetria*.
[3] https://www.etis.ee

mõõdetakse ja hinnatakse teaduse kvaliteeti institutsiooni avaldatud artiklite alusel. Collins leiab, et hetkel peame me häda sunnil võrdlema erinevat tüüpi teaduslikke töid justkui samade kriteeriumite alusel ja samas püüdma välja arendada mõisteid ja keele, mis seda võimaldavad. Collinsi järgi peame me hakkama saama mõistetega nagu revolutsiooniline teadus, madala riskiga teadus, erakordne teadus, teadus, mille eesmärgiks on säilitada või arendada sõnatute vaikivate teadmiste kogumit, teiste avastuste kordamine ja nii edasi. Selline sõnavara mõjutab ka teaduse kvaliteedi hindamist ja rahastusotsuste tegemist. Collins väidab veel, et hetkel saame me töötada ainult institutsioonilisel pinnal baseeruva teadussotsioloogia keelega ning sageli peame vastama küsimustele nagu: milline on ühe avaldatud artikli hind (sh raha, aeg, inimressurss, maine, koostöö jne)? Kui palju kõrge kvaliteediga teadustööd tehakse ühes või teises institutsioonis? Kui püüame defineerida hea teaduse tundemärke uutmoodi, siis on võimalik, et uus lähenemine või isegi uus "keel" lubaks meil küsida hoopis teisi küsimusi. Eelnevale lisaks, kas hea teadus on korrektsed ja selged meetodid ning uued tulemused või hoopis julgus nendelt baasteadmistelt edasi minnes proovida midagi tavatut? Tekib küsimus, kui palju rahalisi ressursse peaks kulutama kõrge riskiga uurimustöödele, teades, et 90% sellistest uurimustest pole edukad ega saa ka kunagi edukaks (Collins, 2007). Viimaste aastakümnete teadusotsioloogia tegeleb teaduse kui institutsiooni toimimise uurimisel muu hulgas ka soouuringute, teadustulemuste ja -saavutuste "ohutuse" ja "ohtlikkuse" uurimisega, teaduskommunikatsiooni, eetiliste dimensioonide ja veel muudegi teemadega (Longino H. , 2015).

2.2 Empiristlik teaduskäsitlus

Empirismi järgi saab teadlane oma tõese teadmise objekte vaadeldes. Piisav kogus erinevaid vaatluskogemusi viib teadlase teooria formuleerimisele ja nõnda tõdebki ta, et miski on üldiselt kuidagi kirjeldatav. Sellise käsitluse järgi ei sünni aga teadusele juurde uut käsitlust, küll aga lisandub hulgaliselt fakte ning teooria sõnastatakse tagantjärele paljude vaatlusotsustuste põhjal. Seda, et empiiriline ja induktiivne maailmakäsitlus on vigane ning viljatu, on juba teadusfilosoofias korduvalt põhjendatud, kuid empirismi ei ole täielikult kõrvale heidetud. Oma töös saan seda kasutada siiski, kuna vaatlus ja üldisemas plaanis andmete kogumine ja nendelt üldistamine on teadusetegemises väga oluline protseduur ja ilma selleta ei ole võimalik empiirilist teadust praktiseerida. Olulisem on siinkohal vast märkus, et teooria olemasolu enne vaatlusi ja katseid on viljakam, kuna võimaldab jõuda uute teadmisteni. Teooria on alati olemas enne katset või vaatlust. Teooria ei pruugi olla eelnevalt olemas mingi kindla sõnastuse kujul, vaid see saab olla ka üldisem (nagu nt eelteooria kujul) ja mitte veel nii täpne. Kui nüüd rakendada empiirilist meetodit ka teaduse kvaliteedi uurimisele, siis peame järeldama, et esimesed teoreetilised saientomeetrilised hindamismudelid olid selgelt empiristlikud, isegi naiivempiristlikud, sest teaduse tulemuslikkuse näitajaks peeti artiklite arvu, mis omakorda eeldati viitavat avastatud empiirilistele faktidele: mida enam empiirilisi leide, seda enam artikleid (Chubin & Restivo, 1983). Loomulikult ei ole selline empiiriline saientomeetriline teaduse kvaliteedi hindamine asjakohane ning selle kasutamine ei anna meile tegelikult teaduse sisu kvaliteedi kohta olulist ning sisulist informatsiooni. Tulles tagasi teaduses kasutatava empiirilise meetodi juurde, siis loomulikult ei ole võimalik teadust teha ega ka midagi uut avastada ilma empiiriliselt probleemile lähenemata. Tänapäeval on mõneti teise nurga alt empirismi arendanud nt Bas Van Fraassen väites, et teaduse ülesanne on luua teooriaid, mis on empiiriliselt adekvaatsed (van Fraasse, 1980). Helen Longino, samas leiab kontekstuaalse empirismi esindajana, et teadusliku teadmise aluseks on sotsiaalsest kogemusest tulenev väärtuste süsteem (Longino H. E., 1990). Nõnda on empiristlikul, tõendite kogumisel põhineval teaduse käsitlusel siiski teadusest rääkides oma kindel koht.

2.3 Kriitiline ratsionalism teaduses

Kui empirism väitis, et teoreetilisele teadmisele eelneb kogemuslik vaatlus, siis kriitiline ratsionalism väidab, et teaduslik teadmine peab olema formuleeritud nõnda, et seda oleks võimalik falsifitseerida ehk tema ümberlükkamiseks peab olema vastav katse korratav või muul moel kontrollitav. Kriitilise ratsionalismi üks peamisi esindajaid teadusfilosoofias oli Karl Raimund Popper. Popperi järgi ei saa tuletada empiirilistest andmetest midagi uut juhul, kui vastavale teadmisele või katsele pole eelnenud teoreetilist hüpoteesi. Kui rakendada sama põhimõtet, püüdes määratleda, mis on teadus, võime jõuda olukorda, kus falsifitseeritavuse printsiibi alusel on teadused ainult loodus- ja täppisteadused. Humanitaariat ning sotsiaaliat võiks siis nimetada uuringuteks, mis järgivad küll rangelt oma meetodeid ja olemata halvemad kui falsifitseeritavusel põhinevad teadused, kuid siiski sobiks nende täpsemaks määratluseks pigem uurimus kui teadus.

Falsifikatsiooni printsiibi järgi, mis ütleb, et hea teooria peab olema eelmisest täpsem ja falsifitseeritavam ning andma rohkem alust uuteks katseteks ja vaatlusteks, polegi mitte-labori teadused justkui teadused. Kriitiline ratsionalism eeldab, et julgetest oletustest tulenevad uudsed ennustused ning see ongi Popperi järgi teadust edasiviivaks jõuks. Uued hüpoteesid peavad andma olemasolevatesse teadmistesse uue panuse, juba olemasolevate taustteadmiste kinnitamine seda aga ei tee, juhul kui just olemasolevaid taustteadmisi kummutada ei suudeta ja sellega kõike hoopis sassi ei lööda.

2.4 Naturaliseeritud teaduskäsitlus

Naturaliseeritud teaduskäsitlus lähtub mitte *a priori* etteantud teadusmudelist, vaid teadusajaloo näidetest ning tänapäeva teaduse juhtumiuuringute materjalist. Nagu juba eespool mainisin, tehakse uurimistööd erinevates asutustes, näiteks ülikoolides, instituutides, eralaborites ja ka ettevõtetes, arhiivides, muuseumites, raamatukogudes ning kindlasti veel mujalgi. Igal sellisel asutusel on oma põhjus ja eesmärk, miks seal teaduslikku uurimistööd tehakse. Igal asutusel on oma põhjendatud eelarve uurimiseks ja arenduseks. Kuidas nendes asutustes otsustatakse, et mida uurida, mille peale oma ressursse kulutada? Kindlasti ei ole hetkel küsimus siin mitte selles, millist teadusvaldkonda viljeletakse, vaid justnimelt millistes suundades oma uurimustega minnakse ja kes on need inimesed, keda soovitakse näha konkreetset uurimust läbi viimas. Kuidas need asutused valivad neid inimesi ehk teadlasi? Millised peavad olema nende inimeste iseloomujooned, juhtimisoskused, varasem teadustegevus ja teadustulemuste arvukus ning kvaliteet? Milline on hea teadus ja milline on hea teadlane? Sellele käsitlusele on aluseks Thomas Samuel Kuhni tööd, kes on kirjeldanud teaduse arengut ja toimimise viise normaalteaduse ja teadusrevolutsioonide mõistete abil (Kuhn T. S., 1970).

Kuhni käsitus teadusest põhineb teaduse enda vaatlemisel ja selle järgi teaduse kirjeldamisel ning võimalike mudelite konstrueerimisel. Kuhni järgi on teaduse põhiolemus normaalteadus, mille tavapärast kulgemist katkestavad revolutsioonid. Normaalteadus on see, kui teadusala liikmed peavad mingeid ühiseid teooriaid tõesteks, hindavad varasemaid teadussaavutusi, arvavad samamoodi vastava teadusala probleemide olulisusest ja leiavad sarnaselt, et mingid meetodid on nende probleemide lahendamise jaoks olulised. See kokku moodustab paradigma. Paradigma loomise protsessi käigus teadus areneb paremini just struktureerides ja korrastades ning tasapisi ennast arendades. Paradigma tähendabki seda, et mingi teadusala varasemad saavutused on eeskujuks teadlastele, kuidas järgmisi probleeme leida ja neid ka lahendada. Normaalteadus on periood, mil uurimistöö on hästi struktureeritud. Kriis saabub siis, kui normaalteadusesse on kuhjunud liialt palju probleeme, mille lahendamiseks ei piisa enam olemasolevatest teadmistest, meetoditest ja arusaamisest. Sellisel juhul hakkab tekkima teadusala revolutsioon, mille puhul varasemad paradigma põhialustalad enam ei kehti ning uus paradigma ei ole veel kindlalt ennast kehtestanud. Samuti esineb sellisel juhul ka asjaolu, et varasema paradigma ja uue tekkiva paradigma teadlased ei mõista sageli teineteist, sest meetodeid, andmeid ja hüpoteese mõistetakse erinevalt. Sergio Sismondo tõlgenduses (Sismondo, 2008) võib rääkida progressist pigem normaalteaduse perioodil kui revolutsiooni perioodil. Normaalteaduses lahendatakse probleeme kumulatiivselt ja täpsustatakse teadmisi ning samal ajal on teadlastel lihtne tunnustada üksteise saavutusi. Seda vastupidiselt revolutsiooni perioodile, mis ühtaegu ehitab ja lammutab. Nõnda jätab kõrvale teadusrevolutsioon kehtinud teooriaid ning hakkab tegelema uutega, luues uusi ja veel mitte täielikult kehtivaid teooriaid. Siinkohal tulebki sisse Kuhni ühismõõdutuse probleem, mis väidab, et varasema paradigma ja uuema paradigma teadlased ei mõista teineteist, sest terminid vahetavad eri paradigmades tähendust ja inimesed erinevates paradigmades näevad maailma erinevalt.

Kuidas hinnatakse teaduse kvaliteeti normaalteaduse sees? Kuna normaalteadus paneb paika nii selle, kuidas teadust tehakse kui ka selle, mida hea ja kehva teaduse all mõistetakse, siis on teaduse kvaliteedi hindamine normaalteaduses lihtsustatult empiristlik tulemuste loendamine. Kuhni ei saa siin kuigi hõlpsasti tuua abiks teadustulemuste hindamise puhul, kui hinnata tuleb ka innovaatilisust, paradigma muutust, mis sageli on teaduspoliitika eesmärkideks. Nendest teaduspoliitika eesmärkidest on juttu peatükis 3.1.5.

Naturaliseeritud teadusekäsitus sobib väga hästi teaduse kvaliteedi hindamiseks ainult sisemiste ja mitte väliste kriteeriumite järgi sest ainult teadlaste endi seatud eesmärkide saavutamiseks valitud viisi adekvaatsuse järgi saame otsustada, kas teadlased on ratsionaalsed, kui nad valivad oma eesmärgi saavutamiseks kohaseima tegutsemisviisi. Naturaliseeritud käsitus tähendab, et filosoofia on ise üks osa teadusest, teatav meta-tasandi analüüs. Seetõttu on kasulik käesoleva magistritöö puhul kasutada teadlaste endi väärtusi ja neid kõrvutada etteantud normidega hea teaduse määratlemise juures.

Järgnevates peatükkides püüan rakendada uurivalt, kuivõrd on võimalik teadlaste ja normatiivsete teaduse hindamise kriteeriumite väärtusi analüüsida, võttes abiks eelpool mainitud nelja filosoofilist voolu. Need voolud moodustavad terviku, uurides teadust läbi tema institutsiooni, kuidas saadakse teaduslik teadmine, millist teadmist võime käsitleda teadusliku teadmisena ning milline võiks olla teaduse protsess ja progress. Selle mõistmiseks ja teaduse kvaliteedi hindamise väärtustest aru saamiseks on tarvilik olla tuttav vastavate teadusfilosoofiliste käsitlustega.

3 Alustekstidest

Oma töös võrdlen ma kahte konkreetset näidet teaduse kvaliteedi hindamisest. Ühel neist on aluseks teadlaste endi arvamus sellest, mida nad ise tunnistavad teaduse kvaliteedi hindamise kriteeriumiteks. Selle lähenemise aluseks olen võtnud Rootsi sotsioloogi Sven Hemlini uurimused, mis ta on kokku koondanud üheks peatükiks raamatus *The socio-cognitive characteristics of natural and social sciences. A sociological view*[4] (21.11.2007)[5]. Mul on erakordne võimalus kasutada selle peatüki mustandit inglise keeles, teos ise ilmus aastal 2008 Zagrebis horvaadi keeles.

Teiseks ja ehk ka mõnes mõttes eelnevale vastandlikuks tekstiks olen valinud Euroopa Teadusnõukogu (edaspidi ERC) tööprogrammi[6] [7] aastast 2007 (European Research Council, 2007), et mõlema teksti ajastused kattuksid. ERC dokument väljendab siinkohal hindamiskriteeriume, mis on paika pandud ühe Euroopa kõige mainekama teadusgrandi (ERC Starting grant) taotlemise jaoks. ERC dokumenti võib nimetada normatiivseks. Sellest peaksid teadlased juhinduma oma granditaotluste koostamisel, et saavutada hindamisel head tulemused.

Kahe mainitud teksti uurimine on mõistlik kuna neil on mõningane ajaline kokkupuude. Hemlini uurimused on küll läbi viidud varasemalt, on ta neid analüüsinud ja üldistanud alles 2007, seetõttu on see uurimus ka ajaliselt sobilik võrdluses ERC 2007. aasta tööprogrammiga. Samuti on oluline, et tekiks arutlus kahe vaatepunkti väärtustest ja ootustest. Viimaste analüüs aitab meil paremini mõista tehtavaid hindamisotsuseid ning vajadusel neid ka uuendada.

Väikese kõrvalepõikena annan ka lühikese ülevaate viimasest so 2015. aasta ERC tööprogrammist (European Research Council, 2015), et saada

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[4] http://www.gu.se/english/research/publication?publicationId=62811
[5] Peatüki kogutekst on ka ära toodud magistritöö Lisana 1.
[6] Selle teksti soovitamise eest olen tänu võlgu Madis Saluveerile, kes aastal 2007 töötas SA-s Archimedes (praegu kuulub see osakond Eesti Teadusagentuuri koosseisu).
[7] Samuti on ka ERC dokumendi tekst magistritöö Lisana 2 tervikuna ära toodud.

põgus mulje sellest, kuidas teaduse hindamine ja selle kriteeriumid on viimase 7 aasta jooksul muutunud ERC silmis[8].

3.1 Teaduse kvaliteet teadlaste silmade läbi

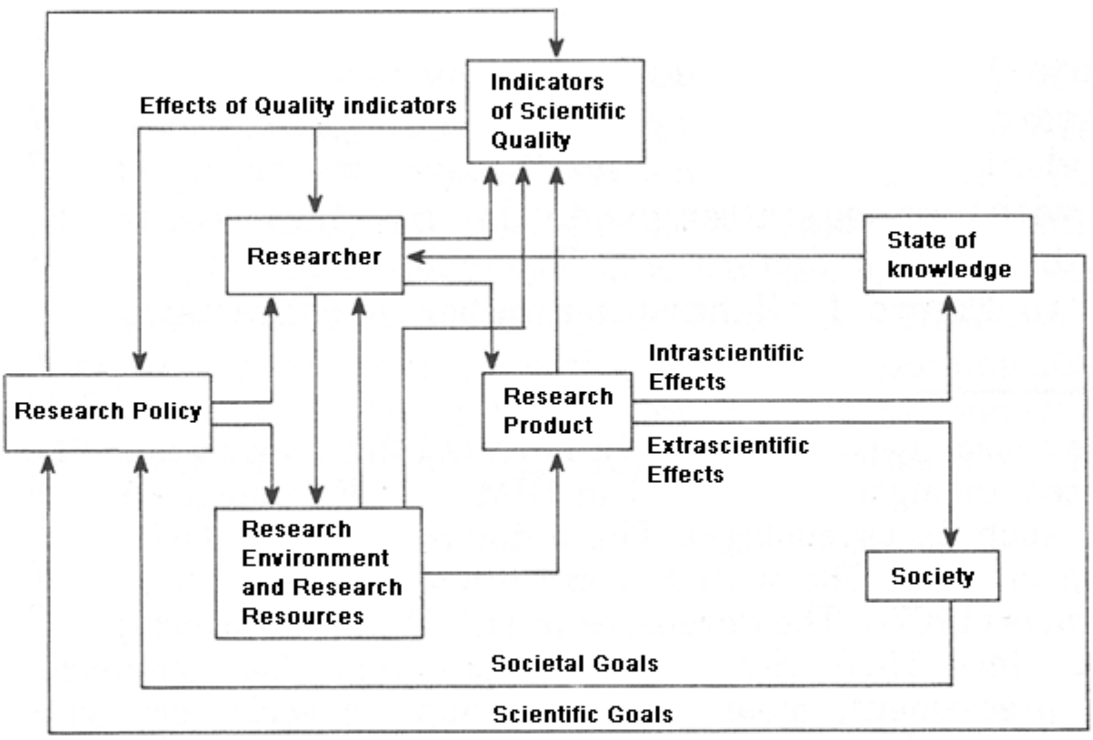
Hemlini uurimus on kokku pandud mitme varasema tema ja Henry Montgomery[9] ühistest uurimustest teaduse kvaliteedi hindamise kohta teadlaste silmade läbi. Hemlini erineva meetodiga uuringud on läbiviidud aastatel 1990 ja 1993. Näiteks 1990. aasta uurimus (Hemlin & Montgomery, Scientist's conceptions of scientific quality, 1990) koostöös Montgomeryga oli intervjuu-uurimus, Hemlini 1993 (Hemlin S. , Scientific quality in the eyes of the scientist. A questionnaire study, 1993) aasta uurimus aga ühes osas vabade vastustega küsitlus ja teises osas hindamisskaalal kriteeriumite hindamine. Teine (Hemlin & Montgomery, Peer judgements of scientific quality. A cross-disciplinary document analysis of professorship candidates, 1993) sama aasta uurimus, taaskord Montgomeryga, viidi läbi avalike *peer review*'de tekstide põhjal. Kõigi kolme uurimuse tulemused koondas Hemlin kokkuvõtvasse tabelisse (Hemlin S. , What is scientific quality?, 2007, lk 15-16), võrdluses millega analüüsin ma ka ERC tööprogrammi hindamiskriteeriume.

Hemlini raamatupeatükk koosneb kolmest osast. Kõigepealt annab ta ülevaate teaduse kvaliteedi teoreetilisest raamistikust. Teises osas esitleb ta oma kolme uurimuse tulemusi ja analüüsi ning kolmandas osas kirjeldab ta üldjoontes toimuvaid muudatusi ja vaateid teaduse kvaliteedi praktikale ja teaduse kvaliteedi hindamisele. Viimaks teeb ta ka mõned kokkuvõtted ja soovitused teaduse kvaliteedi hindamiseks ja sellest mõtlemiseks.

Esmalt kirjeldab Hemlin kuut faktorit, mis on tema uurimuse esimeses osas arutluse all, nendeks on: teadustulemus (product), teadlane (the researcher), teaduskeskkond (the research environment), teaduse

[8] Ka 2015. aasta ERC tööprogrammi tervikteskt on Lisana 3 täismahus ära toodud.
[9] Henry Montgomery – Stockholmi Ülikooli professor, kes uurib inimeste väärtussüsteeme ja vaimseid protsesse ning nende rakendamist majanduses, meditsiinis, organisatsioonis ja poliitikas. http://w3.psychology.su.se/staff/hmy/indexeng.html

asjakohasus (research effects), teaduse finantseerimine, organisatsioon ja poliitika (research financing, organization and policy) ja viimasena teaduse hindamine (research evaluations). Kõiki kuut kirjeldab ta omavahelistes suhetes ning võtab alapeatüki kokku katsega püüda defineerida teaduse kvaliteeti. Selleks, et illustreerida kuue faktori omavahelisi suhteid, on Hemlin nad kokku võtnud joonisele 1. Selle joonise järgi võime eeldada, et Hemlin käsitleb teadust institutsionaalses tähenduses. Toon selle joonise ka täismahus ära.



Joonis 1 – Teaduse kvaliteedi hindamise konteksti faktorid (Hemlin 2007)

Lühidalt kokku võttes kirjeldab Hemlin seda tabelit kui võrgustikku, mille kõik osalised mõjutavad otseselt või kaudselt üksteist ning mida võtavad suuremal või vähemal määral arvesse need, kes teaduse kvaliteedi hindamist läbi viivad. Hemlini joonise 1 järgi ei ole teadus mitte ainult see, mida teadusliku tööna sisuliselt tehakse, vaid teadus on sotsiaalne ning institutsionaalselt keeruline süsteem, milles toimijatena figureerivad faktorid on olulised, kuna mõjutavad teineteist nii otseselt kui kaudselt. Selle süsteemi keskmes ei ole mitte teadustöö ja selle tulemus vaid hoopis teadlane. Seetõttu võime järeldada, et teadus ei ole

Hemlini järgi mitte ainult empiirilised või muud laadi uurimuste teaduslik läbiviimine vaid kõik faktorid on selles olulised, sest vastavalt nendele faktoritele kujunevad teadlasel välja väärtused, millest lähtuvalt ta teeb otsuse, milline on hea teadus ja milline on halb teadus. Väärtustest lähtuvalt peab teadlane langetama ratsionaalseid otsuseid ning samuti väärtustest lähtuvalt kehtivad teaduses ka eetilised normid, millest eeldatakse kinnipidamist. Nüüd nendest faktoritest veidi lähemalt.

3.1.1 Teadustöö tulemus

Teaduse kvaliteedi hindamise objektiks on Hemlini järgi teadustöö tulemus ehk lõpp-tulemus, produkt. Selleks võib olla nii kogu antud teadusvaldkonnas ajaloo jooksul saavutatu või ka üksik teadusartikkel. Mõned relevantsed teadustöö tulemuse omadused võiksid olla, pakub Hemlin, (a) laius, (b) sügavus, (c) probleemipüstituse selgus, (d) metodoloogiliste nõudmiste täitmine jne. Siin võib tuua mõned võrdlused Kuhni (Kuhn T. S., 1977) normatiivsete kriteeriumitega, milleks on (i) täpsus (accuracy), (ii) terviklikkus (consistency), (iii) ulatus (scope), (iiii) lihtsus (simplicity) ja (iiiii) viljakus (fruitfulness). Kattuvateks võiks lugeda (a) laiuse ja (iii) ulatuse; (b) sügavuse ja (ii) terviklikkuse, (d) metodoloogiliste nõuete täitmise (i) täpsusega ning (c) probleemi püstituse selguse ja (iiii) lihtsuse. Mõneti üksikuks jääb siin Kuhni (iiiii) paradigma või teooria viljakus. Viljakuse all mõtleb Kuhn teooria omadust jõuda uute teaduslike leidudeni (Kuhn T. S., 1977). Teaduslikud tulemused on otseses sõltuvuses teooriast, seejuures on oluline, et teooria oleks viljakas või viljakust võimaldav. Viimane kommentaar käib ehk uudse teooria kohta, mille puhul ei ole veel täpselt teada, kuidas see teooria töötab, kas sellega saabki üldse mingite tulemusteni jõuda. Uudsus võib osaliselt viidata avatusele võimalikele uutele tulemustele ja on seega juba eos viljakas.

Hemlin	Kuhn
(a) laius, (b) sügavus,	(i) täpsus, (ii) terviklikkus,

(c) probleemipüstituse selgus, (d) metodoloogiliste nõudmiste täitmine	(iii) ulatus, (iiii) lihtsus ja (iiiii) viljakus

Tabel 1 Hemlini (2007) teadustulemuse omadused ja Kuhni (1977) teooria omadused.

Kuhni nõuded teooriale sobivad Hemlini nõudmistega hea teadustulemuse saavutamiseks. Hemlin ütleb, et need omadused teevad teadustulemusest hea teadustulemuse. Viimane Hemlini hea teadustulemuse kriteerium sisaldab endas head metodoloogiat, mille sisu määrab ära Kuhn. Veidi avades Kuhni teooriale esitatavaid kriteeriume, selgub, et (i) täpsus (accuracy) tähendab seda, et saadud tulemused peavad olema tehtud katse tulemused ja mitte midagi muud. Teiseks, (ii) terviklikkus (consistency) ei tähenda mitte üksnes teooria terviklikkust ainult temas eneses, vaid ka terviklikkust teiste teooriate seisukohalt, mis võiksid haakuda vastavate tulemustega. Kolmandaks, (iii) ulatus (scope) tähendab seda, et teooria peab olema laiapõhjalisem, et ta selgitaks vaatlusi, seadusi või alamteooriaid laiemalt, kui ta algselt oli disainitud seda tegema. Neljandaks, (iiii) lihtsuse (simplicity) olulisus, kui teooria on keeruline, siis on see ka segane ja ei pruugi olla ei tõene, ega ka terviklik. Viimaseks ja viiendaks hea teooria kriteeriumiks on (iiiii) viljakus. Viljakas teooria peab andma meile uusi tulemusi ja uusi seoseid varasemate tulemuste vahel.

3.1.2 Teadlane/uurija

Teadustööd viivad läbi teadlased ja uurijad. Teadlane on eelkõige inimene, oma tunnete, kultuurilise tausta ja muude sh isiksuse omadustega. Teadlast peetakse küll “ratsionaalseks inimeseks” (Mahoney, 1979), kes justkui peaks langetama otsuseid ainult objektiivsetest ja mitte emotsionaalsetest põhjustest lähtuvalt, olema ratsionaalne, avatud meelega, ülimalt intelligentne, terviklik andmete kajastuses ja kokkuvõtetes ning viimaks kogukondlik (communality) see tähendab avatud ja koostööaldis teadmiste jagamiseks. Kuid nagu Mahoney oma ülevaatlikus artiklis arutleb, ei ole teadlane siiski minetanud oma inimlikke iseloomuomadusi. Hemlin (2007) annab põhjaliku ülevaate teadlase isiksuse ja teadlase kui isiksuse uurijate kohta ning järeldavalt rõhutab, et meil on siiski puudu teadmisest, kui otseselt või kaudselt need isiksuse omadused (sealhulgas ka vanus ja ka isiksuse välised mõjutajad) teadlase otsustusprotsessi mõjutavad. Vastavaid empiirilisi uurimusi on ka väga keeruline läbi viia, võimalik, et seetõttu napibki meil vastavaid tõendeid. Loetlen siin omadused, mis on mainitud Hemlini tekstis. Need on mõneti vastandlikud, kuid hea teadlane peaks olema ambitsioonikas, impulsiivne, püsiv, kindlust otsiv, intelligentne, intellektuaalselt uudishimulik, domineeriv, distsiplineeritud, autoritaarne, abi ja nõuandeid mitte otsiv, mitte lõbutsev, agressiivne, juhtimisomadustega, iseseisev, kaitsev, mitte vagur, kannatamatu, motiveeritud ja mitte-toetav. Seda, kas need isiksuseomadused ka hea teadlase juures paika peavad ei ole võimalik tekstist välja lugeda. Seda tuleks kindlasti uurida eraldi ja põhjalikult. Vastavaid teemasid on uurinud Sergio Sismondo (Sismondo, 2008) ja ka mitmed teised sotsioloogid, psühholoogid, filosoofid.

Makrotasandil on joonise järgi teadlast mõjutavateks teguriteks teadusesiseselt teaduse tase (ehk teaduse hetkeseis, millelt teadlane hakkab uut teadmist looma) ning teaduse hindamise kriteeriumid, teadusväliselt on mõjutajateks teaduspoliitika (nt riiklikud prioriteetsed valdkonnad), mis on tihedalt seotud teadustöö materiaalse keskkonna ja rahastusega. Nõnda ei ole teadlane tegelikult kunagi oma otsustustes vaba, vaid sageli laveerib mõjutegurite vahel, et tagada rahastus uuringute läbiviimiseks ning panustada teaduse arengusse.

3.1.3 Teadustöö keskkond

Hemlin peab teaduse praktiseerimise juures teadustöö keskkonda äärmiselt oluliseks. Teadustöö keskkonna all ei mõtle Hemlin mitte ainult füüsilist keskkonda (majanduslikud võimalused, tehniline varustus, juurdepääs publikatsioonidele jne) vaid ka teadustöö sotsiaalset keskkonda (nagu teadusgrupi suurus, grupi liikmete vanus ja varasem taust, üldised grupiliikmete omavahelised suhted jne). Mõlemad keskkonnad omavad mõju nii teadlase motivatsioonile kui ka teadustöö tulemuse kvaliteedile. Teadustöö keskkond on tihedalt sõltuv ja otseselt mõjutatav teadlase enda isiku läbi ning muutuv kaasuvate sotsiaalsete suhete kaudu. Seeläbi on teadlane mitte eraldiseisev teadusest endast, vaid moodustabki osa teadusest kui institutsioonist.

Teadustöö keskkonda mõjutab vastavalt joonisele 1 ühelt poolt teaduspoliitika ja teisalt teadlane ise. Teaduspoliitikal on siin otsene roll läbi rahastuse mõjutada füüsilist keskkonda. Teadlase mõju tema lähemale teaduskeskkonnale on aga kahetine, ühelt poolt rahastuse hankimise läbi ning teisalt "heanaaberlike suhete" hoidmine grupiliikmetega ehk siis sotsiaalne keskkond.

3.1.4 Teadusesisesed ja -välised mõjud

Kõik teod ja nende tegude sage toime panemine avaldavad mõju nii toimija arengule kui ka teda ümbritsevale keskkonnale. Teadustegevuse mõjusid vaadeldakse peamiselt kahest küljest: teadusesisestest ja -välistest mõjudest lähtuvalt. Teadusesisesed mõjud on mõjud, mida avaldab teadusetegevus teaduse enda arengule, need mõjud võivad olla näiteks teooriate ja meetodite arendamine, kuid ma leian, et teadusesisesteks mõjudeks on ka vaatlusandmete kogud, sh igasugused uurimistulemused ja nende kogud, mille alusel on võimalik teostada analüüse ja uurimusi. Teadusesiseste mõjude hulka võib veel lugeda ka uute ja täpsemate mõõteriistade arengut, ehkki see haakub ka teadusväliste mõjudega, mida ma käsitlen allpool. Seega on teadusel ja tehnoloogial alati tugev seos teineteise arengus.

Teadusevälised mõjud on teadustulemuste mõju ühiskonnale kõige laiemas mõistes, näiteks uued tehnoloogiad või uued ravimid, aga ka lihtsalt parem arusaamine maailmast. Need välised mõjud võivad olla samal ajal, olenevalt kelle vaatenurgast vaadata, nii head kui halvad. Head teadusevälised mõjud on täpsema aparatuuri väljatöötamine, sotsiaalsete probleemide lahendamine jne. Halbadeks teadusevälisteks mõjudeks on massihävitusrelvad või keskkonnakahjulikud tehnoloogiad jms.

Hemlini joonise 1 järgi on teaduse sisesed ja välised mõjud teadustulemusest lähtudes ühesuunalised, panustades nii teadusesse endasse kui ka ühiskonda. Neid mõjusid mõjutavad omakorda üksteise kaudu kõik teised joonisel kujutatud faktorid. Teaduse mõjud osutuvad üheks peamiseks aluseks teaduse kvaliteedi hindamisel, lähtudes teadustulemusest ja selle panusest nii teaduse kui ka ühiskonna arengusse. Aina rohkem mängivadki teaduse välised mõjud rolli teaduse õigustamises ühiskonnas. Teadus peab oma olemasolu nö välja teenima ühiskonna silmis, et sellele jagataks rahastust ka edaspidi.

Erinevatest lähtepunktidest vaadatuna peetakse olulisemaks kas teadusesisest või -välist mõju. Näiteks märgib Hemlin, et vastavalt marksismile ja pragmatismile on teaduse kõige olulisem eesmärk ühiskonnale kasulik olemine. Teisalt jälle näevad Hemlini sõnul teadusfilosoofid (ta viitab McMullini ja Niiniluoto töödele) teaduse peamise panusena iseenda arendamist.

3.1.5 Teaduse finantseerimine, organisatsioon ja poliitika

Teadust tehakse tavaliselt mingisuguses institutsioonis, mingisuguse eelarvega ning mingisuguseid üldisemaid või ka kitsamaid suundi järgides. Seda kolmikut lahti harutades järeldub, et kõik nad on olulised faktorid teaduse kvaliteedi hindamises. Teaduspoliitika sõltub oma suundades ühiskonna arusaamisest teadusest, samuti teaduse arengutase mõjutab teaduspoliitika suundi, kolmandaks on teaduse hindamise traditsioonil või viisil ka oluline vastastikune mõju teaduspoliitikale. Teaduspoliitika omakorda, olles eelpoolloetletud faktoritest mõjutatud, saab ise määrata rahastuse reeglid ja suunad, mõjutades sellega nii teadlast (ja üldse kogu teadlaste kogukonda, olenemata teadusvaldkonnast) ja väga otseselt ka teaduskeskkonna ressursse. Ressursside all pean silmas nii rahalisi kui ka inimressursse.

Hemlin leiab, et kriteeriumid, mille alusel teaduspoliitikat suunatakse peaksid olema samad, mille alusel ka teaduse kvaliteeti hinnatakse. Sellest järeldub, et vastavalt teaduse arengule ja muutustele muutub ka teaduspoliitika (selle läbi, kuidas teadusest aru saadakse ja seda mõistetakse), nõnda muutub ka teaduse kvaliteedi hindamine ajas. Seni tehtud teadustöö mõjutab hetkel kehtivat teaduspoliitikat ja teaduse hindamise kriteeriume hetkel tehtava teadustöö suhtes. Kas võime sellest järeldada, et teaduse kvaliteedi hindamine on alati sammukese teaduse enda sisulisest ja sotsiaalsest tasemest maas? Otsused kasutada teatud kriteeriume tehakse ju mineviku andmete põhjal, uuendades varasemaid kriteeriume vastavalt teaduse hetke arengutasemele ja teaduse institutsiooni tunnetamisele ühiskonnas.

Hemlin väidab, et empiirilisi andmeid teaduse kvaliteedi, organisatsiooni ja teaduspoliitika omavahelistes suhete kohta napib, õigemini pole vastavaid uuringuid veel piisavalt läbi viidud. Vastavasisulised debatid esinevad aga peaaegu igas ühiskonnas igapäevaselt. Seoses teaduse rahastusega on mitmeid arutelusid, kuidas teaduse rahastust reguleerida ja millistest vahenditest seda teha. Teadust saab ja rahastataksegi ühelt poolt nö baasfinantseerimise läbi, teisalt sihtfinantseerimise läbi. Kolmandana (ja neid variante on veelgi) rahastatakse teadust ka erasektori kaudu. Kuivõrd eetiline või korruptsioonivaba on aga teaduse rahastamine suurte ettevõtete kaudu (nt meditsiiniuuringute rahastamine biotehnoloogia ettevõtete poolt), seda ma oma magistritöös ei käsitle.

3.1.6 Teaduse hindamine

Viimase faktorina käsitleb Hemlin teaduse hindamist. Ta väidab, et teaduse hindamist mõjutavad teadustulemuse välised faktorid. Ühelt poolt teadlase isikuga seotud mõjud nagu positsioon, vanus või isiksus. Teiselt poolt võivad oluliseks kujuneda ka keskkonnast sõltuvad faktorid, näiteks allasutus, milles teadlane töötab. Hemlin väidab, ja nagu ka jooniselt 1 lähtub, on teaduse kvaliteeti keeruline defineerida ja seda mõjutavad väga mitmed faktorid.

Hemlin väidab, et olenevalt, mida soovitakse teaduse puhul hinnata, sellest sõltub ka teaduse kvaliteedi definitsioon. Kui hinnatakse teaduse sisu ja selle tulemusi, siis on olulised nö sisemised kriteeriumid nagu rangus ja originaalsus. Need kriteeriumid rakenduvad hindamisel just kasutatud meetodi ja probleemi kohta. Teisalt, kui on vajalik teaduse kvaliteedi hindamine teaduse vajalikkuse seisukohalt, siis rakenduvad veidi teistsugused kriteeriumid nagu nt teadusväline asjakohasus. Viimase puhul on oluline teaduse panus ühiskonna heaolu silmas pidades.

Kolmandana järeldab Hemlin, et teaduse tulemustel võivad olla ka mõjud, mida me ehk veel ei tea ega oska ette näha. Sellisel juhul ei ole üldse kindel, milliste kriteeriumite järgi teaduse kvaliteeti hinnata. Hemlin ütleb, et vastavaid näiteid on ajaloos mitmeid ning üks nendest kõige masendavamatest on aatomifüüsika valdkonna arengu tulemusena loodud aatompomm. Sellisel juhul oleme me suurtes raskustes, kuidas määrata teaduse kvaliteedi hindamise kriteeriume üldiselt. Oletan, et hinnates teaduse kvaliteeti, tuleb alati silmas pidada, mille jaoks me seda teeme. Kui küsimuse all on teadusgrandi määramine mingis kitsamas valdkonnas, siis on ilmselgelt otsetarbekohane lähtuda teaduse sisestest kriteeriumitest. Kuid olenevalt grante väljaandvate organisatsioonide iseloomust on ka see erinev.

Leian, et teaduse kvaliteeti on keeruline määrata erinevate teadusvaldkondade vahel. Nagu teadusvaldkonnad ei ole ühesugused, nõnda ei saa ka neid samade kriteeriumite abil hinnata. Teadusvaldkondade erinevused tingivad ka teadusvaldkondade erineva vastuvõtu ühiskonnas. Eriti veel olukorras, kus faktorid, mis mõjutavad teaduse kvaliteedi hindamise kriteeriume, protsessi ja ajalist mõõdet, on ise ajas muutuvad, kuna muutub ju ka teadusvaldkond, mida hinnata soovitakse. Viimaks ei tohiks arvata, et pole üldse mõtet teaduse kvaliteedi hinnata, vaid just teaduste ja teaduste kvaliteedi hindamise variatiivsus teebki teaduse üldiselt viljakaks ning kasulikuks ühiskonnale.

Eelpool kirjeldatud ja arutatud faktorite põhjal koondab Hemlin oma uurimuste tulemused üheks kokkuvõtvaks tabeliks (Hemlin S. , What is scientific quality?, 2007) ning analüüsib saadud tulemusi kriitiliselt. Hemlini uurimustes küsiti erinevatelt Rootsi teadlastelt (läbi kõigi teadusvaldkondade), mida nad ise peavad kõige olulisemateks hea teaduse karakteristikuteks. See uurimus viidi läbi intervjuudena 22 teadlase hulgas. Saadud algteadmistega koostati juba suurem küsitlusankeet, kus paluti teadlastel (n=224) hinnata eelmisest uurimusest väljatulnud aspekte ja atribuute numbrilisel skaalal. See uurimus, tunnistab Hemlin, annab küll ülevaate sellest, kuidas teadlased tunnetavad teaduse kvaliteeti, kuid ei pruugi anda tõest pilti sellest, kuidas teadlased käituvad, kui peavad ise teaduse kvaliteeti hindama. Selleks, et saada ka viimasest ülevaade, uurisid Hemlin ja Montgomery 31 juhtumit aastatel 1975-1984, kus hinnati *peer review*'sid professori ametikohale kandideerimiseks. See oli võimalik, kuna Rootsis on sellised dokumendid avalikult kättesaadavad. Lisaks analüüsisid Hemlin ja Montgomery Rootsi Teadusnõukogule esitatud granditaotluste *peer review*'sid psühholoogia valdkonnas. Hemlin mainib, et sarnaseid uurimusi on läbi viidud ka Taanis, Norras ja Soomes, ning kõikide riikide tulemused olid sarnased ning võrreldavad. Kõigi uurimuste üleselt, nii Hemlini kui ka teiste riikide puhul, oli selgesti ära tuntav, et teadlastel on ühine keel teaduse hindamiseks ning kõige tugevamini rõhutati teaduse kvaliteedi kriteeriumina just korrektset meetodit. Hemlini töö täpsemat arutlust jätkan peatükis 4.

3.2 Rahastaja kriteeriumid teaduse kvaliteedile

Aastal 2007, kui ERC oli äsja asutatud, anti välja esialgu ainult ühte tüüpi granti: ERC alustava iseseisva teadlase granti (The ERC Starting Independent Research Grants). Hiljem lisandus ERC edasijõudnud uurija grant (The ERC Advanced Investigator Grants) ja järgmistel aastatel veel mõned erinevad grandid.

ERC kirjeldab oma missiooni statuudis, et tema missioon on julgustada kõrgeima kvaliteediga teadustööd Euroopas läbi konkurentsivõimelise rahastuse, toetades uurijapõhist eesliiniteadust üle kõigi teadusvaldkondade teadusliku oivalisuse alusel (ERC-mission, 2015).

ERC annab oma tööprogrammis aastal 2007 väga selgelt ja üheselt mõista, et hindamise aluseks on ainult teaduslik oivalisus[10] (excellence), mida ERC hindab mitmete kriteeriumite alusel. Need kriteeriumid omakorda peavad kirjeldama kolme olulist tegurit teaduse oivalisuses, nimelt: (a) teadlast ja tema võimekust uute saavutusteni jõuda, (b) pakutava teadusprojekti kvaliteeti ning (c) teadustöö keskkonda (viimast alles teises voorus).

Sellest järeldub, et teaduse kvaliteeti ei hinnata kontekstiväliselt ja ainult tulemusest lähtudes, vaid teadust võetakse kui terviklikku institutsiooni, kuhu kuulub teadlane koos oma meeskonna või võrgustikuga. ERC hindab konkreetselt just teadlase võimekust või võimetust uusi probleeme sõnastada ja nende lahenduste kallal töötada. On väga oluline, et ERC hindab teaduse kvaliteedi juures ka kodu-ülikooli võimekust pakkuda teadlasele piisavat aparatuurilist, juriidilist ja administratiivset tuge teadustöö läbiviimiseks. Nagu me juba eelnevast Hemlini tekstist lähtuvalt võime järeldada, ei sõltu teadustöö tulemus mitte ainult ühe teadlase või väikese teadlaste grupi pingutusest, vaid teadustulemus on kogu süsteemi (teaduse institutsiooni) tulemus, milles on oluline roll ka kohal, kus teadustööd läbi viiakse. Viimast hinnatakse küll alles teises voorus eeldusel, et kui kandidaat on piisavalt edukas, et läbida esimene voor, siis on üsna tõenäoline, et tema kodu-ülikool on võimeline teda toetama ja võimaldama talle täieliku vabaduse teaduslikes ja majanduslikes otsustustes, mis on seotud tema teadustööga. Siiski hindab ERC organisatsiooni võimekust teadustööle kaasa aidata kõrgelt, sest tänapäeval pole teaduse tegemine enam aristokraatide erahuvi oma

[10] Scientific excellence – teaduslik oivalisus, väljapaistvus, suurepärasus.

koduses laboris, vaid siiski sageli suurema meeskonna kaasamine elukutseliste teadlastena.

ERC hindab teaduse kvaliteeti läbi *peer review* protsessi, see on hästi kooskõlas Kuhni seisukohaga, et “pole kõrgemat normi kui relevantse teadlaskonna hinnang” (Kuhn T. S., 1970). Siinkohal on mõistlik tähele panna, kas ERC kasutab projektitaotluste hindamiseks *peer review* protsessis kahepoolset pimeretsenseerimist või ühepoolset pimeretsenseerimist[11]. ERC ei kasuta teaduse kvaliteedi hindamiseks kahepoolset pimeretsenseerimise meetodit[12], vaid hindaja teab, kelle tööd ta hindab, hinnatav ei tea, kes tema tööd hindab. Kuid hinnatav saab eelnevalt ERC-le märku anda, millist hindajat ei oleks huvidekonflikti ennetamiseks hea tema tööd hindama lasta. Selleks avaldab ERC vahetult enne hindamise algust hindajate nimekirja, et kõik granditaotlejad saaksid võimalikust konfliktist ERC-d teavitada. Järgmises peatükis analüüsin ma detailsemalt, millistele kriteeriumitele peab oivaline taotlus vastama.

Arvan, et kahe valitud teksti (Hemlini 2007 ja ERC 2007) uurimine on tarvilik selleks, et mõista teaduse hindamiskriteeriumite väärtusi mõlemast vaatekohast, nii teadlaste kui teaduse hindaja vaatekohast. Mõistes teaduse hindamise väärtusi, võime analüüsida, kuivõrd on käesolev hindamissüsteem asjakohane ning praktiline. Teaduse kvaliteedi hindamiskriteeriumite väärtustest arusaamine aitab meil teha paremaid hindamisotsuseid.

[11] Inglise keeles: double-blind and single-blind peer review.
[12] Teadusajakiri Nature alustas kahepoolsete pimeretsenseerimistega ka alles veebruaris 2015, kuid autor võib valida, kumba ta eelistab, kas kahepoolset või ühepoolset pimeretsenseerimist (Nature, 2015).

4 Alustekstide võrdlev analüüs

Hemlin võtab kokku oma uurimused üheks ülevaatlikuks tabeliks. Üle kõigi teadusvaldkondade[13] osutusid kõige olulisemateks teaduse kvaliteedi hindamise kriteeriumiteks korrektne meetod (correct method), probleem (problem) ja tulemused (results). Peatükis 3.1 kirjeldasin ma Hemlini ja Montgomery uurimusi ja nende metoodikat. Järgnevalt uurin teadlaste ja ERC teaduse kvaliteedi kriteeriumeid Hemlini atribuutide ja aspektide jaotuse kaudu. Hemlini uurimus jaguneb nõnda, et kõigepealt jaotub see aspektideks ja atribuutideks, seejärel kaheks vastanditepaariks: sügavus versus laius ning teadusesisene versus – väline asjakohasus ja viimaks teadlaste poolt enim mainitud aspektide ja atribuutide kombinatsioonid.

a) teaduse kvaliteedi **aspektid** (aspects),

b) teaduse kvaliteedi aspektide **atribuudid** (attributes),

c) teadustöö **ulatus** vs **sügavus** (breadth vs depth),

d) teaduse **sisene** vs **väline asjakohasus** (intra- vs extrascientific relevance) ja viimasena

e) **aspektide** ja **atribuutide kombinatsioonid** (combinations of aspects and attributes).

4.1 Teaduse kvaliteedi aspektid

Aspektidena näevad Hemlini küsitletud teadlased *probleemi* (problem), *meetodit* (method), *teooriat* (theory), *tulemusi* (results), aga ka *arutluskäiku* (reasoning) ja *kirjutusstiili* (writing style). Kolm kõige rohkem rõhutatud aspekti läbi kolme uurimuse olid meetod, probleem ja tulemused, neljandana mainiti ära ka ühel korral arutluskäik (Hemlin S. , Scientific quality in the eyes of the scientist. A questionnaire study, 1993).

Võrdluseks saab ERC tekstist välja lugeda aspektidena vastutava uurija senised teadustulemused ja nende kvaliteedi. Siinkohal peetakse

[13] Hemlin rõhutab, et sealhulgas ka kunstid ja humanitaarvaldkonnad.

tulemuste all silmas väga laia tulemuste skaalat. Tulemuseks võib olla nii teadlase kogu elutöö kui ka üksik artikkel. Kasutan seda Hemlini määratlust, kuna teadus- ja uurimisvaldkonnad on oma iseloomult ja läbiviidavuselt nõnda erinevad nii vormilt kui sisult, et valides tulemusteks ainult nt publikatsioonid, teeksin sellega liiga peaaegu pooltele teadustele. Samuti ei kitsenda ERC kuidagi tulemuse mõistet ainult kas artikli või monograafia peale, vaid jätab selle tõlgendamise veidi lahtisemaks. Teadusprojektile esitatavate nõudmiste hulgas märgib ERC aspektina ära, kui kasutada siin Hemlini sõnavara, probleemi läbi selle murrangulise iseloomu[14]. ERC jaoks on oluline probleem, mida hakatakse lahendama ja mille lahendamine on väljakutseks ning mis püüab varasemaid teadmisi kas umber lükata või nendes aina rohkem süvitsi minna või, vastupidi, probleemi valdkonda laiemalt käsitledes laiemalt ühiskonna probleeme lahendada. Siinkohal rakendub Popperi falsifitseeritavuse printsiip, et mida enam esitab probleem (teadusprojekt) väljakutse olemasolevaid teooriad ja meetodeid kriitiliselt hinnata ja ümber lükata ning mida spekulatiivsemad ning väljakutsuvamad nad on, seda rohkem on võimalust teaduse arenguks ning ka selle edusammudeks. Teiseks saab ERC tööprogrammis probleemi käsitleda ka teaduse siseste efektide kaudu, milles probleem peab avama uusi ja olulisi teaduslikke, tehnoloogilisi ja akadeemilisi horisonte. Kolmandaks hindab ERC probleemi lahendamise meetodit. Kas valitud meetod on sobilik, kas selle meetodiga on võimalik esitatud probleemi lahendada, arvestades nii eeldatava ajalise ja rahalise ressursiga? Mainin etteruttavalt ära, et 2015 aasta ERC tööprogramm eeldab teadusprojektilt ka meetodi edasi arendamist, mida 2007 aasta tööprogramm veel ei nõua. Leian, et tööprogrammide selline areng on heas kooskõlas teaduse arenguga ja selle arengu soodustamisega.

Teadusfilosoofilisest vaatenurgast on eelmainitud aspektid väga oluliseks tingimuseks, et teadustöö oleks seesmiselt viljakas. Seesmise viljakuse kvaliteetse arendamise (probleemi uudsus läbi püstitatud

[14] Probleemi murrangulise iseloomu käsitlust vt pt 4.2.

hüpoteesi, korrektne meetodikasutus, uudsed tulemused jne) kaudu saab teadus pakkuda ka rohkemat ühiskonnale, olla seeläbi ka kasulik ja mitte ainult iseennast arendav. Eelpool mainitud aspektide olulisus viitab kuhniliku normaalteaduse olulisusele teaduse arengus ning kinnitab sellega ka asjaolu, et normaalteadus viib teaduse arengut edasi ning revolutsioonid on küll olulised, kuid teadus on pigem progress ja areng kui pidev kriisis olek.

Kuna mainitud aspektid olid kõigi Hemlini uurimuste üleselt ja ka ERC dokumendis ühtselt mainitud kehtivatena üle kõigi teadusvaldkondade, siis võime ehk väita, et teadlastel on teaduse kvaliteedist rääkides välja kujunenud osaliselt ühtne keel. Iseasi on muidugi see, kuidas, vaatamata näilisele ühtsusele, teadusvaldkonnad üksteisega suhelda saavad ja kuivõrd tegelikult neid võrdväärselt koheldakse.

4.2 Teaduse kvaliteedi aspektide atribuudid

Atribuutidena käsitleb Hemlin aspektidele liidetud väärtusi komplekssena, nt originaalsed tulemused (original results), range meetod (stringent method), selge kirjutusstiil (clear writing styles). Kolm kõige enim hinnatud atribuuti olid Hemlini koondtabelis uudsus (novelty), millele järgnes kohe rangus (stringency) ja korrektsus (correctness). Viimasena mainiti veel sügavust (depth) ja aktiivsust/produktiivsust (activity/productivity).

ERC tööprogrammist saab välja lugeda, et atribuutidena on väga olulised seniste tulemuste originaalsus ja uudsus/murrangulisus (ground-breaking), mis peaksid siis iseloomustada vastutava täitja võimekust iseseisvalt ja loovalt mõtelda ning tunduvalt ületada oma teadustöös hetke teaduse arenguastet (beyond the state of the art).

Eraldi on ERC tööprogrammis välja toodud vastutava täitja võimekus vastu astuda peamistele teaduslikele väljakutsetele oma valdkonnas ning algatada uusi viljakaid lähenemisi probleemidele. ERC näeb, et vastutava täitja võimekuse loovad tema eelnevad tegevused nagu teadustulemused, koostööd, läbi viidud projektide ülesehitused, üliõpilaste juhendamised, publikatsioonid jne. See oli siis uurija kui isiku hindamine. Pakutava teadusprojekti hindamisel peab ERC oluliseks, kas vastav projekt kõnetab olulisi väljakutseid nendes valdkondades, mida see projekt käsitleb. Kas sellel projektil on sobilikult (suitably) ambitsioonikad eesmärgid, mis suudavad oluliselt süvendada hetke teaduse arengutaset (the current state of the art), sealhulgas distsipliinide ülesed arendused ja uudsed või ebaharilikud lähenemised.

Ei ERC ega Hemlini küsitletud teadlased ei eelda kvaliteetselt teaduselt mitte empiiriliste andmete kogumist või varasemate empiiriliste andmete süstematiseerimist ja korrastamist, vaid ka eelnevatest andmetest uute järelduste ja teooriate püstitamist ning ka ERC eeldab teadlastelt uute katsete läbiviimist (sh uue ja täpsema aparatuuriga, parema ja täpsema metoodikaga uuringuid) ja uute empiiriliste andmete kogumist uutel ja spekulatiivsematel eesmärkidel. Seda kõike selleks, et teooriad oleksid enam falsifitseeritavad, seda nii kitsama kui ka laiema probleemipüstituse korral.

4.3 Teadustöö ulatus vs sügavus

Hemlini uurimustest järeldub, et teadlaste jaoks on olulisim teadustöö ulatus ja vähem selle sügavus (mis ei tähenda, et see oleks kuidagi alahinnatud, vaid esimeseks saab ju valida ainult ühe). ERC järgi võiks sügavuse ja ulatuse välja lugeda ERC tungivast nõudest, et teadusprojekt peab avama uusi ja olulisi teaduslikke, tehnoloogilisi ja akadeemilisi (scholarly) arendavaid horisonte. Leian, et siin on tegu nii ulatuse kui ka sügavusega. Ühelt poolt eeldatakse, et projekt panustab omaenda valdkonna sügavuti minemisse kui ka teisalt külgnevate teadusvaldkondade avardamisse. Seega justkui ühe kriteeriumiga on täidetud kaks olulist nõuet.

Kas sellest, et Hemlini uuritud teadlaste jaoks on olulisem teadustöö ulatus, võib välja lugeda vihje, et avatus ja transdistsiplinaarsus on mõneti olulisemad kui hetkel konkreetses uurimuses süvitsi minemine? Ühelt poolt selleks, et edukas olla ja teadustööle laiemaid tulemuste võimalusi luua, tuleb võib-olla kaasata oma töösse ka teisi distsipliine, olgu see siis kas “teise” arvamuse saamiseks või lihtsalt mõõtmiste läbiviimiseks (nt aparatuuri kasutamine mitmete laborite vahel: bioloogid, keemikud, geenitehnoloogid, geoloogid jne). Teiselt poolt võib läheneda ka teisest küljest, et ükski teadustöö ega projekt ei oleks kvaliteetne, kui see poleks põhjalik, võttes arvesse juba tehtud töid, vaagides võimalikke teooriaid ja hüpoteese ning kaasates vajalikku kompetentsi (nii inimeste kui aparatuuri näol). Kokkuvõttes ei tasu siin näha vist ohumärki, et hea teaduse tunnuseks peaks saama pigem laius kui sügavus, vaid pigem et üks ei saa olla teiseta. Ning hea teaduse tunnuseks ongi vaikimisi süvitsiminek oma uurimuses, hoides samal ajal silmad lahti ka toimuva ja võimaluste suhtes ümberringi. Võimalustena näen ma siin nii sisendit kui ka väljundit. Sisendina teiste distsipliinide kasulikkust konkreetsele uurimusele ja väljundina uurimustöö tulemuste kasulikkust nii enda kui teiste teadusvaldkondade jaoks. Kummaga on siinkohal tegemist – kas Kuhni normaalteadusega või teadusrevolutsiooniga? Ehk peaksin küsima hoopis, kumba selline eelistamine soodustab – kas normaalteaduse tasa ja targu arenemist või teadusrevolutsiooni tekkimist. Ühelt poolt on tegemist kindlasti paradigma arendamisega, teiselt poolt on transdistsiplinaarsusesse ju justkui sisse kirjutatud mõningased murrangulised omadused, näiteks uute inimeste kaasamine uue kompetentsi näol ongi ju uudse perspektiivi saavutamise eesmärk. Teaduse kui institutsiooni seisukohalt on oluline arendada teadust nii süvitsi minnes kui piisavalt laia probleemide ulatust haarates.

4.4 Teaduse sisene vs väline asjakohasus

Selles punktis on teadlastele olulisem teaduse sisene asjakohasus, teaduse väline asjakohasus jääb teisele kohale. Samas ei tulene sellest, et teaduse välisel asjakohasusel oleks seetõttu oluliselt vähem kaalu, vaid kui teadlasel on valida nende kahe vahel, siis pole tal kerge otsust langetada. Kolmest uurimusest ainult ühes ilmnes, et teaduse väline asjakohasus on teaduse sisemisest asjakohasusest olulisem – seda on mainitud vabade vastuste ja hindamisskaala uurimuses (Hemlin S. , Scientific quality in the eyes of the scientist. A questionnaire study, 1993).

ERC käsitleb seda asjaolu oma hindamiskriteeriumite osas, mis puudutab teadusprojekti kvaliteeti. ERC eeldab, et teadusprojekti potentsiaalne mõju peaks avalduma teaduses oluliste teaduslike, tehnoloogiliste ja ka akadeemiliste (scholarly) horisontidena. Ehk siis projektil peavad olema teadusesisesed mõjud. Projekti tulemused peavad edasi viima teaduse enda arengut. Popperit veidi vabamalt tõlgendades peab hea teadus panustama iseenda arengusse, uute ja falsifitseeritavamate teooriate loomisse. Uued teooriad peavad andma teadusele endale midagi juurde, viima teaduse arengut edasi. Tegelikult ei maini ERC tööprogramm sõnagagi teadustöö vajalikkust ühiskonnale. Pigem võime ehk eeldada ja loota, et teadustöö panus teaduse enda arengusse on eelduseks, et teadusest võiks kasu olla ka ühiskonnale. Jättes teadlasele vabad käed uurimisprobleemi sõnastamiseks ja tarvilike meetodite valikuks, on võib olla tõenäolisem saada teaduselt ka võimalikke ühiskondlikult kasulikke tulemusi, olgu need siis kas baasuuringute või rakendusuuringute faasis.

4.5 Aspektid ja atribuudid

Aspektide ja atribuutide kombinatsioonides jagavad Hemlini uuringus osalenud teadlaste jaoks esikohta korrektne meetod ja range meetod. Alates kolmandast kohast ei ole enam selget edetabelit, vaid ühtviisi olulised on järgmised kombinatsioonid: uued tulemused, korrektsed tulemused, range kirjutusstiil, range probleem, uus probleem, korrektne arutluskäik. Võrreldes seda nüüd ERC eeldustega, siis Hemlini küsitletud teadlaste ja ERC arvamused ei lange paljuski kokku. Esimese olulise aspekti ja atribuudi kombinatsioonina märgib ERC tööprogramm ära olulistele väljakutsetele vastamise oma teadusvaldkonnas (important challenges in the field(s) addressed). Teisena mainib ERC ambitsioonikaid eesmärke (ambitious objectives), mis peaksid oluliselt arendama teadusvaldkonda edasi. Kolmandana ja seda võimaliku mõjuna üldse teadusele peab ERC oluliseks uute, oluliste teaduslike, tehnoloogiliste ja akadeemiliste horisontide avanemist. Võiksin järeldada, et horisontide all mõtleb ERC ka mingis mõttes uute ja oluliste probleemide sõnastamist ja neist kriitiliselt mõtlemist. Hinnatava projekti alles kolmanda hindamiskriteeriumina peab ERC oluliseks metodoloogiat. Metodoloogia juures ei ole ERC jaoks sõnaselgelt kirjas, milline see meetod ja metodoloogia täpsemalt olema peaks (olgu see siis range või korrektne või veel midagi muud) vaid ERC jaoks on oluline, et valitud meetodiga oleks võimalik või õigemini oleks lootust esitatud probleemile läheneda ning see võimaldaks ka mingite tulemusteni jõuda. Arvan, et siinkohal jätab ERC meetodi valiku teadlasele võimalikult lahtiseks, et mitte pärssida uute, ebaharilike ja võimalik, et ka võimatutena näivate meetodite rakendamist.

4.6 Kokkuvõtvalt

Milliste tingimuste puhul ja kuidas teadus edasi areneb? Kas teaduse edasiarenemine ja sellele eelnevad teatud tingimused on selle kvaliteedi märgiks? Kui jah, siis kas Hemlini ja ERC tekstides väidetu viib teaduse edasi arenemisele ja kas need eeltingimused on täidetud?

Hemlini uurimuste ja ERC tööprogrammi vahel on mitmed erinevused ja mitmed sarnasused. Erinevused avalduvad peamiselt teadlaste ja ERC ootustes hea teaduse tulemusele. Teadlaste jaoks on pigem oluline see, mis eelneb tulemusele. ERC jaoks on olulisem just see, mis järgneb probleemi, meetodi ja inimeste valiku kombinatsioonile – tulemus. Teadlaste jaoks on oluline, et teaduse areng arendaks eelkõige teadust ennast, tõestaks ja lükkaks ümber teaduse hetke seisukohti ja selle pinnalt konstrueeriks uusi hüpoteese ja meetodeid. ERC eeldab tegelikult ju kõike seda, mida teadlasedki, ainult et ERC tahab näha nende eelduste pealt korjatavaid vilju, ERC tahab saada tulemusi, ERC püüab teadlast oma tööprogrammiga ahvatleda spekuleerima, riskima ja riske hoolikalt kaaluma, et teadus saaks aina rohkem panustada iseenda arengusse.

Eelnevatest Hemlini ja ERC tekstidest järeldades võime väita, et selleks, et teadus areneks, on tarvilik, et iga probleemi lahendamisest kooruks omakorda välja suurem probleem, mida on omakorda tarvis lahendada. Nende lahenduste otsese või kaudse tulemusena võiks muutuda elu Maal füüsiliselt paremaks, säästlikumaks ja moraalselt ning hingeliselt rahuldavamaks[15].

Siin viidatud kolmest Hemlini uurimusest ei tule välja ühtegi vihjet akadeemilise vabaduse kohta. Kas ehk peavad Hemlini küsitletud teadlased seda iseenesestmõistetavaks või on tegemist tabuteemaga? Akadeemiline vabadus on aga ERC tööprogrammis selgesti rõhutatud kui kvaliteetse teadusprojekti üks omadus: kus vastutav uurija on oma teaduslikes ja sellega seotud majanduslikes otsustustes vaba ja sõltumatu. Või püüab ERC siin pehmendada oma üldiselt ülereguleeritud stiili? Eeldan, et ERC peab siin silmas suhtelist ja mitte absoluutset vabadust, kus vastutav uurija saab küll ilma otsese mingi isiku (nt varasema juhendaja) mõjuvõimuta valida ja sõnastada uurimusprobleeme. Absoluutses mõttes aga pole ta vaba, kuna uurimisprobleemid võivad talle dikteerida hoopis teadusevälised nõudmised. Selle üle arutlen ma peatükis 5.

Hemlin teeb veel mõned kokkuvõtted oma uurimustest. Nimelt mainib ta, et erinevate teaduse valdkondade vahel olid mõningased erinevused. *Pehmete* teaduste (sotsiaalteadused, kunstid ja humanitaaria)

[15] Jätan siinkohal targu käsitlemata need teadussaavutused, kus kvaliteetse ja tulemusrikka töö tulemusena on leiutatud ja tootmissegi jõudnu ka destruktiivsed lahendused nt aatompommid. Kuid kas seejuures on tuumafüüsika areng tuumapommide näol halb teadus oma kvaliteedi poolest? Tuumafüüsika probleemide lahendamisel suudeti ohjata tuumareaktsioone, mille tõttu said võimalikuks tuumapommid (vesinikupommid jne), mis omakorda aitasid lahendada muud laadi probleeme nt mõne riigivalitseja peas olevat probleemi etnilistest ja rahvuslikest vaatepunktidest. Kahjuks selline kvaliteetne teadus ei viinud Maa elanikkonda paremale füüsilisele ja säästlikumale (veel vähem hingeliselt ja vaimselt paremale) tasemele, vastupidi Maa elanikkond elab pidevas hirmus, et mõni riigivalitseja hakkab seda taaskord kasutama. Kuid peame tõdema, et teadusuuringud, mis viisid eelpoolnimetatud pommide väljatöötamisele on olnud kvaliteetsed ning teeninud praktilisuse ja teostatavuse eesmärki, mitte jäänud ainult arutluseks sahtlis.

esindajad rõhutasid enim teooria, arutluskäigu, kirjutusstiili ja mõningal määral ka probleemi ja ranguse olulisust. Samal ajal kui *kõvade* teaduste esindajad rõhutasid peamiselt rahvusvaheliste[16] suhete üliolulisust.

Sellest võime järeldada, et selline ilmne erinevus on tingitud *pehmete* ja *kõvade* teaduste põhiolemuse suurtest erinevustest. Teadusi peaksimegi kohtlema kui oma sisult ja vormilt erinevaid ja neile peaksid rakenduma ka erinevad, või siis pigem variatiivsed hindamiskriteeriumid, millega on ka ERC tööprogramm nõus, mainides selle nüansi ära leheküljel 6 olevas joonealuses märkuses 2. Selles märkuses väidab ERC, et erinevatel teadusaladel ongi erinevad "kujud". Kuju ja ka teadusrühma all võib mõista ERC jaoks nii üksikuurijat, kes ka juhendab tudengeid, kui ka suuremat uurimisrühma, millesse on koondatud kokku kümneid teadureid. Samuti erinevad teadusvaldkonnad oma sisu poolest: loodusteadustes on nii sisuliselt, tehniliselt kui majanduslikult suur üksteisest sõltuvus, üksinda ei ole võimalik väga palju ära teha. Humanitaarias töötab igaüks omaette, sõltumata töö sisus oma kolleegidest samas instituudis. Vastavalt on häälestatud ka hindamismehhanismid erinevalt: loodusteadlasi hinnatakse peamiselt suuresti automatiseeritult, lugedes kokku artikleid, tsitaate jne, humanitaarteadlasi saab hinnata ainult nende töö sisusse süvenedes (Lõhkivi, Velbaum, & Eigi, 2012).

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[16] Kahjuks ei maini Hemlin oma peatükis täpsemalt, millest ta sellise siinkohal ootamatu järelduse teeb. Samuti ei ole juures ka vihjet, millisest kolmest uurimusest võiks see järeldus tulla. Ainus vihje selle teadmise päritolule on "Over all data sets...", mis ei ole kuigi palju abiks.

5 Muudatused teaduse kvaliteedi tajumises ja kriteeriumites

Hemlin võtab oma uurimuse kokku alapeatükiga teaduse kvaliteedi hindamisest tulevikus. Ta kirjeldab, kuidas teaduse praktiseerimine, selle roll ühiskonnas ning selle toimijad on muutunud ja muutumas. Muutuste protsessi analüüsib Hemlin, kasutades Michael Gibbonsi ja tema kaasautorite (Gibbons et al 1994) teaduse muutumise käsitlust Moodus 1-st (traditsiooniline akadeemiline teadus) Moodus 2-ks (ühiskondlik-majanduslikust kontekstist sõltuv teadus), mainides sealjuures ära ka John Ziman'i (Ziman, 1994) arutluse teadusest kui püsivas olekus (science in a steady state) ning Henry Etzkowitzi ülikoolide, tööstuse ja valitsusorganite koostöö kolmikheeliksi (Etzkowitz & Leydesdorff, 1997). Zimani akadeemilise ja post-akadeemilise teaduse mõisted on mõnevõrra võrreldavad Moodus 1 ja 2-ga. Tegelikult jaotab Ziman moodused kolmeks: Moodus 1 on *akadeemiline teadus*, Moodus 2 on *tehnoteadus* ja Moodus 3 on *post-akadeemiline teadus*[17]. Kolmikheeliksi osadeks on Leydesdorffil (Leydesdorff, 2006) (1) jõukuse genereerimine majanduses, (2) uudsuse genereerimine organiseeritud teaduse ja tehnoloogiaga ning (3) kahe eelmise üle kontrolli omamine, et süsteem säiliks ja taastoodaks ennast.

Hemlin võtab kokku, et kõik need lähenemised on seni ikka veel empiiriliste andmetega puudulikult põhjendatud. Eelpool mainitud mooduseid kirjeldab ta järgmiselt. Ta nimetab nö traditsioonilise akadeemilise teaduse Moodus 1-ks, seda iseloomustab tulemusele (täpsemini ehk publikatsioonile) orienteeritus ning kvaliteedi kontroll,

[17] Zimani jaotus on väga erinev Hemlini jaotusest, Zimani jaotuse sisuks on teaduse tulemuse ajend ja tulemuse kasutamine. Moodus 1 on juhitud teadlaste eetose poolt, milles teadus on reguleeritud sisemiselt ja selle probleemid ja lahendused on väga kitsad ja konkreetsed. Moodus 2-es on suur rõhk teaduse tulemuste kommertsialiseerimisel, teadussaavutused peavad teenima ühiskonna huve ning teadlaste äriliste huvide kaitsmine on tihedalt seotud teadustulemuste rakendamisega ühiskonna heaks. Moodus 3-e tuumaks on väike, kuid tugev transsdistsiplinaarne teadusrühm, kes lahendab olulisi ja keerulisi probleeme (Ziman, 1994).

mis toimub pärast teadustulemuse avalikustamist. Protsessile orienteeritud teaduse puhul kasutab Hemlin Gibbonsi poolt eelnevalt nimetatud terminit Moodus 2. Viimase puhul toimub hindamine seire näol ning teaduse edenemise kohta tehakse pidevalt vahekokkuvõtteid. Hemlin ei maini, kas tegemist on lineaarse protsessiga või kulgevad mõlemad moodused paralleelselt või osaliselt kattudes ning erinevates hindamissüsteemides on kriteeriumeid mõlemast moodusest. Tabel 1 võtab need muudatused kokku.

Teaduse kvaliteedi kontrolli muundumine kvaliteedi seireks		
Dimensioon	Kvaliteedi kontroll (tulemusele orienteeritud)	Kvaliteedi seire (protsessile orienteeritud)
Kriteeriumid	Teaduslikud	Teaduslikud ja sotsiaalsed
Fookus	Üksikteadlasel	Organisatsioonidel ja võrgustikel
Eesmärk	Kehtivad usaldusväärsed teadmised	Sotsiaalselt jõulised/viimistletud teadmised, õppimine (õppimisvõime)
Hindaja	Traditsiooniline *peer*	Uued *peerid*, kasutajad, konsultandid, tavainimesed
Hindamise ajaline mõõde	Pärast tulemuste saamist	Pidevalt
Teadusuuringute perspektiiv	Esmane: teadmiste filosoofia ja sotsioloogia	Teisene: teadmusjuhtimine ja organisatsiooniline õppimine

Tabel 2 (Hemlin, Rasmussen 2006)

Hemlin kirjeldab muutusi ja muundumisi ühest moodusest teise kuue dimensiooni abil (vt Tabel 1). Kvaliteedi kontrolli ja seire kriteeriumid on erinevad. Moodus 2-s lisandub teaduslikule kriteeriumile ka sotsiaalne kriteerium. Nõnda ei ole enam oluline mitte ainult teaduslik tulemus ja selle panus teadusesse endasse ning eraldatus selle teadmise loojast, vaid oluliseks saab nii teadusliku tulemuse teaduslikkuse tase kui ka selle tulemuse rakendatavus “päris elus” ning muud sotsiaalsed asjaolud. Uurija seisukohalt on samuti mooduste fookus suunatud erinevalt. Moodus 1-s on olulisel kohal üksikteadlane, traditsioonilises käsituses on teadlane abstraktne olend, subjekt, kelle suhteid teiste samasugustega üldse ei käsitleta. Moodus 2-s on vastupidi, oluline organisatsioon ja võrgustikud. Organisatsiooni all mõeldakse siin teadusgruppi koos oma ülikooliga (aga ka instituudid, eralaborid ja muud uurimisasutused), organisatsioon koosneb nii teadlastest kui ka administratiivsest ja juriidilisest tugistruktuurist, mis kokku moodustabki selle organisatsiooni, mille kõik osad on olulised, et teaduse praktiseerimine oleks võimalik ja tulemuslik[18]. Kolmas dimensioon on teaduse praktiseerimise eesmärk (goal), miks ja kelle jaoks seda tehakse. Moodus 1-s on rõhk kehtival ja usaldusväärsel teadmisel, mis on oma keskkonnast välja võetud ning nö steriilsena tõene. Tulemuse haakumine kasutatavuse printsiibiga ei ole oluline. Moodus 2-s on teaduse eesmärgiks sotsiaalselt viimistletud teadmised ning üksteiselt õppimine ja ka õppimisvõime. Enam pole eesmärgiks saavutada igikestvat ja ainuõiget teadmist (kuna me ei saa kunagi olla kindlad mingi teadmise igikestvas täpsuses, peamegi võtma igat teadmist kui hetkel kehtivat, kuid võimalik, et muutuvat), vaid teaduslikke teadmisi mõistetakse kui hetkel kehtivaid, (võimalik, et tulevikus muutuvaid uskumusi). Eesmärgiks on luua teadmisi või teadmust, millega saab midagi ära teha, mida saab millekski kasutada ja millest on midagi omakorda õppida ja edasi arendada. Just saadud teadmistest uute teadmatuste ilmsikstulek on teaduse arengut edasi viivaks jõuks. Hemlini tabelis on neljandaks dimensiooniks hindaja, see, kes teostab teaduse kvaliteedi hindamist (ükskõik millises situatsioonis). Moodus 1-s oli selleks kuhnilikult traditsiooniline kaasteadlane, kui võimalik, siis samalt või lähedaselt teadusalalt. Moodus 2-s on hindajateks aga lisaks traditsioonilistele *peeridele* ka uued *peerid* (kaasuvatelt teadusaladelt), teaduse kasutajad ja sealhulgas lõppkasutajad, konsultandid ja ka tavainimesed. Samuti on hindamise aeg

[18] Täpsemalt on organisatsiooni osadena olulised: teadlased ja teised uurijad, tehnikud, asjaajajad, kes vabastaksid projekti juhi administratiivsetest kohustustest, juristid (intellektuaalomandi kaitse, rahastus- ja koostöölepingud jne), raamatupidajad jne.

leidnud teise käsitluse: kui Moodus 1-s oli hindamise hetkeks teadustulemuste saamine ja sellele järgnenud hinnangu andmine (nt artiklite eelretsenseerimine enne avaldamist, projekti teaduslik lõpparuanne ilma vahearuanneteta), siis Moodus 2-s toimub hindamine pideva seire läbi (Eesti kontekstis nt personaalsete uurimistoetuste vahearuanded koos edasise rahastuse otsusega ja ka muude teadusprojektide vahearuanded ning analüüsid, professorite atesteerimine jne). Viimasena ehk kuuendana märgib Hemlin ära teadusuuringute perspektiivi, milleks Moodus 1-s on teadmiste filosoofia ja sotsioloogia ning Moodus 2-s on teadmusjuhtimine ja organisatsiooniline õppimine. Teadmiste filosoofia ja sotsioloogia all püütakse leida vastuseid küsimustele, mis on tõene teadmine, kuidas tõese teadmiseni jõuda ja kes saavad ütelda, et mingi teadmine on tõene. Teadmusjuhtimise ja organisatsioonilise õppimise juures on oluline saadud teadmistega mingite uute järeldusteni jõudmine ja nende järelduste levitamine ning sihipärane organisatsiooniline õppimine. Hemlin peab organisatsioonilise õppimise all silmas teadust kui sotsiaalset institutsiooni, mille eesmärk on luua sotsiaalselt jõulist teadmist. Sotsiaalselt jõuliste teadmiste juures on oluline teadmiste tootmise keskkonna kompetents ja võimekus õppida. Sellisel juhul jõuab teaduse kvaliteedi seire teadmusjuhtimisele ja organisatsioonilisele õppimisele väga lähedale. Viimaseid ei vaadata enam kui teaduse väliseid omadusi, vaid kui iseenesest teaduslikku lähenemist teadustööle, kuna teadus ja teaduslikud väärtused sõltuvad teaduskeskkonna võimest reflekteerida kognitiivseid, sotsiaalseid ja institutsionaalseid baaseeldusi.

Analüüsides Hemlini ja Rasmusseni (2006) artiklit, võime järeldada, et esiteks selline muutus ei ole ette kirjutatud ja see toimub nüüd ja praegu ning teadlased peavad paratamatult kohanema selle olukorraga. Nagu käesoleva magistritöö sissejuhatuses mainisin, siis teaduse tegemine muutub aina kallimaks ja seetõttu on selline surve nii poliitiliselt kui ka majanduslikult mõneti õigustatud, et teaduse kohustus on ühiskonnale kasu tuua. See muutus on hetkel üks ajalooline seik, milles teaduse institutsioon muutub, nagu see on muutunud ka varem, nt siis, kui teadust veel ei tuntudki teadusena vaid käsitöö ja sepatööna. Ehk siis ühiskonnal ei ole tarvis mitte üksikuid kontekstiväliseid avastusi, järeldusi või analüüse, vaid need tulemused peavad olema kontekstis, kasulikud ja rakendatavad ning seda kõike mitte ainult oma kitsas valdkonnas vaid oluliselt laiemalt.

Hemlin ja Rasmussen väidavad, et akadeemiline vabadus on utoopia (Hemlin & Rasmussen, The shift in academic quality control, 2006, lk 189). Nad rõhutavad, et teadus ei ole enam vabalt kulgev ettevõtmine, mis on eraldatud kogu ülejäänud ühiskonnast. Akadeemiline vabadus, seni kõige mainekam ja tugevam ideoloogia teadusest, tuleb hüljata ning omaks võtta asjaolu, et teadus on osa ühiskonnast (Merton, The sociology of science: theoretical and empirical investigations, 1973). Nõnda on teaduse kvaliteedile esitatud veidi teistsugused standardid, nagu selle haakuvus ja kasulikkus kaasuvatele teadusvaldkondadele ja tööstusele nii otsesemas kui ka veidi kaudsemas tähenduses. Teadus ei ole mitte ühiskonnast välja lülitatud vaid väga tugevalt sõltuv sotsiaalsetest mõõdetest. Nõnda siis ei tohiks ERC tööprogrammi nõuet iseseisva ja sõltumatu vastutava uurija isikust segi ajada absoluutse iseseisvuse ja sõltumatusega.

5.1 ERC tööprogramm 2015

Selles alapeatükis annan ülevaate sellest, mis on erinev ERC tööprogrammides 2007 ja 2015. Tööprogrammi formaat on aastast 2007 üsna palju muutunud ja lisandunud on ka teisi grante peale alustava ja edasijõudnud uurija grandi. 2015 aasta tööprogrammis kirjeldab ERC hindamiskriteeriumite all nii seda, mida ta peab oivaliseks teaduseks kui ka seda, mida ta selleks kindlasti ei pea. ERC jaoks koosneb oivaline teadus järgneva kahe aspekti sidususest: (1) projekti murrangulisest (ground-breaking) ja ambitsioonikast iseloomust, olles samal ajal meetodi poolest teostatav ning (2) vastutava uurija intellektuaalsest võimekusest, loovusest ja pühendumusest. Samal ajal märgib ERC ära ka mitte-eesliiniteaduse omadused, milleks on juba olemasolevate materjalide analüüsid, struktureerimised, korrastamised ja kollektsioneerimised. Julgeksin eelnevast järeldada, et kõik teaduse ja uuringute tegevused, mis ei taotle uut teadmist, probleemi, meetodit vms, liigitub pigem Kuhni normaalteaduse alla ning on iseennast arendades korrastav ja struktureeriv. Normaalteadus ei ole vähem tähtis ega kuidagi muul moel vähem väärtuslik. Pigem on normaalteadus väga oluline, kuna määrab ära, mis on hea teadus ja millises suunas see peaks liikuma. On mõneti keeruline määratleda, kas ERC eesliiniteadus on oma sisult sama, mis Kuhn'i normaalteadus. Või on Kuhni normaalteadus siiski olemasolevate materjalide analüüsimine, struktureerimine, korrastamine ja kollektsioneerimine. Alapeatükis 2.4 mainin Sismondo (Sismondo, 2008) väidet, et teadus areneb peamiselt siiski normaalteaduse faasis, olles siis pigem ülesehitava kui lammutava iseloomuga. Ma ei oska hetkel määratleda, kas ERC eeldab eesliiniteaduselt murrangulisusena näiteks mõne olulise loodusseaduse ümberlükkamist või pigem paradigma arendamist. Võib-olla kui meil õnnestuks määratleda, kas ERC eeldused teaduse kvaliteedile võiksid sobituda Kuhni normaalteadusega, saaksime me ka ERC motiive paremini mõista. Võib olla on aga teaduse institutsioon vahepeal niivõrd palju muutunud (nagu väidab Hemlin kirjeldades Moodus 1-te ja 2-te), et Kuhni käsitlus teadusest vajaks olulisi täiendusi. Järgnevalt võtan kokku ERC 2007 aasta ja 2015 aasta tööprogrammide peamised hindamiskriteeriumite erinevused.

Aspekt	2007	2015
Prioriteet	Vastutav uurija	Projekt
Vastutav uurija	• Teadustöö väljundi kvaliteet (teadustulemuste avaldamine eelretsenseeritavates ajakirjades; murrangulised publikatsioonid; iseseisvad publikatsioonid; võimekus tunduvalt ületada hetke teaduse arengutaset) • Intellektuaalne võimekus ja loomingulisus (võime vastu astuda teaduslikele väljakutsetele; uue mõtteviisi algatamine)	• Intellektuaalne võimekus ja loomingulisus (vastutava uurija võime välja pakkuda ja ellu viia murrangulisi uuringuid; tõendid vastutava uurija loovast ja iseseisvast mõtlemisest; vastutava uurija saavutused tüüpiliselt ületada hetke teaduse arengutaset) • kohusetruudus (soov panustada oma tööajast oluline osa projekti läbiviimiseks)
Projekt	• Uurimistöö murranguline iseloom (väljakutsete olulisus; sobilikult ambitsioonikad eesmärgid, oluliselt ületada uurimistöös hetke teaduse arengutaset sealhulgas distsipliinideülene arendus ja uudne või ebaharilik lähenemine) • Võimalik panus (avab uusi ja olulisi teaduslikke, tehnoloogilisi ja akadeemilisi horisonte) • Metodoloogia (väljapakutud teadusliku lähenemise teostatavus; metodoloogia ulatuslikkus ja asjakohasus; eesmärkide saavutamiseks arvesse võetud ajaliste ja muude ressursside seos võimaliku ebaõnnestumise riskiga)	• Uurimistöö murranguline iseloom ja potentsiaal (eesmärkide olulisus; ambitsioonikus; võime ületada hetke teaduse arengutaset, kõrge riski-saavutuse vahekord) • Teaduslik lähenemine (projekti teostatavus kõrge riski ja saavutuse vahekorras; asjakohane metodoloogia; uudse metodoloogia arendamine; ajaliste ja muude ressursside vajalikkus ja põhjendatus)
Teadustöö keskkond	• Vastutava uurija iseseisvus otsustamisel • Koduinstitutsiooni vajaliku infrastruktuuri olemasolu; tarviliku intellektuaalse keskkonna ja infrastruktuuri tugi ja administratiivne assisteerimine • Teiste juriidiliste asutuste osalemise põhjendatus teadusliku panuse järgi.	

Tabel 3 ERC tööprogrammide 2007 ja 2015 hindamiskriteeriumid

Esimene põhierinevus, mis hakkab silma, vaadates hindamiskriteeriumeid, on vastutava uurija ja projekti kohtade vahetus tähtsuse järjekorras. Aastal 2007 oli selleks kindlalt vastutav uurija kui isik ja teadusuurimuse edukust tagava projekti vedaja. 2015 aastal osutub aga vastutavast uurijast olulisemaks projekt. Tundub, et üksikisik ja projekti juht on seetõttu teisele kohale paigutatud, kuna projekti all peetakse silmas ka kogu ülejäänud projekti läbiviivat meeskonda. Meeskond tähendab projekti jaoks kompetentsi, oskusi, kogemusi, grupisiseseid suhteid jne. Loomulikult sõltub meeskonna valik vastutavast uurijast. Moodustades meeskonda, komplekteerib vastutav uurija projekti õnnestumise jaoks erinevaid elemente. Miks on toimunud see prioriteetide vahetumine vastutav uurija vs projekt? Kas sellest võib välja lugeda ERC soovi arvestada teadusprojektiga kui tervikliku institutsiooniga, milles iga element on oluline tükike, et moodustuks terviklik kooslus, kus ka vastutav uurija ise on tegelikult ainult osa, kuigi väga oluline ja juhtiv osa sellest ettevõtmisest? Piltlikult öeldes võib kujutada 2007. ja 2015. aasta tööprogrammide erinevust järgmiselt: kui aastat 2007 iseloomustab tugev juht, kes veab eest nii projekti kui seda teostavat meeskonda, siis 2015. aasta tööprogrammis kulgeb projekt terviklikult, isegi monoliitselt, ja seda juhitakse meeskondlikult seestpoolt. ERC tööprogrammi 2015 fookus uurijalt projektile on sarnane Moodus 2-e fookusega (vt tabel 2) organisatsioonidele ja võrgustikele, mille puhul on oluline teadlaste liikumine, suhtlemine ja teadusrühma liikmete kompetentside kooslus, mille puhul teadustulemuse kvaliteet ei sõltu üksnes üksikteadlase panusest vaid kollektiivsest pingutusest.

5.1.1 Vastutavale uurijale esitatavad nõudmised: ERC 2007 vs ERC 2015

Millised on erinevused nõudmistes, mis esitatakse vastutavale uurijale 2007. ja 2015. aasta tööprogrammides? 2007. aasta tööprogramm rõhutab esimesena vastutava uurija seniste teadustulemuste olulisust, nimetades kriteeriumitena publitseerimist eelretsenseeritavates ajakirjades, publikatsioonide murrangulisust, iseseisvat publitseerimist ja publikatsioonide võimekust olla hetkel valitsevast üldisest teadustasemest ees. Teisena toob ERC 2007 tööprogramm ära vastutava uurija intellektuaalse võimekuse ja loomingulisuse, milleks on võimekus vastu astuda peamistele uurimisväljakutsetele ja algatada uusi mõtlemissuundi. 2015. aasta tööprogramm ei maini publikatsioone[19] eraldi, vaid rõhutab esiteks intellektuaalset võimekust ja loomingulisust, nagu vastutava uurija võimekus välja pakkuda ja läbi viia murrangulisi uurimusi, milleks on selgelt arusaadavad tõendid vastutava uurija võimest iseseisvalt mõtelda ning vastutava uurija senised saavutused pidevalt püüda olla teaduse hetke arengu tasemest ees.

Teise punktina on 2015. aasta tööprogrammis ära toodud hindamiskriteerium, mida 2007. aasta tööprogrammis ei ole – vastutava uurija seotus ja kohustus pühendada projekti juhtimiseks oluline osa oma tööajast. Arvan, et sellega soovib ERC rõhutada, et vaatamata sellele, et projekt on juhist prioriteetides ettepoole liikunud, on siiski väga oluline, et projekti juhiks ka ajaliselt pühendunud juht. Võimalik, et siin on tegemist ERC enesekaitsega, kus neil on varasematel aastatel ehk esinenud juhtumeid, milles mitmed projektid ei ole oma eesmärke täitnud, kuna vastutaval uurijal on liialt palju muid kohustusi kanda. Projekti toetuseks annab ERC suure summa raha ning, et selle heaperemehelikku kasutust tagada, on sisse toodud ajalise pühendumuse klausel.

5.1.2 Projektile esitatavad hindamiskriteeriumid: ERC 2007 vs ERC 2015

Eduka projekti kriteeriumid on mõlema aasta tööprogrammides üsna sarnased. Esimesel kohal on projekti murranguline iseloom: kas projekt kõnetab vastava teadusvaldkonna olulisi väljakutseid, millisel määral on esitatud eesmärgid ambitsioonikad ning kas projekt avab uusi teaduslikke, tehnoloogilisi ja akadeemilisi võimalusi. Ka projekti

[19] Need peab küll taotluses ära märkima, kuid ei ole otseselt hindamiskriteeriumitena kirjas.

läbiviimise meetodi kohta on mõlemas tööprogrammis esitatud sarnased hindamiskriteeriumid: kas valitud meetoditega on projekt teostatav, kas esitatud aja ja rahaliste ressurssidega on projekti eesmärgid saavutatavad. Kuid ühes olulises punktis erineb 2015. aasta tööprogramm varasemast 2007. aasta omast. 2015. aasta tööprogramm hindab projekti ka selle läbi, kuivõrd see on seotud uudse metodoloogia arendamisega. Siin on sobilik tuua paralleele Hemlini (Hemlin S. , What is scientific quality?, 2007) poolt küsitletud teadlaste vastuste kokkuvõttega, millest nähtub, et aspektidena rõhutati enim meetodit (üldiselt), atribuudina enim uudsust (üldiselt) ning aspekti ja atribuudi paarina enim hoopis korrektset ja ranget meetodit ja mitte näiteks uudset meetodit. Järeldan sellest, et ERC jaoks on oluline ka teaduse "tööriistade" areng ehk siis metodoloogia arendamine. ERC eeldab siis, et teaduses ei saa kuigi pikalt kõrge riskiga uurimusi olemasoleva metodoloogiaga läbi viia, vaid mõneti võib see ehk isegi takistada murranguliste teadustulemusteni jõudmist. Seega ka "tööriistad" peavad arenema. Kas sellega soovib ERC esile kutsuda teadusrevolutsioone, nii nagu Kuhn (Kuhn T. S., 1970) on neid kirjeldanud?

Teadustöö keskkonda ma ei käsitle, kuna 2015. aasta tööprogrammis puudub see sootuks ning 2007. aasta tööprogrammis on see pigem ettekirjutavat laadi, kuigi hindamiskriteeriumite all välja toodud.

5.2 Tööprogrammide 2007 ja 2015 kokkuvõtteks

Esiteks on mõlema programmi vormiline kuju juba oluliselt erinev. 2007. aasta tööprogramm on veidi lihtsam oma vormilt ja sisult, siiski hindamiskriteeriumites põhjalik ja teaduslikku projekti tervikuna käsitlev. Arvestades, et 2007 oli esimene aasta, kui hakati välja andma ERC grante, on see võrreldes 2015. aasta tööprogrammiga mitte oluliselt teistsugune. Soovin ülevaatlikult üle korrata kaks peamist erinevust: esiteks vormilise prioriteedi muudatuse projekti juhilt projekti peale ning teiseks sisulise muudatuse, milles projekt peab panustama metodoloogia arengusse. Viimane on väga tugev kriteerium teaduse sisemise arengu kasuks. Võib olla langeb metodoloogia arendamine siin kokku Moodus 2 eesmärgi ja perspektiiviga (vt tabel 2), mille järgi teaduse eesmärk on luua sotsiaalselt robustseid teadmisi ja võimet õppida ning teadmust juhtida ja organisatsioonina õppida. Esimene erinevus aga näitab juhi isiksuse taandumist esikohalt, millega eeldan, et ERC pöörab vähem tähelepanu juhi mõjukuse indeksile (sh tsiteeringud ja muud arvulised edukuse indikaatorid). 2015. aasta tööprogramm näeb oivalise teadlasena isikut, kes lisaks sellele, et ta on oma uurimuses põhjalik ja uuenduslik, on ka hea administraator ja inimeste juhtija, komplekteerides projektimeeskonna ja valides uurimissuuna. Need muutused on arvatavasti toimunud vastavalt teaduse institutsiooni muutumisele ja ehk on siin ka paralleeli võimalik tuua Ziman'i Moodus 3-ga (Ziman, 1994), mille järgi teaduse institutsiooni juhib edasi väike kuid tugev teadusrühm, kes lahendab olulisi ja keerulisi probleeme.

6 Kokkuvõte

Käesoleva magistritöö eesmärk oli arutleda küsimuste üle, mis puudutavad teaduse kvaliteedi hindamise kriteeriume. Oma töös esitasin ma sellega seoses järgmised küsimused. Mille alusel ja kuidas mõõdetakse teaduse kvaliteeti? Kellel on õigust ütelda, milliste hindamiskriteeriumite järgi peaks hindama teaduse kvaliteeti ja millised väärtused nendele kriteeriumitele omistatakse? Selleks, et leida vastuseid nendele küsimustele, valisin kaks mõneti oponeerivat käsitlust teaduse kvaliteedi hindamise kohta. Üheks neist oli teadlaste arvamus teaduse kvaliteedi hindamise kohta ning teiseks oli etteantud teaduse hindamise kriteeriumid.

Käesoleva magistritöö teises peatükis käsitlesin teaduse kvaliteedi hindamise aluseks olevaid filosoofilisi voolusid. Nendeks vooludeks valisin a) teaduse institutsionaalse käsitluse, b) empiristliku teaduskäsitluse, c) kriitilise ratsionalismi teaduses ja d) naturaliseeritud teaduskäsitluse. Need neli filosoofilist voolu on olulised, et mõista teaduse käsitlust laiemalt ja aru saada juba tehtud tööst teadusfilosoofia vallas. Teadusfilosoofilised käsitlused on kujundanud ühiskonna ja teadlaste endi ettekujutust teadusest ning samas läbi oma sisu ka määranud teaduse kvaliteedi tunnuseid. Iga teadusfilosoofiline vool määrab ära, kuidas ta teadust tunnetab, mis määrab tema jaoks teaduseks olemise tuuma.

Kolmandas peatükis kirjeldasin käesoleva magistritöö kriitilise analüüsi aluseks olevaid tekste. Analüüsi jaoks valisin kaks teksti erinevatest lähtepunktidest: ühelt poolt teadlaste arusaam teaduse kvaliteedi hindamiskriteeriumitest. Vastavad andmed teadlaste arvamuse kohta pärinevad Rootsi sotsiaalpsühholoogi professor Sven Hemlini vastavasisulistest uuringutest aastatel 1990 ja 1993. Teiselt poolt kaasasin analüüsi teadusele väljastpoolt esitatavad kvaliteedi kriteeriumid. Selle näiteks olen valinud Euroopa Teadusnõukogu (ERC) tööprogrammi dokumendi aastast 2007. 2007. aasta valisin seetõttu, et

Hemlin kirjutas samal aastal kokkuvõtva raamatupeatüki eelpool mainitud uuringute tulemuste analüüsina. Hemlini käsitlus baseerus teaduse kvaliteedi hindamise kontekstil. Sellesse keskkonda kuulusid kuus faktorit: teadustulemus (product), teadlane (the researcher), teaduskeskkond (the research environment), teaduse mõjud (research effects), teaduse finantseerimine, organisatsioon ja poliitika (research financing, organization and policy) ja viimasena teaduse hindamine (research evaluations). ERC dokumendist võis välja lugeda, et hindamise aluseks on ainult teaduslik oivalisus, mille määrasid ära mitmed kriteeriumid. Nendeks kriteeriumiteks olid (a) teadlase võimekus uusi saavutusi korda saata, (b) pakutava teadusprojekti kvaliteet ning (c) teadustöö keskkond.

Neljandas peatükis analüüsisin kahte eelpool mainitud teksti kriitiliselt. Analüüsi meetodiks on võrdlev kriitiline analüüs. Analüüsi viisin läbi Hemlini teksti ülesehituse eeskujul, et kahte teksti oleks võimalik analüüsida süsteemselt. Analüüs käsitles a) teaduse kvaliteedi aspekte (aspects), b) teaduse kvaliteedi aspektide atribuute (attributes), c) teadustöö sisulist ulatust ja sügavust (breadth vs depth), d) teaduse sisest ja välist asjakohasust (intra- vs extrascientific relevance) ja viimasena e) aspektide ja atribuutide kombinatsioone (combinations of aspects and attributes).

Viies peatükk andis ülevaate teaduse kvaliteedi tajumise ja hindamiskriteeriumite muudatustest ERC dokumentides 2007 ja 2015. See peatükk võrdleb kahe erineva aasta hindamiskriteeriume. Üldiselt on erinevate aastate tööprogrammid võrreldavad ja sarnased. Üks olulisimaid erinevusi kahe teksti vahel on prioriteetide muutus vastutava uurija ja projekti tähtsuse järjekorras. 2015. aasta tööprogrammis on esikohal teadusprojekti tugevus ja alles siis tuleb vastutava uurija oivalisus. Võime järeldada, et 2007. aasta tööprogrammi iseloomustab tugev juht, kes veab eest nii projekti kui seda teostavat meeskonda, ning 2015. aasta tööprogrammis kulgeb projekt terviklikult, isegi monoliitselt, ja seda juhitakse meeskondlikult seestpoolt. Teiseks oluliseks erinevuseks on see, et 2015. aasta tööprogramm hindab projekti ka selle läbi, kuivõrd see on seotud uudse metodoloogia arendamisega.

Käesoleva magistritöö analüüsi tulemusena võib järeldada et, teaduse kvaliteedi hindamise kriteeriumitega ei peagi kunagi rahule jääma, vaid selleteemaline diskussioon peab olema pidev, sest esiteks muutub teadus ja selle tegemise viis ning eesmärk ja teiseks viib ainult rahulolematus edasi arengule, nagu näitab ka ERC teaduse kvaliteedi hindamiskriteeriumite muutus. Selles suhtes ühtib ERC arvamus eesliiniteaduse olemusest popperlikuga, et uued hüpoteesid peavad andma olemasolevatesse teadmistesse uue panuse ning juba olemasolevate taustteadmiste kinnitamine seda aga ei tee, juhul kui just olemasolevaid taustteadmisi kummutada ei suudeta ja sellega kõike hoopis sassi ei lööda. Samaga nõustuvad ka Hemlini poolt küsitletud teadlased, kes on samuti arvamusel, et teaduse areng toimub eelkõige arendades iseennast, tõestades ja ümber lükates teaduse hetke seisukohti ja selle pinnalt konstrueerides uusi hüpoteese ja meetodeid. See võiks sobida ka kuhniliku paradigma loomise protsessi mõistega, kus teadus areneb paremini just struktureerides ja korrastades ning tasapisi ennast arendades. Teiseks , et teaduse kvaliteedi hindamise kriteeriumid ei ole üle kõigi teaduste samad ja ei peagi olema. Teaduse nõnda arenedes on tarvilik ka teadust hinnates arendada teaduse hindamise süsteemi. Kui lõppeb arutlus teaduse kvaliteedi hindamise kriteeriumite üle, lõpeb ka teaduse areng.

7 Viited

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8 Resümee

Käesolev magistritöö keskendus teaduse kvaliteedi hindamise filosoofilistele probleemidele. Töö ülesanne oli võrrelda teaduse kvaliteedi hindamiskriteeriume kahest seisukohast. Ühelt poolt teadlaste endi arvamus teaduse kvaliteedi hindamise kohta ning teiselt poolt teadusgrandi taotlemise puhul taotluse kvaliteedi hindamiskriteeriumid. Teaduse kvaliteedi analüüsimine filosoofilisest vaatekohast on viljakas, kuna võimaldab jõuda teaduse kvaliteedi hindamise kriteeriumites kriteeriumite väärtuste ja tuumani.

Magistritöö analüüsi tulemusena võib järeldada, et ERC, Popperi ja teadlaste arvamused teaduse kvaliteedist langevad kokku: uued hüpoteesid peavad andma olemasolevatesse teadmistesse uue panuse. Kvaliteetse teaduse üheks tunnuseks on panustamine iseenda arengusse nii sisu kui meetodi poolest. Selle seisukohaga võiks sobida ka kuhniliku paradigma loomise protsessi mõiste, milles teadus areneb paremini just struktureerides ja korrastades ja nõnda ennast arendades. Ja teiseks, et teaduse kvaliteedi hindamise kriteeriumid ei ole üle kõigi teaduste samad ja ei peagi olema. Nii muutub teaduse institutsioon, selle tegemise viisid ja eesmärgid. Seetõttu on kindlasti tarvilik teadlaste seas pidevalt läbi viia vastavaid empiirilisi teaduse kvaliteedi hindamise alaseid uuringuid.

9 Summary

Current thesis is titled “Quality assessment in science: a philosophical perspective”. The aim of the thesis was to analyse quality assessment criteria from two perspectives. Two aspects were analysed - scientists’ cognition of scientific quality and prescriptive scientific quality norms that apply when submitting grant application. Analysing scientific quality criteria from a philosophical perspective is fruitful, because it helps us reach scientific quality assessment to its core and values.

As a result of the critical analysis we may conclude that ERC, Popper and scientists agree on scientific quality criterion that new hypothesis must give a new input to existing knowledge. According to that, science must contribute to its own development through scientific problems and methodology. This might also suit to Kuhnian paradigm creation process when science develops better by structuring, arranging itself. In such a way the institution of science changes and also its goals and ways. And scientific quality criteria are not the same over all scientific fields and they do not have to be. If we stop analysing scientific quality criteria then the development of science also stops. The need for empirical research on scientists’ cognition of scientific quality is constant.

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Author information:

Sven Hemlin, Associate Professor, Ph.D.

Gothenburg Research Institute,
School of Law, Economics and Business,
Gothenburg University
PO Box 600
SE 405 30 GÖTEBORG
Sweden

Email: sven.hemlin@gri.gu.se

Draft of a book chapter prepared for a volume edited by K. Prpic. Title: Sociokognitivne osobitosti prirodnih i društvenih znanosti: Sociološki pogled (The socio-cognitive characteristics of natural and social sciences. A sociological view).

What is scientific quality?

Introduction

Scientific quality is judged and evaluated by scientists in a number of ways, for example when a manuscript is submitted to a journal and reviewed by peers, when a grant application is reviewed, when a candidate for an academic position is scrutinized and on other occasions. Most of these evaluations of scientific quality are made by scientists themselves. This is done by means of the peer review system. In addition, scientists also make use of scientific indicators to evaluate science and its actors.

However, not only scientists are evaluating science. Also, actors outside the scientific community are interested as recipients of scientific results and applications and therefore influencing how it is assessed. For example, it is interesting to people what clinical therapies for stroke or depressions are found, what environmental technology innovations that reduce pollution are developed and how different organisational problems may be overcome. Furthermore, the commercial sector and politicians are dependent on the results from a scientific community. If science is not of a high quality giving rise to new knowledge, advanced technologies, and influence commercially exploitable innovations and increasing welfare of people, then science would not prevail.

As is evident from what was previously said scientific quality is dependent on the perceptions of various individuals and social groups in science and also in society at large. This means that we must take into account the social psychology studies of scientific quality. How is scientific quality perceived by scientists and also others? What perspectives do they have on scientific quality? What criteria of scientific quality are used in judgments and evaluations of scientific outcomes? Is there a common view of scientific quality? How do perceptions of scientific quality vary between actors in science and in society at large? Such questions can be answered by social psychologists and in empirical studies of scientific quality (e.g., Feist, 2006; Hemlin, 1993; Shadish, 1998). Previously, this was an issue mostly dealt with by philosophers of science and approached in a normative way. Psychological studies can bring empirical research findings on perceptions of scientific quality to elucidate how quality is viewed[1]. Moreover, and importantly empirical research can analyse how quality perceptions are used in practice that is when assessments of scientific contributions are carried out.

In this chapter I will start with a description of a framework for viewing scientific quality. Secondly, a presentation is made of a number of empirical findings concerning scientific quality. Finally, I outline current changes in views and assessment practices of scientific quality and draw some conclusions. The analysis of scientific quality and empirical results in this chapter are based on a body of theoretical and empirical studies by colleagues and the author of this chapter.

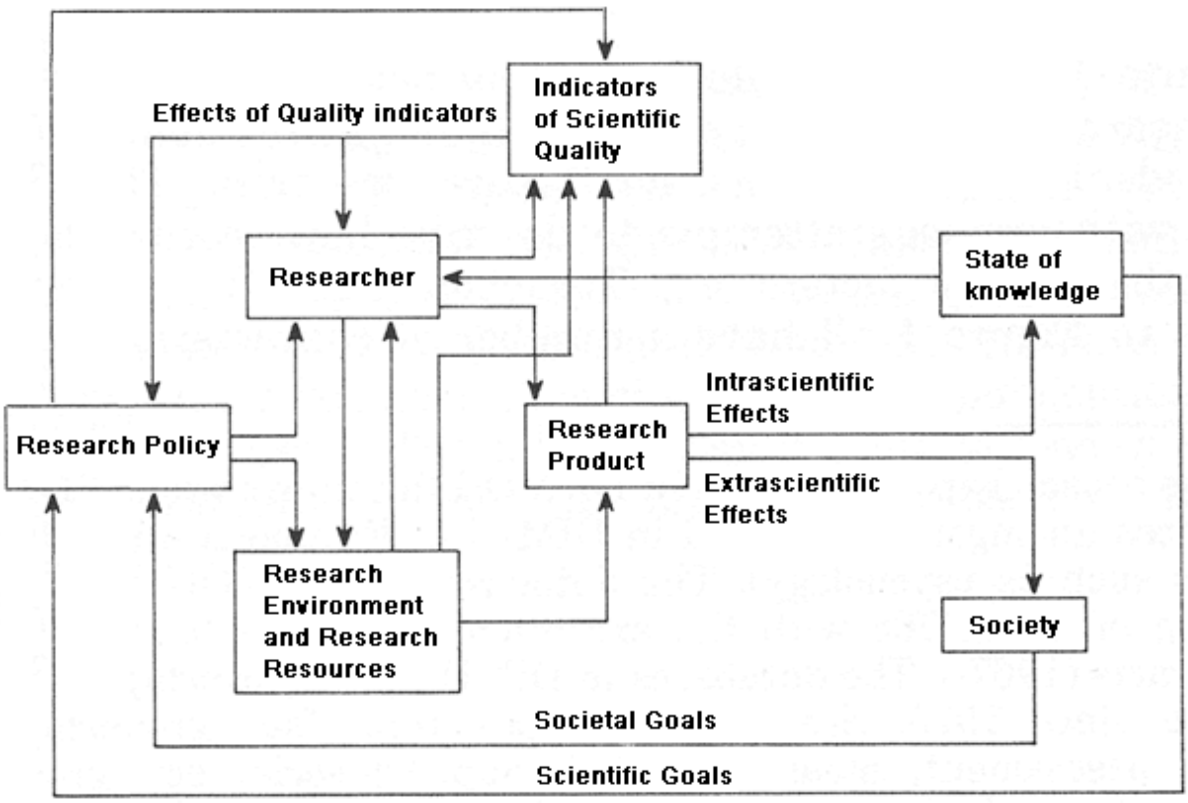
A theoretical framework of scientific quality

Research assessments or evaluations of scientific quality are part of a context in which several different factors interact and where the interplay between the factors is essential to understand the concept quality in science[2].

Figure 1 presents a system of factors which is, I argue important in research evaluations. The systems model bears some similarity to previous attempts to describe how research develops in interaction with external factors (e.g. Törnebohm, 1983). However, this model is new in that it should be viewed as a description of factors influencing evaluations of research and scientific quality.

[1] Of course other disciplines such as sociology and political science can be helpful as well.
[2] This is further complicated by the fact that not only the real interplay between different factors is important but also the evaluators´ conceptions of this interplay are crucial.

Figure 1. Context factors in research evaluations.



All factors in Figure 1 have a number of characteristics. The interplay between the factors means that these characteristics will be influenced. Further on I describe each of the factors in the figure and present examples of features of each factor as well as relevant literatures connected to the features.

The six factors in the framework are: the research product, the researcher, the research environment, research effects, research financing, organization and policy, and research evaluation. In my view, all of these factors are to a larger or lesser extent taken into consideration in the evaluation of scientific quality by those who carry out the evaluation.

The Research Product

The object of an evaluation is a research product, i.e. the end-product of research. It may be all of the research carried out within a discipline or just one scientific article. Some relevant characteristics of the research product might be its breadth, depth, clearness of the problem statement, fulfilment of methodological demands etc. These characteristics are supposed to be connected with the research product itself and the starting point for an evaluation.

When scientific quality is evaluated the object for the evaluation is typically one or several documents, which describe the research effort. These evaluations may be based on empirically generated as well as normatively or theoretically formulated quality criteria. A number of criteria have been suggested in the literature, for example Smigel and Ross (1970) found that scientists ranked highest (in order) the criteria "interesting", " significant, meaningful", "well written", "informative and useful", "good methodology" and so on. Also Kuhn (1977), suggested normative criteria related to scientific theory, which should have "accuracy", "consistency", "scope", "simplicity" and "fruitfulness". In the volume on the psychology of science, McGuire (1989) discussed criteria of scientific quality. He made a distinction between intrinsic (e.g. internal consistency, novelty) and extrinsic criteria (e.g. author's status, useful for valued human goals) for evaluating scientific explanations. Moreover, in the same volume Shadish (1989) added a further distinction beside the internal - external one. Science aims to achieve certain goals, e.g. truth, but also have inputs and operations to achieve these goals, for example falsification. Shadish named these two components outcome and process. A further analysis, review and categorisation of quality criteria in the literature can be found in Hemlin and Montgomery (1990).

The Researcher

A research product is carried out by one or several researchers who's world view, knowledge, interest, intelligence and personality influence the direction of and the accomplishment of the research product. A number of authors have pointed out that the competence and the personality of the researcher is important to the quality of the research (see reviews by Feist, 2006; Hemlin et al., 2004). The creative researcher should be ambitious, compulsive, enduring, seeking definiteness, intelligent, intellectually curious, dominant, orderly, authoritarian, non-seeking of help and advice, not fun loving, aggressive, showing leadership, independent, defensive, not meek, impatient, motivated and non-supportive according to studies using factor analysis of personality traits. The three best predictors of research effectiveness were achievement, motivation and ambition according to Rushton et al. (1983) in studies of professors in psychology. Type A behaviour, i.e. strong and continuous fighting behaviour to achieve more in a short time and under pressure was found among successful, male researchers (Matthews, Helmreich, Beane & Lucker, 1980). The contribution of intelligence above an IQ score of 120 to successful research was small, according to a review of studies by Albert (1975). In Feist´s review (2006) he found the following characteristics to be more salient of creative scientists than less creative scientists in the literature. In the cognitive domain he found openness and flexibility, in the motivational domain a scientist was driven and ambitious, and finally in the social domain the traits dominance, arrogance, hostility, self-confidence, autonomy and introverted were typical for the high quality producing scientists. However, we still lack evidence of the directional influence between personality traits and scientific excellence.

Scientists have traditionally been viewed as more rational than others. However, Mahoney (1979) rejected the picture of the scientist as "rational man". Researchers are no less than other people under influence of motivational and emotional factors, which in turn exerts influence on science and rationality. These ideas also go along with results from the Mitroff study (1974), in which he found that Apollo moon scientists possessed deep intellectual, affective and personal commitment in their endeavour.

Age and creativity was reviewed by Simonton (1988) who found that lyric poetry, pure mathematics and theoretical physics showed early peaks (around the early 30's or even late 20's) in age curves for creative output, while peaks were late (the late 40's or even 50's) in history, philosophy and medicine. However, in many disciplines researchers reached a maximum output rate in intermediate years (around 40 years). Simonton also reported that the correlation between the eminence of psychologists and the age at which they contribute their most influential work was almost exactly zero (a result that goes for arts as well). According to Feist (2006) the relation between age and productivity (quantity and quality) in science can be viewed as an inverted U. The peak across all fields is found at the age of forty, but peaks differently for various disciplines that is earlier for mathematics and later for biology to take two examples.

A path analysis of the publishing productivity of psychologists, showed that ability (a multiple indicator based on four data sources, mainly test scores), graduate program quality, early productivity, the quality of the first job (i.e. ratings of departments on quality of the faculty and effectiveness in training scholars) and the sex of the researcher were causal antecedents across disciplines (Rodgers & Maranto, 1989). More interestingly, it was found that ability played an important role for all other predictors, suggesting the crucial role of the person, the researcher and his/her competence. Another finding of importance by Rodgers and Maranto (1989) was that sex had a significant effect on quantity, but not on quality of research. This finding indicates that women in psychology produced less than men, but at the same level of quality. Earlier results have shown large sex differences in rank and salary that cannot be explained by differences in productivity or departmental prestige (Cole, 1979; Rodgers & Maranto, 1989). Studies by Cole (1979) in the nineteen-seventies among Ph.D. women in the natural and social sciences showed that women were less productive as well as less cited as men. In the same study, ability and IQ measures of researchers with Ph.D. exams were high for both men and women.

The Research Environment

Immensely important for the research product is the research environment in which scientists do research. For example colleagues, students, premises and the supply of research resources such as economic means and equipment belong to a scientist´s research environment. The environmental and resource factors might influence the research effort more or less directly, but also indirectly by the relevance of the environment for the motivation and interests of the individual researcher.

An early review by Barron (1963) demonstrated that research creativity was favoured by environments characterized by great freedom and lack of order. Research effectiveness, measured as productivity per time unit and group member and number of citations for the group, was found in one study to increase in the technical area with larger groups (Wallmark, Eckerstein, Langered & Holmqvist, 1973). However, group size has more lately been shown not to be correlated with the individual output of scientists in a review by Hicks and Skea (1989).

In a study of successful researchers and information habits (Kasperson, 1978) it was found that the creative researcher was active in seeking information and exposed him/herself to lots of information inside and outside the research area. Leadership in high performing research groups was characterized by experience and competence with professors and senior lecturers (Pelz & Andrews, 1966; Stankiewicz, 1980). A recent review of the literature about leadership and creativity revealed that apart from expertise it was essential with leadership support in various ways for members of research groups (Mumford et al., 2002).

In conclusion, the reviewed studies concerning the researcher and her/his environment give us a picture of the successful researcher characterized by strong ability, an IQ score at least around 120 but not necessarily higher, strong motivation, ambition and achievement. According to recent studies of creative knowledge environments a scientist´s environment can be summarized and divided into three main factors, i.e. cognitive, social and physical factors, where it is clear that the first two ones are exerting the most direct and dominating influence. Further, it is shown in several studies in this review that the psychosocial climates of research groups are connected to the creative output of scientists. One repeated finding is that research group climates should mainly be open and allow freedom to scientists. Secondly, a heterogeneous composition of the group is important to promote creativity. Thirdly, it was found that group leadership as was mentioned above influences the group creativity in the two main ways that is by expertise and social support to groups. Finally, rich information sources, good knowledge management and access to frontline knowledge are typical of creative knowledge environments (Hemlin, Allwood, & Martin, 2004; Hemlin, Allwood, & Martin, in press; Hemlin, 2006).

Research Effects

Research can be viewed as having two main effects, i.e., intrascientific and extrascientific effects (e.g. Elzinga, & Jamison, 1984). The intrascientific effects denote effects on the current state of scientific knowledge within the research area (e.g. if the research effort lead to development of theories or methods). Also, there might be long term effects (e.g. if the research product lead to a situation in which new theories more easily will be formulated in the future). The extrascientific effects might concern the effects a research product has on society in a wide sense, e.g. groups of individuals in a country, a whole country or all mankind. The extrascientific effects may be more or less direct or long term and they may be positive or negative. Positive effects are for example cures for diseases, new technologies such as safer traffic vehicles and improvements in the welfare of people. Bad research effects which could be judged as negative are the development of military arms or environmentally harmful technologies.

Intrascientific and societal factors are not only influenced by different research products. These factors also influence research or rather how a researcher chooses problems and methods for his/her work. Within the scientific community as well as in society generally, value systems, ideologies, politics and markets exert an influence on the research carried out and also on how the research is evaluated. Several scientists have noticed the significance of different scientific views or paradigmatic views for the evaluation of scientific results (De Mey, 1982; Kuhn, 1970; Törnebohm, 1983). The significance of societal factors on science was early emphasized by Hessen and Bernal (see Elzinga & Jamison, 1984), by Merton (1938) in his classical study on influences from the military area and the mining industry on the direction of research in England in the 1800's. The Swedish sociologist Brante (1984) presented a number of examples of how positions in scientific disputes can be explained with reference to personal and political factors. Proponents of the Strong programme in Great Britain and followers claim that all scientific knowledge is of social origin, or as it is now coined, as socially constructed (e.g., Mulkay, 1979; Woolgar, 1989).

According to several authors the extrascientific or societal effects of research are of the highest importance, although intrascientific effects are not neglected as an indirect means in advancement of man and society. To this group of authors, one could include Hessen and Bernal (see Elzinga & Jamison, 1984), who were early out to focus the science and society link. This school of thought, based on pragmatism and Marxism, views basic and applied research as if they have the same ultimate goal and that is positive effects on society. Quality in science should according to this school be viewed by science effects on society

A large number of philosophers of science (e.g., McMullin, 1983;Niiniluoto, 1990) emphasise intrascientific effects of science, i.e. whether the results contribute to scientific progress and in the end the truth (or truthlikeness) of a phenomenon. The intrascientific effect of the research process must, according to these authors, be the primary purpose of science independent of the societal effects. Quality of science must according to this view be assessed by its internal effects.

Research Financing, Organisation and Policy

The influence that intrascientific and extrascientific factors exerts on research and its evaluation can be directed by research policy, which is the term for all activities aiming at steering research. This activity is often carried out by research councils and other funding authorities. It can also be carried out within the scientific community itself. For example, editors of scientific journals and researchers arranging scientific conferences have a more or less pronounced policy for their activities.

The direction of research within the frame of a research policy cannot easily be separated from societal interests more or less originating from outside the scientific community. As Fridjonsdottir (1983) remarked we can talk about a process of interaction between a national direction of research policy and activities within the scientific community. Similar views were proposed by Toulmin (1964) who emphasized that a successful direction of research presupposes that the research community is well integrated into society. Also Lakatos (1976) showed a clear interest in society's role for science. He claimed that universal criteria contradictory to elite criteria should be applied to distinguish progressive research from bad research. Scientists themselves should not decide about the criteria by themselves, according to Lakatos. Instead they should guide societal committees (consisting of researchers and laymen) in the distribution of research funding. This is also a common topic in certain EU research programmes and in national contexts within the EU, for example Denmark.

The criteria used for directing research are supposed to be similar to the criteria used for the judgment of research products. Therefore, it should be relevant to distinguish between internal (intrascientific) evaluation criteria and external (societal) evaluation criteria (see De Mey, 1982; Fridjonsdottir, 1983;Weinberg, 1963). The emphasis laid on these criteria and the way in which they will be measured by means of quality indicators are apparently dependent on the prevalent research policy. In this way evaluations are part of an ever changing cycle in which the criteria for quality assessments occasionally change by the effects previous research have had on the current state of scientific knowledge, the society and the research policy.

The relations between scientific quality and financing, organisation and research policy are not as much empirically investigated as the previous mentioned factors, but indeed very much debated. However, attempts have been made to study differences in research output for basic, governmentally and research council financed research versus sectoral funding[3]. In the Swedish case and in many other countries research funding is channelled through four main sources. First, grants are channelled to research directly after governmental decisions to universities as block grants (to hire research staff and as basic resources for equipment). Secondly, research councils can fund scientists for projects after peer review (approved grant applications). Thirdly, sectoral organisations such as the Energy Authority can provide money for university research on assignment or after an application from university scientists. Sectoral research in other countries than Sweden (e.g., Germany, Norway) is often done by scientists at institutes rather than at universities. Fourthly, the industry or other private funding sources can fund research at universities.

An interesting point regarding funding sources is that they influence the perceived quality of research. It is often found that sectorally funded researchers regard sectoral financing as a good means for increasing the quality of the research output. However, researchers funded in other ways, especially researchers with grants from research councils, are often negative to sectoral funding as a means to enhance the quality of the research. The sectoral funding of research was criticized by Elzinga (1988). He argued that sectoral funding of short-term and quasi-research projects leads to "deinstitutionalization", which will result in a negative change and dissolution of the disciplinary structure of academic research. Hence, it is tempting to draw the conclusion that the "deinstitutionalization" of academic research, described by Elzinga, will have an impact on the scientific quality. However, more positive views from scientists on external funding and its consequences for science were found in a Finnish study by Nieminen (2005).

[3] Sectoral funding denotes governmental funding to societal or political sectors such as the military, building and energy sectors. Sectoral organisations in Sweden conduct research on their own and hire university researchers on contract research.

Studies on research organisation was carried out by Foss Hansen (1988) who claimed that a number of control mechanisms influence research activities. She stressed mechanisms such as dialogues (within or between research departments), scientific norms (universalism, disinterestedness etc), markets (the publishing market, the grant market etc), bureaucracy (exerted by funding agencies, university councils and local departmental offices) and democracy. The latter two mechanisms were proposed to work in an indirect way influencing the conditions for research. Bureaucracy was excluded from the list of "good"mechanisms, since it is suitable only for routine tasks, and those tasks are not characteristic of science. Market is also less "good" than the others, because researchers who adjust themselves strongly to different markets may affect the scientific quality in a negative way (e.g. problem choice might be influenced by opportunism). In sum, a favourable research policy for scientific quality should de-emphasize bureaucratic control and set restrictions on market mechanisms according to Foss Hansen (1988). The quality of research might, according to this line of reasoning, also be attributed to how governments finance research and the way funding agencies and bureaucracies work (see also Elzinga, 1988).

In Figure 1 also two other causal cycles are displayed. One cycle concerns the effects the result of an evaluation has on the present research policy, which in turn can lead to a change in research evaluation criteria. This cycle might presumably and in the normal situation be viewed as smaller changes of the present evaluation criteria within the frame of intrascientific and societal goals. The second cycle is viewed as the effects an evaluation directly exerts on the researcher, which might lead to an adjustment of his/her research in favour of the criteria used. This effect might in the next time phase increase the possibilities for an improved outcome in new evaluations. Such adaption processes can evidently become serious problems for future research on research evaluation and research itself.

Research evaluations

Finally, Figure 1 shows that evaluations (in the figure called indicators of scientific quality) might be influenced by factors external to the research product under scrutiny. On the one hand characteristics of the researchers such as position, age, or personality influences the evaluation. On the other hand environmental factors might be important, e.g. the departmental status that the researcher belongs to. How background factors influence the final outcome of a research evaluation is an issue which is often discussed in the literature. Moreover, as can be seen in the figure also other factors may influence evaluations.

An attempt to define scientific quality

The system in Figure 1 shows in a number of ways why it is difficult to precisely define the concept "scientific quality". First, scientific quality might correspond to a smaller or a larger part of the framework. A simple way of solving the problem would be to let scientific quality correspond to the methods used to assess scientific quality. The definition would then correspond to the evaluation box in Figure 1 and be equivalent to an operational definition of scientific quality. However, such a definition makes it difficult to discuss how to assess scientific quality in the best way. It is important to know which aspects one wants to assess in order to make judgments on different methods or indicators. Scientific quality might then be defined in terms of different characteristics of a research effort (stringency, originality etc). Another possibility is to widen the definition to entail intrascientific and extrascientific effects of a research effort that have taken place or are forecasted.

I have now touched upon another difficulty in defining scientific quality, namely that this concept might correspond to uncertain effects and effects that have not yet occurred. This problem implies that it will be difficult to achieve a precise definition because there might be different views how to decide upon research effects that have not yet occurred. In the history of science there are many examples of such unpredictable effects. A rather depressive example is the development of the atomic bomb as a consequence of the research in atomic physics.

The conclusive difficulty to delimit precisely what is meant by scientific quality concerns the nature of research itself, in which perceptions of what is good or bad research varies between different scientific fields and time periods. The causal cycles visualized in Figure 1 implies that suitable assessment methods and quality indicators, desirable characteristics in research products and intrascientific and extrascientific effects are permanently changing. These changes are the results of a process of interactions between new results in science and events in the world outside the scientific community.

The purport does not imply that it is meaningless to try to pursue the meaning of scientific quality. I do not want to exclude that there is a possibility of unity among scientists on a number of generally formulated, universal criteria on good research. Let us imagine that good research corresponds to the creation of clearness, the revelation of new connections and the beauty of a good theory or interesting results. The emphasis that is put on different aspects of research and the precise meaning of the suggested aspects might of course change. To allow such diversity in the meaning of good research is probably one of the most important preconditions for science to develop in a fruitful manner.

Empirical research on scientific quality

As was evident in the previous sections about scientific quality this concept is here viewed as a relational concept. It is dependent on at least the presented six factors and their interplay described here.

I will now make an attempt to delimit the quality in research to its characteristic features. To test our framework and find out about how such features are perceived and conceptualized we asked in one study scientists from various disciplines in Sweden what they believed was characteristic of good science in their fields. This study entailed 22 scientists and gave us a first indication of scientists´ perceptions of important quality concepts such as novelty, correct methods and a clear writing style which could be viewed as properties of the final research product. As a result of the study and the literature we formulated a conceptual system that distinguished between different parts of the research process that is problem, method, theory, results, reasoning and writing style (*aspects*) and the value attached to each part, for instance an original result, a stringent method and a clear writing style (*attributes*) (Hemlin & Montgomery, 1990;1993). To validate our conceptual system we constructed a questionnaire to a larger stratified random sample of scientists (n= 224) in the main research areas of academia (medicine, natural sciences, social sciences, technology as well as the arts and humanities). In the questionnaire we asked scientists to rate the importance of each aspect in relation to a number of chosen attributes as was previously decsribed. In addition, we asked scientists to rate the importance of the factors in the framework described previously when assessing the quality of science more generally. However, this approach to study scientific quality was focused on scientist´s perceptions, which does not tell us how scientist´s behave when assessing scientific quality. To that end we wanted also to know how scientists assess scientific quality in their science practice that is what criteria are used in peer reviews. In other words, we wanted to know not only what scientist´s perceive of research quality, but also if and how they apply their conceptions. To study scientist´s quality assessment behaviour we analysed the documents of peer reviews of candidates to professor positions (31 cases the years 1975-1984) (Montgomery & Hemlin, 1993). This method is feasible in Sweden (and perhaps some other countries) since peer reviews of the candidates are done in writing and the reviews are publicly available documents. In addition, we analysed peer review documents of grant applications in psychology to the Swedish Science Council (Hemlin, Montgomery & Niemnmaa, 1995). The results of these studies will be described and compared in the following sections.

Our findings have been supported to a surprisingly high degree by similar studies in three other Nordic countries (in Denmark by Andersen, 1997; in Norway by Gulbrandsen and Langfeldt, 1997; and in Finland by Kaukonen, 1997). The results from the other Nordic countries were in agreement with our framework and the notion of a concept of scientific quality as a common language composed of aspects and attributes. The general finding was that scientists without problems rated aspects and attributes of research products to assess its quality. For example, to use correct methods were perceived as one of the most important signs of scientific quality. The findings support our view that the common language among scientists could be used to assess scientific quality of research products.

Table 1

Emphasis on specific aspects and attributes in four data sets

Emphasized aspects or attributes	***Hemlin & Montgomery, 1990 (interviews)***	***Hemlin, 1993 (free answers)***	***Hemlin, 1993 (ratings)***	***Hemlin & Montgomery, 1993 (documents)***
Three most emphasized Aspects	Method Problem Results	Method Problem Results	Reasoning Results Method	Method Results Problem

Three most emphasized attributes	Novelty Correctness Stringency	Novelty Stringency Correctness	Correctness Stringency Depth	Stringency Novelty Activity/Productivity
Emphasis on Breadth vs. Depth	Breadth Depth	Breadth Depth	Depth Breadth	Breadth Depth
Emphasis on intra-vs. extra-scientific relevance	Intrascientific Extrascientific	Extrascientific Intrascientific	Intrascientific Extrascientific	Intrascientific Extrascientific
Three most emphasised combinations of aspects and attributes	Correct method New results Stringent problem	Stringent method Correct method New problem	Correct method Correct Results Correct reasoning	Stringent method Stringent writing style New results

Adapted from Hemlin and Montgomery (1993)

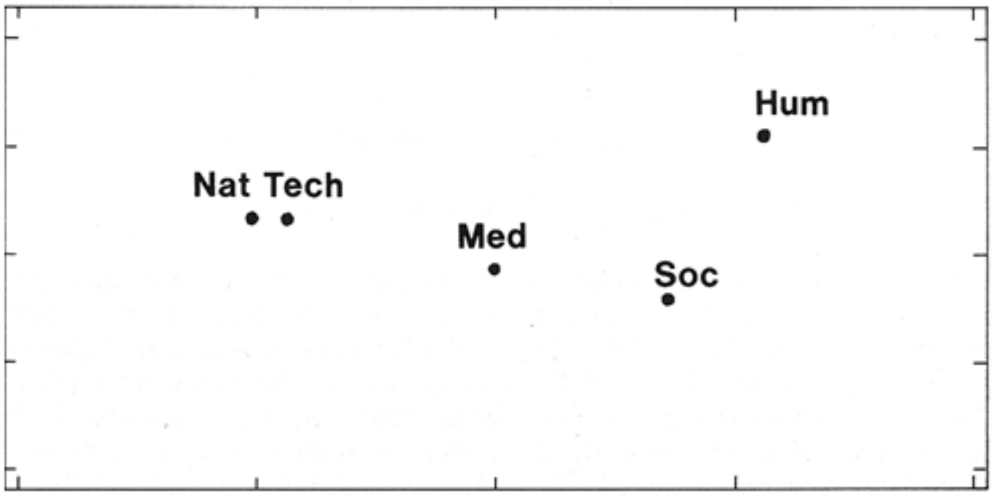
The results across all scientific fields including arts and humanities showed that originality and correct methods were regarded as the highest ranked concepts of scientific quality. Some variations were found between the different data sets but methods and novelty were generally top ranked quality concepts (see Table 1).

Table 1 shows that researchers were united in perceiving Methods, Problems and Results in connection with research quality in all studies. Only in the rating data set we found a deviation that Reasoning was emphasized before Results. Novelty (originality), Stringency and Correctness were the most favoured attributes, but also Depth was ranked high in the questionnaire study (Hemlin, 1993). In Hemlin and Montgomery (1995), Activity/ Productivity of the researcher occurred more frequently than Correctness. Breadth was more stressed than Depth, but for ratings. Intrascientific and Extrascientific Relevance were equally stressed. However, Intrascientific Relevance was more emphasised than Extrascientific Relevance in interview and rating data. In data from free answers results were reversed. Over all data sets, the most frequent combinations of aspects and attributes were Correct or Stringent Methods. In an analysis of differences between soft (social sciences and arts and humanities) and hard sciences (medical, natural and technical sciences) it was consistently shown that soft scientists focused on Theory, Reasoning, Writing Style and to some extent on Problems aspects and the Stringency attribute when assessing scientific quality. In comparison, hard scientists were almost uniformly stressing International Relations as the best indicator of scientific quality.

Differences between scientific fields are summarised and shown by a multidimensional scaling procedure of results from the analysis of responses to all parts of the questionnaire (Figure 2). In figure 2 it is clear that we received different perceptions by hard and soft scientists which are shown by the medical, natural and technical sciences´ respondents clustering together to the left in the figure and the social sciences and arts and humanities clustering to the opposite side (horizontal axis). Secondly, we can observe that fields within the hard sciences are different with respect to the closeness or distance to the soft sciences. The natural scientists being the hardest, then the technical and closest to the soft are the medical scientists. Also, among the soft scientists it is obvious that social scientists are closer to the hard ones and the arts and humanities respondents take the most extreme position on perceptions of scientific quality in comparison with the hard ones. If the vertical axis is considered we will find that also here the arts and humanities are taking the most extreme position in comparison to the others and a bit surprisingly furthest away from the social sciences[4].

[4] The multidimensional scaling procedure does not result in a fixed name of the axis. Instead, they must be inferred theoretically. The horizontal axis in Figure 2 is suggested to be a hard-soft sciences quality perception continuum while the y-axis is more difficult to title. The y-axis distinguishes between arts and humanities, hard sciences and the social sciences on the other extreme end.

Figure 2. Multidimensional scaling showing scientific quality conceptions by natural (Nat), Technical (Tech), Medical (Med), Social (Soc) scientists and researchers in the arts and humanities (Hum).



Adapted from Hemlin (1993)

A more detailed picture of the differences between scientific fields is shown in table 2 below. In this table arts and humanities are the most distinct representatives of the soft scientists. From the results one can see that they were *less* interested than the hard sciences in physical research environments, in international contacts, in successful research, in intrascientific relevance, in more directed research in industrial and sectoral financing and in research evaluations. Instead, arts and humanities researchers favoured reasoning and writing style of papers as quality features. In addition, they supported political and cultural effects of research and increased research grants. They also stressed stringency attributes and theory aspects of research efforts as well as creative research. Another significant feature by humanists was that individual researchers´ brightness was perceived as important. Together with social scientists they differed from one or more of the hard sciences as to favoured aspects of the research effort that is theory (in free answers), reasoning and writing style.

Soft scientists laid less stress on international relations, emphasised political-cultural effects, were against external influences on research, and were less positive to research evaluations than hard scientists. In some areas, social scientists came close to the opinion of natural and technical scientists. Productivity and international contacts were rated higher by social scientists than by the humanists, but researchers´ brightness and increased research funding were rated lower. However, social scientists rated not surprisingly political-cultural research effects higher than hard scientists. Technical scientists regarded extrascientific relevance as a criterion of scientific quality more than natural scientists did. Instead, natural scientists favoured economic resources to technical scientists.

In conclusion, our results demonstrated agreement about the fundamentals of science. They supported the framework, components of scientific quality appeared in scientists´ interview answers and were found important to scientific quality in ratings. The aspect and attributes distinction in judgments of scientific quality was generally supported in ratings and by and large in agreement with free answers. In general, international contacts, intrascientific effects and varied research funding was essential for scientific quality.

Table 2

Significant differences in index variables between research fields

Index variable	**Arts & Humanities**	**Medical sciences**	**Natural sciences**	**Social sciences**	**Technical sciences**	**P**
Problem	>Nat**					.0045
Reasoning	>Tech*			>Tech*		.0073
Writing Style	>Nat**			>Nat*		.0009
Stringency	>Nat**, >Tech*					.0050
Extrascientific Relevance					>Nat*	.0213
International Relations			>Hum*	>Hum*	>Hum*	.0001

Creative research	>Tech**					.0025
Successful research			>Hum**	>Hum*		.0001
Personal brightness	>Soc*, >Nat**					.0001
Physical environment		>Hum**			>Hum**	.0001
Material-Economic effects				>Hum*		.0150
Political-Cultural effects	>Med*, >Nat**			>Med**,>Nat** >Tech*		.0001
Against external influence on research	>Nat**, >Tech**	>Tech**		>Tech**		.0001
Block grants increases scientific quality	>Soc*,>Tech*		>Tech*			.0025
External funding increases scientific quality		>Hum*				.0087
Favourable attitude to research evaluation		>Hum**, >Soc**	>Hum**, >Soc*		>Hum*	.0001

Adapted from Hemlin (1993)

It was possible to identify differences supporting a hard and soft sciences distinction because the distinction implies a differential emphasis on different factors and characteristics of scientific quality. Hard scientists de-emphasised all aspects of the research product which may be an indication of that basics in science are not debated and thus supports the conclusion. Theory aspects were stressed by soft scientists but not by the hard ones. This is in line with Kuhn´s paradigm theory (1970) where pre-paradigmatic sciences debate fundamental theories vividly while paradigmatic (normal) sciences rather focus on fact gathering activities to strengthen already existing theories. However, another result contradicted Kuhn´s theory since soft scientists´ favoured precision in research as much as hard scientists although one might expect hard scientists to be more interested in a greater accuracy of results.

Also, Whitley´s (1984) differentiation of scientific fields into restricted and configurational sciences could be applied to the results. The hard sciences de-emphasis of theory aspects of scientific quality is in agreement with Whitley´s restricted sciences as characterised by sharing common theoretical ideals and basic conceptual assumptions, besides being task specific and using mathematical formalisms. On the contrary, objects studied by soft sciences are approached from competing theoretical perspectives in accordance with the configurational sciences´ features. Our findings that reasoning and writing style are stressed by soft sciences researchers are also similar to Whitley´s idea that configurational sciences make use of a greater variety of definitions and analyses of objects than restricted sciences.

Finally, quality criteria in assessments of grant applications in psychology were studied to validate previous findings from data on perceptions of scientific quality and data from peer review documents where candidates to professorship were assessed. We analysed review protocols (n=413) of grant applications to the Swedish Council for Social Sciences and the Humanities between the years 1988-1993 (Hemlin. Niemenmaa & Montgomery, 1995). The findings corroborated previous studies to a great extent, but some differences were found. Theory and Method aspects were in that order the most frequently used aspects by peers in psychology. This result coincides with the previous results on favoured aspects in the social sciences from ratings but in a reverse order. Stringency, Novelty and Correctness attributes were in that order frequently used to assess grant applications in psychology. In comparison with previous results from the social sciences we can observe that Novelty, Stringency and Extrascientific Relevance were in that order mostly favoured. These are similar results apart from the thirdly ranked attribute (Correctness) by grant application peers. This was instead ranked as attribute number four in previous findings. However, Extrascientific Relevance was applied as an attribute in reviews by peers in psychology, but ranked one place lower.

In conclusion, peers in psychology appeared to share basic values in their reviews of grant applications in psychology, but also in the way they wanted to justify their recommendations to the applicants and other members of the Board of the Social Sciences and the Humanities who make the final decision about granting. We should also take into account that rhetorical purposes as well as notions about what is socially expected from the review protocols may disguise some of the criteria that were applied in the reviews. It is well known that influences such as nepotism, sexism (Wold & Wennerås, 1997) and other biases may distort peer reviews.

Future changes in scientific quality perceptions and criteria

A final section of this chapter will be devoted to the future of scientific quality. We have noticed during the period since - the 1980´s up to the mid 1990´s - the empirical studies of perceptions of scientific quality and quality criteria used in peer review were carried out that changes are going on. Since then a lively debate about changes in science and its conditions in society generally have been taking place. This debate has occurred as well as within the scientific community itself (e.g. the "science wars") as outside with societal actors taking part more intensively. We have witnessed a science policy discussion starting in the 1990´s about a new mode of science, an on-going shift from mode 1 (traditional science) to mode 2 (context dependent science) (Gibbons et al., 1994) and science in a steady state (Ziman, 1994) and the triple helix of universities, industries and governments which is suggested to blur the borders between science and society (Etzkowitz & Leydesdorff, 1997)[5]. All these observations of the scientific development are still weakly supported by empirical data. However, there are some studies that seem to give partial evidence of this "new" science (Hemlin, 2000; Hicks & Katz, 1996). If these trends are taken to be true we would be surprised if they would not make scientific quality assessments and even scientific quality itself change a bit. The big question is only how would it change? What factors are changing, what aspects and attributes will be favoured?

In a rather recent paper we discussed the issue of changing quality criteria in research evaluations and its consequences (Hemlin & Rasmussen, 2006). In table 3 I show a

Table 3

The Transition from Quality Control to Quality Monitoring in Science

Dimension	*Quality Control*	*Quality Monitoring*

[5] However, an early observer of changes in scientific knowledge production called it ´industrialized science´ (Ravetz, 1971).

	(product orientation)	*(process orientation)*
Criteria	Scientific	Scientific and social
Focus	Individual researchers	Organisations, networks
Goal	Valid, reliable knowledge	Socially robust knowledge, Learning
Evaluator	Traditional peers	New peers, users, consultants, lay persons
Evaluation time	After production	Continuously
Science study perspective	1st order: Philosophy and sociology of knowledge	2nd order: Knowledge management, organisational learning

Adapted from Hemlin and Rasmussen (2006)

draft of what we believe is happening in the scientific community and its relations to society at large in connection to quality criteria and its assessment. Our argument in the article is that developments in science and new perspectives on science are changing academic quality control into a quality monitoring system that has a process rather than product orientation, uses new criteria, has other foci and goals, uses different peers, different evaluation times and bring new and organisationally based perspectives to science and technology studies.

The drivers of this change we argue in the paper are new forms of organisations in knowledge production that are crossing the public and private distinction (e.g. Hemlin, 2001). Not only universities produces socially demanded knowledge in contemporary societies, but private knowledge enterprises, knowledge brokers, consultancies and think tanks may be knowledge producers. It appears also that boundaries in science and society are dissolving such as the basic and applied research distinction and disciplinary structures (within academia) as well as the previously strict borders between university, industry and government. For example, we have a long range of university-industry relationships, but also a number of university links with the public community. We have also noticed a more pronounced end-user orientation in science policies at large. There is more emphasis on applications, social accountability and a capitalisation of science in science and science policy discussions. For instance the commercialisation of scientific results is nowadays an important research policy goal in many countries. Finally, scientists' behaviour is changing in that heterogeneous skills and knowledge (e.g., interdisciplinarity), reflexivity (e.g., to put one´s scientific actions into a societal perspective), new careers (e.g., in the private sphere), new organizations (e.g. semi-public-private institutions), and new forms of science (e.g., by means of visualizations in medical fields) are becoming more frequent than previously.

In addition we also have noticed new views of science influencing quality control. They are summarised in the following observations. The first one is an *external view*[6] of science as expressed for instance in the book by Gibbons et al. (1994) that has its roots in the Mertonian tradition of science studies which is empirically based on a critical realist tradition. As opposed to this stance there is simultaneously an *internal view* of science as can be found in the literatures by for example Latour (1987) which is conceptually based rather than empirically and characterised by a social constructivistic epistemology.

Another feature of the new views of science concerns the problematic distinction between basic and applied science, which is so often pronounced nowadays. A number of authors criticised this traditionally fundamental divide in the sciences as outdated and historically biased (see Stokes, 1997). Moreover, Ziman (2000) argued that basic and applied science can both be used as terms about the same research activity depending on the context and who addresses the research. A scientist may carry out basic research although the grant for the research will be termed applied research by the funding body and the departmental unit where the research is taking place is a called "Applied psychology".

We have also witnessed that here is a shift in the view of knowledge from certified knowledge ("justified true belief") according to the philosophy of science tradition to socially robust knowledge (Nowotny, Gibbons & Scott, 2000). The latter view is based on a number of features where the most important ones are: a pragmatic view of science where knowledge is established through its use rather than on certified knowledge, an emphasis on inter-

[6] External means in this context a view of scientific knowledge which does not admit that social factors can penetrate the epistemological core, but only influence or possibly distort it. In accordance, the epistemological core can only be changed by epistemic arguments. In contrast, the internal view of science argues that scientific knowledge is solely socially constructed and that the epistemic domain is collapsed into the social (see e.g. Cole, 1992).

disciplinarity applied in trading zones where different disciplinary oriented scientists collaborate, and value-integrated knowledge where societal values are merged with the intrascientific views of what is typically good science.

Another trend in the literature have appeared and particularly in science policy contexts that emphasises less the individual researcher but rather the knowledge producing organisation in quality assessments by focusing on both truthlike knowledge and trustworthy organising as well as a demand for collaboration or collective research (e.g., in networks, centres of excellence). This view of science makes the knowledge producing organisation come into the foreground for quality control rather than the individual scientist or research group.

Furthermore, the division between science and society is viewed in a new light. Science is now more of a reflexive, social knowledge working institution and an open system, which establishes itself by continuous evaluations, and through science and society partnership. This means that science and society distinctions are no longer as important but rather viewed as interacting parts or aspects of one system. The traditional social contract between science and society in Vannevar Bush´s terms is re-negotitated.

In summary, we argue first that the shift in academic quality control is related to the knowledge environment's skills and abilities to learn (this environment can be seen for instance as a group, a department or an organisation). Quality control will change from being purely cognitive and epistemological to become more than previously a social and organisational phenomenon. This will influence researchers in the field of science and technology studies to interact more frequently with researchers who have organisations (or organising) as study objects.

Knowledge management and organisational learning will become a scientific task rather than a management task. This is a consequence of the observation that science depends to a large extent on its ability to reflect and act on its cognitive, social and institutional base. Basically, knowledge management is also a task that universities should be able to handle in a professional way rather than business companies where the term was invented.

Organisational learning in science will be based on both internally and externally oriented processes and should be based on an open system perspective, where double loop learning can take place (Scott, 1981). Such organisational learning processes will internally entail ways of building, supplementing, sharing and organising knowledge and routines. Moreover, the organisational learning processes directed to the outside environment of scientific organisations are processes that aim at adaption and change. An organisational learning perspective on quality issues in scientific organisations as outlined here will probably be a crucial task for conceptual and empirical research in the future.

Conclusion

We have in the foregoing been presented with a relational view of the scientific quality concept. Different factors could be taken into account when we conceptualise scientific quality. It could be viewed in terms of a research product (e.g., an article), a research environment (e.g., colleagues, premises), research effects (e.g. new theories, new medical drugs), research financing, organisation and policy (e.g., support to centres of excellence), and research evaluation (i.e. how scientific quality is assessed). It was further suggested that these factors interact with one another. For example, a certain research policy may promote a new field in science which has beneficial effects for societal needs. A way to delimit scientific quality was suggested by focusing on the research product and its properties. According to this view quality in science could be described in a common language of aspects (e.g., methods) and attributes (e.g. originality).

The relational view of scientific quality is a conceptual model which is valid over time since it is flexible visavi scientific quality perception changes. In the latter part of the chapter there was outlined a future look ahead at scientific quality and its assessment. It was suggested that there is a change in how quality is looked upon in science and society. We proposed a number of arguments for that this change would lead to a process rather than a product perspective on scientific quality. This implied that quality criteria drifted from science to society, focus shifted from individuals to organizations, goals changed from valid and reliable knowledge to socially robust knowledge, evaluators incorporated new actors, evaluation times were more frequent and the science studies perspective shifted to knowledge management and organisational learning perspectives.

The new perspective on scientific quality is compatible with the previous framework in that it shifts the focus to other factors than previously (or currently if you like). Whether this is a true picture or not should be subject to empirical tests. And whether this is beneficial or not should be discussed by scientists, research policy analysts and others. In the end, we should be convinced that scientific knowledge is never fixed.

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10.2 Lisa 2

The IDEAS Work Programme

EUROPEAN RESEARCH COUNCIL WORK PROGRAMME

Version agreed by the founding members of the ERC Scientific Council and transmitted to the Commission
17 January 2007

This Work programme will be implemented by the Dedicated Implementation Structure of the ERC which the Commission intends to establish in the legal form of an Executive Agency.

(European Commission C(2007) 561 of 26/02/2007)

European Research Council

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Changes to the "Ideas" Work Programme

This work programme is an update with respect to the provisional version adopted on 21 December 2006. The majority of changes are minor typographical corrections. The more substantive modifications are as follows:

Cover page	Insertion of "……..**and transmitted to the Commission 17 January 2007"** and removal of "~~Provisional~~" and relevant footnote
Insertion of current page with main changes	
Section 3.2, 1st paragraph rephrasing	……. at the stage at which they are starting or ~~leading their fist~~ **consolidating their own independent research team** or, …….
Section 3.2, last paragraph rephrasing	make **or consolidate** the transition to independence
Section 3.6, 2nd paragraph	Extension of the eligibility period from 2-~~8~~ to 2-**9** years after first PhD award
Section 3.6, 3d paragraph	Insertion of parentheses: **(1 year per child born after the PhD award)** and **(accumulation of actual time off)**
Section 3.6, last paragraph	Extension of possible cumulative eligibility period from ~~11~~ to **12** years
Section 3.7, title of first element of evaluation	Title changes from: "~~Potential to become world class leader~~" to "**Potential to perform work class research**"
Section 3.8, 4th paragraph	Insertion of parentheses: **(with half-point resolution)** following the grading scales
Section 4	Identification of the **College of Europe** as the recipient of the CSA

Table of Contents

1. Introduction

The European Research Council (ERC) has a unique position as a pan-European funding organisation designed to support the best science and scholarship. It will operate at the highest level of ambition to generate the maximum benefit to European research from the activities it pursues. As a new organisation, it will not be hostage to the conventional wisdom; instead, it will take the best practice wherever it can be found.

The fundamental principle for all ERC activities is that of stimulating investigator-initiated frontier research across all fields of research, on the basis of excellence. Awards will be made and grants operated according to simple procedures that maintain the focus on excellence, encourage initiative and combine flexibility with accountability.

By using competition on the basis of excellence at the European level, the ERC will add value to other funding schemes, such as those of Research Funding Agencies operating at the national level. The ERC will also complement other research activities under the 7th framework programme managed by the European Commission, including the Marie Curie schemes, strategic basic research in support of thematic priorities, and support for European infrastructures.

The ERC will aim to create leverage towards structural improvements in the research system of Europe. For example, since many investigators who will be involved in the funded activities are likely to be working within universities, academies, research centres and similar establishments, the ERC can have a strong incentive effect on these institutions by:

- Offering greater independence to early stage (starting) investigators as an investment in the next generation and towards enhancement and sustainability of the institutions' research capacity.

- Setting quality benchmarks, allowing institutions better to judge their research performance.

- Revealing in a bottom up manner the availability of top talent in various fields and emerging areas, and thus assisting the institutions' strategic thinking and priority setting.

- Promoting interaction of European research institutions with similar institutions around the world on the basis of the participation of individual researchers from these institutions in ERC activities.

The Scientific Council of the ERC establishes the ERC's strategy. It has full authority over decisions on the type of research to be funded and acts as guarantor of the quality of the activity from the scientific perspective. Its tasks cover, in particular, the development of the annual work programme, the establishment of the peer review process, as well as the monitoring and quality control of the programme's implementation from the scientific perspective including the development of the ERC's strategy regarding international cooperation.

2. ERC Grants

Two types of ERC grant will be available. These two funding streams, operating on a "bottom-up" basis, across all research fields, without predetermined priorities, are expected to be the core of the ERC's operations for the duration of the 7th Framework Programme.

- The ERC Starting Independent Researcher Grants (ERC Starting Grants). The objective is to provide adequate support to the independent careers of excellent researchers, whatever their nationality, located in or moving to the EU and associated countries, who are at the stage of establishing and leading their first research team or programme.

- The ERC Advanced Investigator Grants (ERC Advanced Grants). The objective is to encourage and support excellent, innovative investigator-initiated research projects by leading advanced investigators across the EU member states and countries associated to the framework programme. This funding stream will complement the Starting Grant scheme by targeting the population of researchers who have already established themselves as being independent research leaders in their own right.

The Grants will support projects carried out by individual teams which are headed by a single **principal investigator** of any nationality and, if necessary, include additional **team-members**[1]. These teams could be of national or trans-national character.

The grant will be awarded to the institution (Applicant Legal Entity) that will be engaging and hosting the Principal Investigator, with the attached **commitment that this institution will grant the Principal Investigator the independence to manage the research funding for the duration of the project.**

The ERC's funding will increase substantially over the period 2007-2013. **The first call will cover research proposals only for Starting Grants. The ERC Advanced Grant scheme will be introduced in the second call for proposals, expected to be published later in 2007**.

From 2008 onwards it is anticipated that both ERC Starting Grants and ERC Advanced Grants will be the subject of annual calls. As experience and the portfolio of funded projects builds up, the Scientific Council will be in a position to evaluate the programme achievements, adjust mechanisms and procedures as needed, and elaborate its scientific strategy as this is seen to be appropriate.

[1] With the focus on the Principal Investigator, the concept of individual team is fundamentally different from that of a traditional "network" or "research consortium"; proposals of the latter type will not be acceptable under this scheme

3. ERC Starting Independent Researcher Grants

3.1 Background

A widely accepted view is that Europe offers insufficient opportunities for young investigators to develop independent careers and make the transition from working under a supervisor to being independent research leaders in their own right. This structural problem leads to a dramatic waste of research talent in Europe. It limits or delays the emergence of the next-generation of researchers, who bring new ideas and energy, and it encourages highly talented researchers at an early stage of their career to seek advancement elsewhere, either in other professions or as researchers outside Europe.

Up to now, only some relatively small scale efforts have been made in Europe to address these problems. The ERC is well placed to develop a broad, international and consistent scheme on the much larger scale that will be necessary to make a real impact on European science and scholarship.

3.2 Objectives of the scheme

ERC Starting Independent Researcher Grants are designed to support researchers (Principal Investigators) at the stage at which they are starting or consolidating their own independent research team or, depending on the field, establishing their independent research programme[2].

Independence implies that the Principal Investigator has the authority to:

- apply for funding independently of senior colleagues
- manage the research funding for the project and make appropriate resource allocation decisions
- publish as senior author and invite as co-authors only those who have contributed substantially to the reported work
- supervise team members, including research students or others
- have access to reasonable space and facilities for conducting the research

The scheme will support the creation of independent and excellent new individual research teams and will strengthen others that have been recently created.

The peer review evaluation Panels will be empowered to conclude whether the grant and the conditions specified by the hosting institution will allow the Principal Investigator to make or consolidate the transition to independence[3].

[2] It is recognised that in certain fields (e.g. in the humanities and mathematics), research is often performed individually, aside from guiding research students. The term "team" is used in the broadest sense, including cases where a single individual works independently or conversely in cases when several investigators are working so closely together as to constitute a single team.

3.3 Size of ERC Starting Grants

The level of the ERC Starting Independent Researcher Grants will be between €100,000 and €400,000 per year for a period of up to 5 years.[4]

The Community financial contribution shall be in the form of a grant to the budget corresponding to 100% of the total eligible and approved direct costs and a contribution of 20% of the total eligible direct costs (excluding sub-contracting) towards indirect costs.

The level of the grant offered will be determined by the peer review evaluation, on the basis of the needs of the project, judged by the panel against the requested budget of the proposal[5].

3.4 Submission procedure and peer review evaluation

Proposals are submitted by the Principal Investigator, who has scientific responsibility for the project, on behalf of the hosting institution which is the "applicant legal entity"[6], confirming the hosting institution's commitment to the conditions of independence set out in section 3.2. Applications may be made in any field of research with particular emphasis on the frontier of science and scholarship. Proposals of an interdisciplinary nature which cross the boundaries between different panels, proposals in new and emerging fields and "high-risk, high-gain" proposals are encouraged.

Pre-registration of the proposals is required and should be done as early as possible in advance of the proposal submission.

The Scientific Council has established, based on world-wide practice, the following indicative budget for each of the 3 main research domains:
Physical Sciences & Engineering: 45%
Life Sciences: 40%
Social Sciences & Humanities: 15%
A reserve in the overall budget, not exceeding 20% of the total, may be retained for funding proposals that have been judged of comparable merit but beyond the budget allocated to the

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3 Note that the conditions of independence provided to the PI and his/her team are consistent with the "*The European Charter for Researchers and The Code of Conduct for the Recruitment of Researchers*", C(2005)576, 11.3.2005

4 The level of the grant represents a maximum overall figure – payments must be justified on the basis of the amounts actually disbursed for the project.

5 The requested budget should reflect the Principal Investigator's estimation of the real project cost, taking account of the nature of the project and team and whether it is intended to set up a new team or add support to a recently-established team. Evaluation panels will review the proposed budget and, as appropriate, suggest adjustments using rounded figures (increments of € 10 000).

6 In very exceptional cases, the Principal Investigator may himself/herself act as the "applicant legal entity", if he/she is acting in the capacity of the legal entity in his/her own right.

specific research domain, and can be used to further promote frontier research and interdisciplinarity.

A two-stage application procedure will be followed. At the first stage, a proposal will be presented and evaluated, describing the project and the qualifications of the Principal Investigator. Successful Principal Investigators at the first stage will be invited to submit a more detailed proposal by the second stage deadline.

The following elements will be required:

a) CV and a self-evaluation of the Principal Investigator's research achievements, including a succinct "funding ID" which must specify any current research grants and any ongoing application for work related to the proposal.
b) Description of scientific and technical aspects of the project
c) Description of the scientific environment and resources

Strict limits will be applied to the length of proposals[7]:

- Stage 1: 8 pages total (3+4+1)
- Stage 2: 16 pages total (4+10+2)

Only the material that the proposal contains within these limits will be evaluated.

At stage 1, the hosting institution must confirm its association and support to the project and Principal Investigator. At stage 2, the hosting institution must provide a binding statement that the conditions of independence, set out in section 3.2, are already fulfilled or will be provided to the Principal Investigator if the application is successful.[8]

The peer review evaluation for ERC Starting Grants will be carried out by means of a structure of high level Panels.[9] The Panels may be assisted by referees and will carry out interviews with applying Principal Investigators at the second stage of the evaluation. The assignment of the proposals to the various panels will take into account the subject of research of each proposal.

Information on the first ERC Starting Grant call for proposals is provided in Annex 1. The proposed research activities should respect fundamental ethical principles[10]. Proposals must

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[7] 12 pt font, single spaced with minimum 2 cm margins.

[8] These conditions will be the subject of an agreement (supplementary to the Grant agreement between the principal investigator and the hosting institution) based on the principles set out in section 3.2.

[9] Approximately 20 panels will be established to span the spectrum of research areas, each of which will have responsibility for a broadly-defined set of research fields. Panel members will be compensated on the evaluation tasks they perform. Additional reimbursement of travel and subsistence will be carried for assignments involving travel. Additional referees who may assist the evaluation panels will not be compensated.

[10] Including those reflected in the Charter of Fundamental Rights of the European Union. The opinions of the European Group on Ethics in Science and New Technologies are and will be taken into account. Research activities should also take into account the Protocol on the Protection and Welfare of Animals, and reduce the use of animals in research and testing, with a view to ultimately replacing animal use.

meet a quality threshold in order to qualify for funding. Amongst the proposals meeting the quality threshold in any call for proposals, a ranked list (stage 2) will be drawn up to determine the retained proposals to be funded in the context of the available budget[11]. Separate retained lists may be prepared for each of the three main research domains indicated above, in addition to the overall retained list. The number of proposals passing the first stage of the evaluation will be limited to avoid oversubscription at the second stage.

3.5 Reapplications and multiple applications

Rules will apply to reapplications by Principal Investigators for ERC grants whose proposals are not judged to meet the threshold of quality, as well as for multiple applications within the same or different type of ERC grants. These rules, which may subsequently be modified by the Scientific Council in light of experience, are as follows:

- No principal or collaborating investigator may be associated with more than one application to the ERC during the same year.
- A Principal Investigator may not submit an application for an ERC grant during the calendar year following the submission of an unsuccessful application unless that application was judged to meet the quality threshold for funding. (Note: this rule will not apply to the second call for ERC Starting Grants, in view of the long interval between first and second calls.)
- Only one ERC grant by the Principal Investigator can be active at any time. In addition, applications by researchers who have successfully applied for a similar type of funding (e.g. EURYI award) will not be normally accepted unless the objectives of the proposed project are clearly distinct. However, it will be possible for ERC Starting grantees to compete for an Advanced Investigator Grant to allow for uninterrupted funding of their project/activity.

3.6 Eligibility Criteria

Eligible Scientific Fields

Applications may be made in any field of research[12].

Funding of human embryonic stem cell research will be possible within the ethical framework defined in the EC 7th Framework Programme[13] as well as the "Ideas" Specific Programme.

[11] Following allocation of available funding to the highest ranked proposals, a reserve list may be established in case additional funds become available

[12] Research proposals directed towards nuclear energy applications should be submitted to relevant calls under the EURATOM Specific Programme

Eligible Principal Investigator

The ERC actions are open to researchers of any nationality who would like to set their research activity up in any European Union Member State as well as any Associated or Associated- Candidate Country.

The Principal Investigator can be of any age and nationality and he/she can reside in any country in the world at the time of the application. He/she must have been awarded[14] his/her first PhD (or equivalent doctoral degree) more than 2 and less than 9 years prior to the deadline of the call for proposals.

Extensions of this period may be allowed only in case of eligible career breaks which must be properly documented: maternity (1 year per child born after the PhD award) & paternity leave (accumulation of actual time off) and leave taken for long-term illness, national service. Leave taken for unavoidable statutory reasons (e.g. clinical qualifications) may also count as an extension.

The cumulative eligibility period should not in any case surpass 12 years following the award of the first PhD. No allowance will be made for part-time working (2 years of half-time working count as 2 full-time years).

Eligible Hosting Institution (Applicant Legal Entity)

This institution will host and engage the Principal Investigator for at least the duration of the grant. It must be situated in one of the European Union Member States, or one of the countries that are Associated to the Framework Programme including the countries that are candidates to become EU members. It may also be an International European Interest Organisation (such as CERN, EMBL, etc.) or the European Commission's Joint Research Centre. The country of primary residence of the Principal Investigator during the period of the grant must be in one of the eligible states.

Normally, the applicant legal entity will be the only participating legal entity. Other legal entities, including those located in third countries, may however be involved and receive funding to support the work of additional team members, if so specified in the grant award. This presupposes that in such cases the scientific added value is properly justified and accepted during evaluation by the peer review panels.

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[13] "Commission Declaration" in Annex IV of European Council's political agreement on 7th Framework Programme on 25/07/2006. Accordingly, proposals which will include research activities which destroy human embryos, including for the procurement of stem cells, will not be submitted to the Regulatory Committee. The exclusion of funding of this step of research will not prevent funding of subsequent steps involving human embryonic stem cells.

[14] The reference date towards the calculation of the eligibility period should be the date of the actual award according to the national rules in the country that the degree was awarded.

3.7 Evaluation criteria

Excellence is the sole criterion of evaluation. It will be applied to the evaluation of both the Principal Investigator and the research project. The evaluation will also assess the extent to which the research environment enables the excellence of the project to be achieved.

The detailed criteria applying to these 3 elements of the proposal are as follows:

1. Principal Investigator: Potential to perform world class research

Quality of research output: Has the Principal Investigator published in high quality peer reviewed journals or the equivalent? To what extent are these publications ground-breaking and demonstrative of independent creative thinking and capacity to go significantly beyond the state of the art?

Intellectual capacity and creativity: To what extent does the Principal Investigator's record of research, collaborations, project conception, supervision of students and publications demonstrate that he/she is able to confront major research challenges in the field, and to initiate new productive lines of thinking?

2. Quality of the proposed research project

Ground-breaking nature of the research: Does the proposed research address important challenges in the field(s) addressed? Does it have suitably ambitious objectives, which go substantially beyond the current state of the art (e.g. including trans-disciplinary developments and novel or unconventional approaches)?

Potential impact: Does the research open new and important, scientific, technological or scholarly horizons?

Methodology:

a) is the outlined scientific approach (including the activities to be undertaken by the individual team members) feasible? (Stage 1)

b) is the proposed research methodology (including when pertinent the use of instrumentation, other type of infrastructures etc.) comprehensive and appropriate for to the project? Will it enable the goals of the project convincingly to be achieved within the timescales and resources proposed and the level of risk associated with a challenging research project? (*Stage 2*)

3. Research Environment (to be assessed only during stage 2 evaluation)

Transition to independence: Will the proposed project enable the Principal Investigator to make or consolidate the transition to independence?

Hosting institution (normally applicant legal entity): Does the institution hosting the project have most of the infrastructure necessary for the research to be carried out? Is it in a position to provide an appropriate intellectual environment and infrastructural support and to assist in achieving the ambitions for the project and the Principal Investigator?

Participation of other legal entities: If it is proposed that other legal entities participate in the project, in addition to the applicant legal entity, is their participation fully justified by the scientific added value they bring to the project?

3.8 Application of Criteria

Panels and referees will evaluate and score numerically the proposals under the criteria of Heading 1: *Potential of the Principal Investigator* and Heading 2: *Quality of the proposed research project.*

Proposals will be evaluated under Heading 3 criteria on a "pass/fail" basis and commented but not scored during stage 2 of the evaluation.

The overall scoring of the proposals will integrate the strengths and weaknesses including these scores as well as an overall appreciation of the proposal.

Each evaluation criterion (Heading 1 and 2) will be marked on a scale of 0 to 5 (with half-point resolution). The full proposal will be evaluated on a scale of 0 to 10 (with half-point resolution) and an overall quality threshold of 8/10 will be used to establish the "retained list" of proposal which will be ranked in order of priority for funding.

For the proposals retained at stage 2, panels will establish a recommended budget according to the provisions of section 3.3.

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4. Coordination & Support Actions (CSA)

To assist in preparing its future activities and optimising its impact, the ERC will provide financial support for the analysis of developments and trends in science and technology, analysis and dissemination of research results and impact assessment. This will be done by means of "Coordination and Support Actions" (CSAs) established on the basis of specific calls for proposals to be launched during the course of the ERC's operations.

CSAs (Support Actions) will also be used to support the establishment and activities of the Secretary General of the ERC who will assist the ERC Scientific Council in ensuring its effective liaison with the ERC dedicated implementation structure and with the Commission, and in monitoring the effective implementation of its strategy and positions as carried by the ERC dedicated implementation structure. It is envisaged to include a similar CSA in the subsequent work programmes.

In particular the CSA to support the Secretary General will be established immediately by means of a grant to the College of Europe[15].

The objective of the CSA will be to provide an independent position for the Secretary General, who will be selected by the Scientific Council and work under its authority to assist in the organisation of its work, and assure effective liaison with the European Commission and the dedicated implementation structure.

The maximum budget will be € 335,000 for the year 2007.

4.1 Eligibility Criteria

Proposals for co-ordination and support actions must be focused on requirements specified in the work programme and/or call for proposals.

Applicants for co-ordination and support actions must be situated in one of the European Union Member States, or one of the countries that are Associated to the Framework Programme including the countries that are candidates to become EU members. Applications from International European Interest Organisations (such as CERN, EMBL, etc.) or the European Commission's Joint Research Centre are also eligible.

4.2 Evaluation Criteria

Proposals for Coordination and Support Actions (CSA) will be evaluated on the basis of the following criteria:

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[15] In conformity with the provisions of the Specific Programme “Ideas” and in compliance with Article 14(a) of the Rules of Participation and Article 168 of the Implementing Rules of the Financial Regulation.

1. Objectives and impact (award):

Are the objectives of the proposed project consistent with the requirements specified in the work programme and/or call for proposals? Will the project have a substantial impact in the context of the ERC strategic objectives?

2. Quality and effectiveness (award):

Is the proposed methodology and work plan effective in reaching the goals of the project? Does it ensure the highest quality and/or utility of results? Does it, where appropriate, correspond to, or go beyond, best current practice?

3. Resources (selection):

Are the resources (personnel, equipment, other) appropriate for the goals of the project? Will they be used effectively? Are they properly justified?

Indicative budget for the ERC 2007 Work Programme

Call	2007 M€
ERC-2007-StG	289.5
OTHER ACTIVITIES:	0.335
EVALUATION COSTS	2.00
ESTIMATED TOTAL BUDGET ALLOCATION (rounded)	**291.8**

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<u>Call title: ERC Starting Independent Researcher Grant (ERC-2007-StG)</u>

Please note that the call fiche has been updated with respect to the provisional version published on CORDIS on 22 December 2006. The substantive modifications are as follows:

Deadline	Insertion of 2nd stage deadline: 17 September 2007 at 17.00 (Brussels local time)
Minimum number of participants	Clarification: "At least 1 independent legal entity established in one of the European Union Member States, or one of the countries that are Associated to the Framework Programme including the countries that are candidates to become EU members…"
Evaluation procedure	Removal of bullet point: ~~*The second stage deadline will be announced with the invitation to submit a second stage proposal*~~
Update of web sites:	http://erc.europa.eu http://cordis.europa.eu/fp7/ideas/home_en.html

Annex 1 Call Information

Call Title: Call for proposals for *ERC Starting Independent Researcher Grant*

Call identifier: ERC-2007-StG

Date of publication: 22 December 2006

Date from which proposals are receivable: 1 April 2007

Call deadline: 1st Stage - **25 April 2007** at 17.00 (Brussels local time)
2nd Stage - **17 September 2007** at 17.00 (Brussels local time)

Indicative budget: 289.5 million EUR from 2007 budget

Activity: European Research Council Starting Grants

Minimum number of participants: At least 1 independent legal entity established in one of the European Union Member States, or one of the countries that are Associated to the Framework Programme including the countries that are candidates to become EU members (in the case of the participation of more than one legal entity the participants are not obliged to establish a consortium agreement)

Restrictions on participation: see eligibility criteria in the Work Programme

Topics: Applications may be made in any field of research, other than those specifically excluded from the 7th framework programme

Evaluation procedure:

- The evaluation is carried out through evaluation panels, assisted by referees.
- Proposals may be evaluated remotely.
- The evaluation shall follow a two stage submission.
- Interviews with the applying Principal Investigators will be carried out during the second stage of the evaluation.

Evaluation criteria: See the work programme for the applicable criteria

Information on the modalities of the call and guidance to applicants on how to submit projects is available on:

http://erc.europa.eu
http://cordis.europa.eu/fp7/ideas/home_en.html

10.3 Lisa 3

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Annex to the decision

ERC Work Programme 2015

European Research Council

Established by the European Commission

(European Commission C(2014)5008 of 22 July 2014)

Who should read this document?

This document is the annual work programme for the European Research Council funded by the European Union's Horizon 2020 Framework Programme for Research and Innovation. It is established by the Scientific Council of the ERC and subsequently adopted by the European Commission.

Principal Investigators who wish to apply to one of the ERC's calls will need to apply through the Participants Portal. This contains all the information necessary for applying to each ERC call as well as details of your National Contact Point who can provide information and personalised support in your native language at:

http://ec.europa.eu/research/participants/portal/page/home

Potential applicants, and those interested in more information on the ERC in general can find out more about the ERC, including the background to the ERC's mission and organisation, a description of the main funding schemes, a step by step guide to applying to the ERC and details of funded projects here:

http://erc.europa.eu/

Summary of main features in 2015

Three ERC frontier research grants will be available under Work Programme 2015: Starting; Consolidator; and Advanced Grants.

The Scientific Council will analyse the pilot phase of the ERC Synergy Grant (calls were made under Work Programmes 2012 and 2013) before deciding on future calls. There will be no call under Work Programme 2015.

Important extensions to the restrictions on applications will apply to the 2015 calls based on the outcome of the evaluation of the 2014 calls – see restrictions on submission of proposals under "Eligibility criteria" below.

ERC Principal Investigators will also continue to be able to apply for Proof of Concept Grants.

Indicative summary of main calls from the 2015 budget[1]

	Starting Grant	*Consolidator Grant*	*Advanced Grant*	*Proof of Concept Grant*
Call identifier	**ERC-2015-StG**	**ERC-2015-CoG**	**ERC-2015-AdG**	**ERC-2015-PoC**
Call Opens	7 October 2014	13 November 2014	10 February 2015	7 November 2014
Deadline(s)	3 February 2015	12 March 2015	2 June 2015	5 February 2015 28 May 2015 1 October 2015
Budget million EUR *(estimated number of grants)*	430 (330)	585 (330)	630 (280)	20 (130)
Planned dates to inform applicants	7 July 2015 12 November 2015	6 August 2015 20 January 2016	18 November 2015 16 March 2016	1 May 2015 1 October 2015

[1]These opening dates and call deadlines are indicative. The Director-General responsible for the call may open it up to one month prior to or after the envisaged opening date. The Director-General responsible may delay the envisaged deadline by up to two months. The budget amounts for 2015 are subject to the availability of the appropriations provided for in the draft budget for 2015 after the adoption of the budget for 2015 by the budgetary authority or if the budget is not adopted as provided for in the system of provisional twelfths.

				31 January 2016
Indicative date for signature of grant agreements	12 March 2016	20 May 2016	16 July 2016	5 September 2015 1 February 2016 31 May 2016

Table of contents

Objectives and principles of ERC funding

The fundamental activity of the ERC is to provide attractive, long-term funding to support excellent investigators and their research teams to pursue ground-breaking, high-gain/ high-risk research.

Research funded by the ERC is expected to lead to advances at the frontiers of knowledge and to set a clear and inspirational target for frontier research across Europe.

Scientific excellence is the sole criterion on the basis of which ERC frontier research grants are awarded

The evaluation of ERC grant applications is conducted by peer review panels composed of renowned scientists and scholars selected by the ERC Scientific Council. The panels may be assisted by remote experts.

The ERC's peer review evaluation process has been carefully designed to identify scientific excellence irrespective of the gender, age, nationality or institution of the Principal Investigator and other potential biases, and to take career breaks, as well as unconventional research career paths, into account. The evaluations are monitored to guarantee transparency, fairness and impartiality in the treatment of proposals.

Applications can be made in any field of research

The ERC's frontier research grants operate on a 'bottom-up' basis without predetermined priorities.

The ERC puts particular emphasis on the frontiers of science, scholarship and engineering. In particular, it encourages proposals of an interdisciplinary nature which cross the boundaries between different fields of research, pioneering proposals addressing new and emerging fields of research or proposals introducing unconventional, innovative approaches and scientific inventions.

Independent researchers of any age and career stage can apply for attractive long-term funding

The ERC awards funding to excellent investigators looking to set up or consolidate their own independent research team or programme, as well as to already established research leaders.

The ERC awards generous, long-term funding for a period of up to five years for the Starting, Consolidator and Advanced Grants. The Scientific Council will review funding conditions regularly to make sure that grants remain attractive both at European and international level.

The maximum grant varies by grant type. An ERC grant can cover up to 100% of the total eligible direct costs of the research plus a contribution towards indirect costs.

ERC grants are portable[2] as described in the ERC Model Grant Agreement.

The ERC aims to use procedures that maintain the focus on excellence, encourage initiative and combine simplicity and flexibility with accountability. The ERC is continuously looking for further ways to improve its procedures in order to ensure that these principles are met.

Principal Investigators from anywhere in the world can apply for an ERC grant

ERC grants are open to researchers of any nationality who may reside in any country in the world at the time of the application.

> *The ERC is particularly keen to encourage excellent proposals* ***from Principal Investigators based outside Europe*** *that wish to carry out a project with a host institution in the EU or in one of the Associated Countries.*

However the host institution must be established in an EU Member State or Associated Country. In certain conditions team members may be based outside of the EU or an Associated Country (see "Eligible host institution" below).

[2] *Portability* means that the Principal Investigator may request to transfer the entire grant or part of it to a new beneficiary, under specific conditions included in the ERC Model Grant Agreement. These conditions may include provisions for the transfer of equipment purchased and used exclusively for the implementation of the project.

The ERC frontier research grants aim to empower individual researchers and provide the best settings to foster their creativity

The Starting, Consolidator and Advanced Grants will support projects carried out by individual teams which are headed by a single Principal Investigator. The constitution of the research teams is flexible. Depending on the nature of a project the research team may involve team members from other research organisations situated in the same or a different country (see "Eligible host institution" below).

> *With the focus on the Principal Investigators, the concepts of the individual team is fundamentally different from that of a network or consortium of undertakings, universities, research centres or other legal entities. Proposals from such* ***consortia*** *should not be submitted to the ERC.*

Host institutions must provide appropriate conditions for the Principal Investigator to independently direct the research and manage its funding

An ERC grant is awarded to the institution that engages and hosts the Principal Investigator[3]. Grants are awarded to the

[3] Normally the Principal Investigator will be employed by the Host Institution, but cases where, for duly justified reasons, the Principal Investigator's employer cannot become the host

host institution with the explicit commitment that this institution offers appropriate conditions for the Principal Investigator to independently manage the ERC funded research. These conditions[4], including the '*portability*' of the grant, are the subject of a supplementary agreement between the Principal Investigator and the host institution[5] and must ensure that the Principal Investigator is able to:

- apply for funding independently;
- manage the research and the funding for the project and make appropriate resource allocation decisions;
- publish independently as senior author and include as co-authors only those who have contributed substantially to the reported work;
- supervise the work of the team members, including research students, doctoral students or others;
- have access to appropriate space and facilities for conducting the research.

Public or private institutions, including universities, research organisations and undertakings can host the Principal Investigator and his/her team as long as the principles indicated above are respected and the Principal Investigator is not constrained by the research strategy of the entity.

The ERC welcomes applications from Principal Investigators ***hosted by private for-profit research centres,*** *including industrial laboratories.*

Host institutions are expected to make all appropriate efforts to provide the conditions to attract and retain scientists and scholars of the calibre to be awarded an ERC grant, within the framework provided by the ERC Model Grant Agreement and any other available administrative and legal possibilities.

Open access

The ERC supports the principle of open access to the published output of research, including peer-reviewed articles, monographs, data and data related products such as computer codes, as a fundamental part of its mission. The ERC considers that providing free online access can be the most effective way of ensuring that the fruits of the research it funds can be accessed, read and used as the basis for further research.

institution, or where the Principal Investigator is self-employed, can be accommodated. The specific conditions of engagement will be subject to clarification and approval during the granting procedure or during the amendment procedure for a change of host institution.

[4] These conditions are consistent with the 'The European Charter for Researchers and The Code of Conduct for the Recruitment of Researchers'.

[5] This is supplementary to the ERC Grant Agreement and is described in the ERC Model Grant Agreement.

Under Horizon 2020, beneficiaries of ERC grants must ensure open access to all peer-reviewed scientific publications relating to its results. The detailed requirements on open access to publications are contained in the Horizon 2020 ERC Model Grant Agreement[6].

Ethical principles

The proposed research and innovation activities shall comply with ethical principles and relevant national, Union and international legislation, including the Charter of Fundamental Rights of the European Union and the European Convention on Human Rights and its Supplementary Protocols. Particular attention shall be paid to the principle of proportionality, the right to privacy, the right to the protection of personal data, the right to the physical and mental integrity of a person, the right to non-discrimination and the need to ensure high levels of human health protection. The proposed research and innovation activities shall have an exclusive focus on civil applications.

Funding of human embryonic stem cell research is possible within the ethical framework defined in the Horizon 2020 Framework Programme for Research and Innovation 2014 – 2020.

Research Integrity

It is essential to maintain and promote a culture of research integrity at all stages of the evaluation and granting process to make ERC competitions fair and efficient and to maintain the trust of both the scientific community and society as a whole.

Cases of scientific misconduct such as fabrication, falsification, plagiarism or misrepresentation of data that may arise during the evaluation or throughout the life cycle of an ERC funded project will be addressed vigorously by the ERC within the applicable legal and procedural framework. Any breach of research integrity by Principal Investigators or beneficiaries may be sanctioned by measures such as the exclusion of proposals from evaluation, requests for measures to be taken by the host institution, reduction of the grant and suspension or termination of grants.

However, the host institutions that engage and host ERC Principal Investigators have the primary responsibility for the detection of scientific misconduct and for the investigation, and adjudication of any breaches of research integrity that may arise. Therefore host institutions are expected to have structures in place to uphold research integrity and to make all appropriate efforts to verify that no allegations of scientific misconduct are pending against any Principal Investigator applying for or participating in an ERC grant and to bring to the attention of the

[6] Beneficiaries of ERC frontier research grants funded under this Work Programme may also opt-in, on an individual and voluntary basis, to the Horizon 2020 Pilot on Open Research Data in order to facilitate access, re-use and preservation of research data generated by the action. Beneficiaries choosing this option should understand the additional requirements that apply to actions that opt-in to the Pilot as described in the Horizon 2020 ERC Model Grant Agreement.

ERC any such allegations or cases of scientific misconduct.

The ERC applies the same rigour to ensuring that its evaluation process is governed by principles of research integrity, in particular through rules on confidentiality and conflict of interest.

ERC frontier research grants

Funding rates

Maximum size of grant and grant assessment

The maximum grant varies by grant type.

During the peer review evaluation, evaluation panels will assess the funding requested by the applicant against the needs of the project before making any recommendation for funding. The funding requested must be fully justified by an estimation of the real project cost. The panels may suggest modifications to the indicative budgetary breakdown in the application, particularly where they consider funding requests to be not properly justified. In such cases they shall explain in writing any such suggested modification. The Principal Investigator will have the freedom to modify the budgetary breakdown during the course of the project.

Union Contribution

The Union financial contribution will take the form of the reimbursement of up to 100% of the total eligible and approved direct costs and of flat-rate financing of indirect costs on the basis of 25% of the total eligible direct costs[7]. The level of the awarded grant represents a maximum overall figure – the final amount to be paid must be justified on the basis of the costs actually incurred for the project.

Call budgets

For the Starting, Consolidator and Advanced Grant calls an indicative budget will be allocated to each panel in proportion to the budgetary demand of its assigned proposals.

[7] Excluding the direct costs for subcontracting and the costs of resources made available by third parties which are not used on the premises of the host institution.

Eligibility criteria

Eligible proposals

All proposals must be complete and submitted before the relevant call deadline. A complete proposal entails all parts or sections (see *"Proposal submission and description"* below). Incomplete proposals may be declared ineligible.

The content of the proposal must relate to the objectives and to the grant type set out in the call, as defined in this work programme. A proposal will only be deemed ineligible on grounds of 'scope' in clear-cut cases.

Where there is a doubt on the eligibility of a proposal, the peer review evaluation may proceed pending a decision following an eligibility review committee[8]. If it becomes clear before, during or after the peer review evaluation phase, that one or more of the eligibility criteria has not been met, the proposal will be declared ineligible and not considered any further.

Eligible Scientific Fields

Applications may be made in any field of research[9].

Eligible Principal Investigator

The ERC actions are open to researchers of any nationality who intend to conduct their research activity in any Member State or Associated Country. Principal Investigators may be of any age and nationality and may reside in any country in the world at the time of the application. However Principal Investigators funded through the ERC frontier research grants shall spend a minimum percentage of their total working time in an EU Member State or Associated Country and a minimum percentage of their total working time on the ERC project (see profiles of Starting, Consolidator and Advanced Grant Principal Investigators below).

Starting, Consolidator and Advanced Grant proposals are submitted by the Principal Investigator who has scientific responsibility for the project, on behalf of the host institution. There are specific eligibility criteria for a Principal Investigator applying to the Starting or Consolidator Grants based on the date of award of his/her first PhD (or equivalent

[8] For further information see ERC rules for submission and evaluation.

[9] Research proposals within the scope of Annex I to the Euratom Treaty, namely those directed towards nuclear energy applications, shall be submitted to relevant calls under the Euratom Framework Programme.

doctoral degree[10]) as below. This "streaming" allows applicants to be compared with researchers at a similar career stage.

[10] See ERC Scientific Council's note on 'PhD and Equivalent Doctoral Degrees' at Annex 2, including specific provisions for holders of medical degrees.

	Starting Grant	Consolidator Grant	Advanced Grant
Specific Eligibility Criteria	Principal Investigator shall have been awarded his/her first PhD ≥ 2 and ≤ 7 years prior to 1 January 2015	Principal Investigator shall have been awarded his/her first PhD > 7 and ≤ 12 years prior to 1 January 2015	none

The reference date towards the calculation of the eligibility period should be the date of the actual award according to the national rules in the country where the degree was awarded.

However, the effective elapsed time since the award of the first PhD taken into consideration for eligibility can be reduced ***in the following properly documented circumstances.***

For maternity, the effective elapsed time since the award of the first PhD will be considered reduced by 18 months for each child born ***before or after*** *the PhD award. For paternity, the effective elapsed time since the award of the first PhD will be considered reduced by the documented amount of paternity leave actually taken for each child born* ***before or after*** *the PhD award.*

For long-term illness[11], clinical training or national service the effective elapsed time since the award of the first PhD will be considered reduced by the documented amount of leave actually taken by the Principal Investigator for each incident which occurred ***after*** *the PhD award.*

[11] Over ninety days for the Principal Investigator or a close family member (child, spouse, parent or sibling).

Eligible Host Institution

The host institution (Applicant Legal Entity[12]) must engage the Principal Investigator for at least the duration of the project, as defined in the grant agreement. It must either be established in an EU Member State or Associated Country as a legal entity created under national law, or it may be an International European Interest Organisation (such as CERN, EMBL, etc.), the European Commission's Joint Research Centre (JRC) or any other entity created under EU law. Any type of legal entity, public or private, including universities, research organisations and undertakings can host Principal Investigators and their teams.

It is expected that the research project will be implemented within the territory of the Member States or Associated Countries. This does not exclude field work or other research activities in cases where these must necessarily be conducted outside the EU or the Associated Countries in order to achieve the scientific objectives of the project/activity.

It is also expected that the host institution will be the only participating legal entity. However, where they bring scientific added value to the project, additional team members may be hosted by additional legal entities[13] which will be eligible for funding, and which may be legal entities established anywhere, including outside the European Union or Associated Countries, or international organisations. Legal entities established outside the European Union or Associated Countries shall be eligible for funding provided that their participation is deemed essential for carrying out the action.

Please also refer to Annex 3 - Countries Associated to Horizon 2020 and Restrictions Applying to Some Legal Entities Established in Certain Third Countries.

Restrictions on submission of proposals

The ERC calls are extremely competitive. Only exceptional proposals are likely to be funded and the number of applications has generally risen faster than the available budget. In order to maintain the quality and integrity of ERC's evaluation process the Scientific Council has therefore applied restrictions on applications since 2009.

The restrictions for submission under the ERC Work Programme 2015 are set out below. They may be modified in subsequent years by the Scientific Council in light of experience. The restrictions related to the outcome of the evaluation in previous calls are designed to allow unsuccessful Principal Investigators the

[12] Please see important information for Principal Investigators, Candidates, Tenderers and Grant Applicants on possible registration of legal entities in the Commission's Early Warning System (EWS) and Central Exclusion Database (CED) on final page.

[13] Consortia agreements are not required for ERC multi-beneficiary grants.

time necessary to develop a stronger proposal.

The year of an ERC call for proposals refers to the Work Programme under which the call was made and can be established by its call identifier. A 2012 ERC call for proposals is therefore one that was made under the Work Programme 2012 and will have 2012 in the call identifier (for example ERC-2012-StG).

Ineligible or withdrawn proposals do not count against any of the following restrictions.

A Principal Investigator may submit proposals to different ERC frontier research grant calls made under the same Work Programme, but only the first eligible proposal will be evaluated.

*A Principal Investigator whose proposal was evaluated as **category C** in the Starting, Consolidator or Advanced Grant calls for proposals under Work Programme 2014 may <u>not</u> submit a proposal to the Starting, Consolidator or Advanced Grant calls for proposals made under Work Programmes 2015 and 2016.*

*A Principal Investigator whose proposal was finally evaluated as **category B** in the Starting, Consolidator or Advanced Grant calls for proposals under Work Programme 2014 may <u>not</u> submit a proposal to the Starting, Consolidator or Advanced Grant calls for proposals made under Work Programme 2015.*

A researcher may participate as Principal Investigator or Co-Investigator[14] in only one ERC frontier research project at any one time[15].

A researcher participating as Principal Investigator in an ERC frontier research project may not submit a proposal for another ERC frontier research grant, unless the existing project ends[16] no more than two years after the call deadline.

A Principal Investigator who is a serving Panel Member for a 2015 ERC call or who served as a Panel Member for a 2013 ERC call may not apply to a 2015 ERC call for the same type of grant[17].

[14] Projects with Co-Investigators were supported under the Advanced Grant in ERC Work Programmes from 2008 – 2011. A Co-Investigator was a team-member of the Principal Investigator with particular research responsibilities.

[15] A new frontier research project can only start after the duration of the project fixed in a previous frontier research grant agreement has ended.

[16] According to the duration of the project fixed in the previous frontier research grant agreement.

[17] The members of the ERC panels alternate to allow panel members to apply to the ERC calls in alternate years.

Starting Grant profile

Objectives

ERC Starting Grants are designed to support excellent Principal Investigators at the career stage at which they are starting their own independent research team or programme. Applicant Principal Investigators must demonstrate the ground-breaking nature, ambition and feasibility of their scientific proposal.

Size of ERC Starting Grants

Starting Grants may be awarded up to a maximum of **EUR 1 500 000** for a period of **5 years**[18].

However, up to an **additional EUR 500 000** can be requested in the proposal to cover (a) eligible "start-up" costs for Principal Investigators moving to the EU or an Associated Country from elsewhere as a consequence of receiving the ERC grant and/or (b) the purchase of major equipment and/or (c) access to large facilities[19].

Profile of the ERC Starting Grant Principal Investigator

The Principal Investigator shall have been awarded their first PhD **at least 2 and up to 7 years prior to 1 January 2015.** The effective elapsed time since the award of the first PhD can be reduced in certain properly documented circumstances (see *"Eligible Principal Investigator"* above).

A competitive Starting Grant Principal Investigator must have already shown the potential for research independence and evidence of maturity, for example by having produced **at least one important publication without the participation of their PhD supervisor.** Applicant Principal Investigators should also be able to demonstrate a promising track record of early achievements appropriate to their research field and career stage, including significant publications (as main author) in major international peer-reviewed multidisciplinary scientific journals, or in the leading international peer-reviewed journals of their respective field. They may also demonstrate a record of invited presentations in well-established international conferences, granted patents, awards, prizes etc.

[18] The maximum award is reduced pro rata temporis for projects of a shorter duration. This does not apply to ongoing projects.

[19] As any additional funding is to cover major one-off costs it is not subject to pro-rata temporis reduction for projects of shorter duration. All funding requested is assessed during evaluation.

Early achievements track record

In the Track record (see "Proposal description" below) the applicant Principal Investigator should list:

*1. **Up to five publications** in **major international peer-reviewed multi-disciplinary scientific journals** and/or in the **leading international peer-reviewed journals, peer-reviewed conferences proceedings and/or monographs** of their respective research fields, highlighting those without the presence as co-author of their PhD supervisor, and the number of citations (excluding self-citations) they have attracted (if applicable);*

*2. **Research monographs and any translations thereof** (if applicable);*

*3. **Granted patent(s)** (if applicable);*

*4. **Invited presentations to peer-reviewed, internationally established conferences and/or international advanced schools** (if applicable);*

*5. **Prizes/ Awards/ Academy memberships** (if applicable).*

Expected time commitment of the Starting Grant Principal Investigator

The question of whether the Principal Investigator is strongly committed to the project and demonstrates the willingness to devote a significant amount of time to the project forms a key part of the evaluation.

Principal Investigators funded through the ERC Starting Grants shall spend a minimum of 50% of their total working time in an EU Member State or Associated Country and a minimum of 50% of their total working time on the ERC project.

Principal Investigators shall ensure a sufficient time commitment and presence throughout the course of the project to guarantee its proper execution. The time commitment will be monitored, and in cases where the actual commitment is below the minimum levels set out above, or the levels indicated in the proposal (see proposal description below), appropriate measures may be taken, up to and including reduction of the grant and suspension or termination of grants in accordance with the grant agreement.

Consolidator Grant profile

Objectives

ERC Consolidator Grants are designed to support excellent Principal Investigators at the career stage at which they may still be consolidating their own independent research team or programme. Applicant Principal Investigators must demonstrate the ground-breaking nature, ambition and feasibility of their scientific proposal.

Size of ERC Consolidator Grants

Consolidator Grants may be awarded up to a maximum of **EUR 2 000 000** for a period of **5 years**[20].

However, up to an **additional EUR 750 000** can be requested in the proposal to cover (a) eligible "start-up" costs for Principal Investigators moving to the EU or an Associated Country from elsewhere as a consequence of receiving the ERC grant and/or (b) the purchase of major equipment and/or (c) access to large facilities[21].

Profile of the ERC Consolidator Grant Principal Investigator

The Principal Investigator shall have been awarded their first PhD **over 7 and up to 12 years prior to 1 January 2015**. The effective elapsed time since the award of the first PhD can be reduced in certain properly documented circumstances (see *"Eligible Principal Investigator"* above).

A competitive Consolidator Grant Principal Investigator must have already shown research independence and evidence of maturity, for example by having produced **several important publications without the participation of their PhD supervisor**. Applicant Principal Investigators should also be able to demonstrate a promising track record of early achievements appropriate to their research field and career stage, including significant publications (as main author) in major international peer-reviewed multidisciplinary scientific journals, or in the leading international peer-reviewed journals of their respective field. They may also demonstrate a record of invited presentations in well-established international conferences, granted patents, awards, prizes etc.

[20] The maximum award is reduced pro rata temporis for projects of a shorter duration. This does not apply to ongoing projects.

[21] As any additional funding is to cover major one-off costs it is not subject to pro-rata temporis reduction for projects of shorter duration. All funding requested is assessed during evaluation.

Early achievements track record

In the Track Record (see "Proposal description" below) the applicant Principal Investigator should list:

*1. **Up to ten publications** in **major international peer-reviewed multi-disciplinary scientific journals** and/or in the **leading international peer-reviewed journals, peer-reviewed conferences proceedings and/or monographs** of their respective research fields, highlighting those without the presence as co-author of their PhD supervisor, and the number of citations (excluding self-citations) they have attracted (if applicable);*

*2. **Research monographs and any translations thereof** (if applicable);*

*3. **Granted patent(s)** (if applicable);*

*4. **Invited presentations to peer-reviewed, internationally established conferences** and/or **international advanced schools** (if applicable);*

*5. **Prizes/ Awards/ Academy memberships** (if applicable).*

Expected time commitment of the Consolidator Grant Principal Investigator

The question of whether the Principal Investigator is strongly committed to the project and demonstrates the willingness to devote a significant amount of time to the project forms a key part of the evaluation.

Principal Investigators funded through the ERC Consolidator Grants shall spend a minimum of 50% of their total working time in an EU Member State or Associated Country and a minimum of 40% of their total working time on the ERC project.

Principal Investigators shall ensure a sufficient time commitment and presence throughout the course of the project to guarantee its proper execution. The time commitment will be monitored, and in cases where the actual commitment is below the minimum levels set out above, or the levels indicated in the proposal (see proposal description below), appropriate measures may be taken, up to and including reduction of the grant and suspension or termination of grants in accordance with the grant agreement.

Advanced Grant profile

Objectives

Advanced Grants are designed to support excellent Principal Investigators at the career stage at which they are already established research leaders with a recognised track record of research achievements. Applicant Principal Investigators must demonstrate the ground-breaking nature, ambition and feasibility of their scientific proposal.

Size of ERC Advanced Grants

Advanced Grants may be awarded up to a maximum of **EUR 2 500 000** for a period of **5 years**[22].

However, up to an **additional EUR 1 000 000** can be requested in the proposal to cover (a) eligible "start-up" costs for Principal Investigators moving to the EU or an Associated Country from elsewhere as a consequence of receiving the ERC grant, and/or (b) the purchase of major equipment and/or (c) access to large facilities[23].

[22] The maximum award is reduced pro rata temporis for projects of a shorter duration. This does not apply to ongoing projects.

[23] As any additional funding is to cover major one-off costs it is not subject to pro-rata temporis reduction for projects of shorter duration. All funding requested is assessed during evaluation.

Profile of the ERC Advanced Grant Principal Investigator

ERC Advanced Grant Principal Investigators are expected to be active researchers and to have a track record of significant research achievements **in the last 10 years** which must be presented in the application. There is little prospect of an application succeeding in the absence of such a record, which identifies investigators as exceptional leaders in terms of originality and significance of their research contributions.

Thus, in most fields, Principal Investigators of Advanced Grant proposals will be expected to demonstrate a record of achievements appropriate to the field and at least matching one or more of the following benchmarks:

- 10 publications as senior author (or in those fields where alphabetic order of authorship is the norm, joint author) in major international peer-reviewed multidisciplinary scientific journals, and/or in the leading international peer-reviewed journals and peer-reviewed conferences proceedings of their respective field;
- 3 major research monographs, of which at least one is translated

into another language. This benchmark is relevant to research fields where publication of monographs is the norm (e.g. humanities and social sciences).

Other alternative benchmarks that may be considered (individually or in combination) as indicative of an exceptional record and recognition in the last 10 years:

- 5 granted patents;
- 10 invited presentations in well-established internationally organised conferences and advanced schools;
- 3 research expeditions led by the applicant Principal Investigator;
- 3 well-established international conferences or congresses where the applicant was involved in their organisation as a member of the steering and/or organising committee;
- International recognition through scientific or artistic prizes/awards or membership in well-regarded Academies or artefact with documented use (for example, architectural or engineering design, methods or tools);
- Major contributions to launching the careers of outstanding researchers;
- Recognised leadership in industrial innovation.

Ten-year track record

In the Track Record (see "Proposal description" below) the applicant Principal Investigator should list:

*1. **Up to ten representative publications, from the last ten years, <u>as main author</u>** (or in those fields where alphabetic order of authorship is the norm, joint author) in **major international peer-reviewed multi-disciplinary scientific journals** and/or in the **leading international peer-reviewed journals and peer-reviewed conferences proceedings** of their respective research fields, also indicating the number of citations (excluding self-citations) they have attracted (if applicable);*

*2. **Research monographs and any translations thereof** (if applicable);*

*3. Granted **patents** (if applicable);*

*4. **Invited presentations to peer-reviewed, internationally established conferences** and/or **international advanced schools** (if applicable);*

5. ***Research expeditions*** *that the applicant Principal Investigator has led (if applicable);*

6. *Organisation of* ***international conferences*** *in the field of the applicant (membership in the steering and/or organising committee) (if applicable);*

7. ***Prizes/ Awards/ Academy memberships*** *(if applicable);*

8. ***Major contributions to the early careers of excellent researchers*** *(if applicable);*

9. ***Examples of leadership in industrial innovation or design*** *(if applicable).*

If a Principal Investigator so chooses, their achievements over a longer period than the past ten years can be considered in the following circumstances which should be highlighted in the CV.

For maternity, the track record considered can be extended by 18 months for each child born **before or during** the last ten years. For paternity, the track record considered can be extended by the documented amount of paternity leave actually taken for each child born **before or during** the last ten years. For long-term illness[24], clinical qualification or national service the track record considered can be extended by the documented amount of leave actually taken by the Principal Investigator for each incident which occurred **during** the last ten years.

Expected time commitment of the Advanced Grant Principal Investigator

The question of whether the Principal Investigator demonstrates the level of commitment to the project necessary for its execution and demonstrates the willingness to devote a significant amount of time to the project forms a key part of the evaluation.

Principal Investigators funded through the ERC Advanced Grants shall spend a minimum of 50% of their total working time in an EU Member State or Associated Country and a minimum of 30% of their total working time on the ERC project.

Principal Investigators shall ensure a sufficient time commitment and presence throughout the course of the project to guarantee its proper execution. The time commitment will be monitored, and in cases where the actual commitment is below the minimum levels set out above, or the levels indicated in the proposal (see proposal description below), appropriate measures may be taken, up to and including reduction of the grant and suspension or termination of grants in accordance with the grant agreement.

[24] Over ninety days for the Principal Investigator or a close family member (child, spouse, parent or sibling

Proposal submission and description

Proposal Submission

Starting, Consolidator and Advanced Grant proposals are submitted by the Principal Investigator who has scientific responsibility for the project, on behalf of the host institution.

Proposal submission is made electronically. ***Early registration and submission is strongly recommended and should be done as early as possible in advance of the call deadline.***

For each call, Information for Applicants[25] is published on the ERC website and Participants Portal, which describes in detail how the electronic forms should be completed.

Proposal description

A complete proposal shall consist of the following elements[26].

Extended Synopsis: 5 pages

Curriculum Vitae: 2 pages

Track Record: 2 pages

Scientific Proposal: 15 pages

Host Institution Binding Statement of Support

Ethics Review Table

PhD record and supporting documentation for eligibility checking (for Starting and Consolidator Grants only).

The host institution must confirm its association with and its support to the project and the Principal Investigator. As part of the application, the institution must provide a binding statement that the conditions of independence are already fulfilled or will be provided to the Principal Investigator if the application is successful, according to the template provided. Proposals that do not include this institutional statement may be declared ineligible.

[25] As well as other relevant documents, including the ERC rules for submission and evaluation.

[26] Incomplete proposals may be declared ineligible, see *"Eligibility criteria"* above.

*In fairness to all applicants, **these page limits will be applied strictly**. Only the material that is presented within these limits will be evaluated (peer reviewers will only be asked, and will be under no obligation to read beyond, the material presented within the page limits).*

Extended Synopsis: This should be a concise presentation of the full scientific proposal, with particular attention to the ground-breaking nature of the research project and the feasibility of the outlined scientific approach. At step 1 the full scientific proposal is not assessed so all <u>essential information</u> must be covered in the synopsis. The applicant will choose a primary evaluation panel and may also indicate a secondary evaluation panel. He/she should indicate when they believe that their proposal is of a cross-panel or cross-domain nature.

Curriculum Vitae: The CV should include the standard academic and research record as well as a succinct "funding ID" which must specify any current research grants and their subject, and any on-going application for work related to the proposal. Any research career gaps and/or unconventional paths should be clearly explained so that they can be fairly assessed by the evaluation panels.

Track Record: The Principal Investigator must provide a list of achievements reflecting their track record. The type of achievements expected for Starting, Consolidator and Advanced Grant applicant Principal Investigators are set out in the relevant profiles above.

Scientific Proposal: Description of the scientific and technical aspects of the project, demonstrating the ground-breaking nature of the research, its potential impact and research methodology. The proposal will also need to clearly specify the percentage of the applicant's total working time that will be spent in the EU or an Associated Country and the percentage of the applicant's total working time that will be devoted to the project, as well as a full estimation of the real project cost.

*Applications where the Principal Investigator proposes to commit less time in the EU or an Associated Country or to the project than the minimum percentages set out under the profiles of Starting, Consolidator and Advanced Grant Principal Investigators above **will be declared ineligible.***

Evaluation procedure and criteria

Evaluation procedure

A **single submission of the full proposal** will be followed by a **two-step evaluation**. The evaluation will be conducted by means of a structure of high level peer review panels as listed in Annex 1. The panels may be assisted by independent experts working remotely.

Applicant Principal Investigators can request during the electronic proposal submission that up to three specific persons should not act as an evaluator in the evaluation of their proposal[27].

At step 1, the extended synopsis and the Principal Investigator's track record and CV will be assessed (and **not** the full scientific proposal). **At step 2** the complete version of the retained proposals will be assessed (including the full scientific proposal).

The allocation of the proposals to the various panels will be based on the expressed preference of the applicant Principal Investigator (see *"Proposal description"* above). Proposals may be allocated to a different panel with the agreement of both Panel Chairs concerned.

[27] The persons identified may be excluded from the evaluation of the proposal concerned, as long as it remains possible to have the proposal evaluated.

The panel to which a proposal is allocated may request additional reviews by appropriate members of other panel(s) or additional remote experts.

The ERC strongly encourages ***multi- and inter-disciplinary research proposals****. Proposals of this type are evaluated by ERC's regular panels with the appropriate external expertise.*

Proposals will be retained for step 2 based on the outcome of the evaluation at step 1 (see below) and a budgetary cut-off level of three times the panel's indicative budget.

Principal Investigators whose proposals are retained for step 2 of the evaluation for the Starting and Consolidator Grants will be invited for an interview to present their project to the evaluation panel meeting in Brussels.

Evaluation criteria

For all ERC frontier research grants, **excellence is the sole criterion of evaluation**. It will be applied in conjunction to the evaluation of both: the ground-breaking nature, ambition and feasibility of the research project; and the intellectual capacity, creativity and commitment of the Principal Investigator.

During the evaluation, the phase of the Principal Investigator's transition to independence, possible breaks in the research career of the applicant and/or unconventional research career paths should be taken into account. Benchmarks set in the relevant profiles above including the expected minimum working times to be spent in the EU or an Associated Country and on the ERC project, will also be taken into consideration.

In general, projects wholly or largely consisting in the collation and compilation of existing material in new databases, editions or collections are unlikely to constitute ground-breaking or "frontier" research in themselves, however useful such resources might be to subsequent original research. Such projects are therefore unlikely to be recommended for funding by the ERC's panels.

Plagiarism detection software may be used to analyse proposals submitted to the ERC.

The detailed evaluation elements applying to the excellence of the research project and the Principal Investigator are set out below.

1. Research Project

Ground-breaking nature, ambition and feasibility

Starting, Consolidator and Advanced

Ground-breaking nature and potential impact of the research project

To what extent does the proposed research address important challenges?

To what extent are the objectives ambitious and beyond the state of the art (e.g. novel concepts and approaches or development across disciplines)?

To what extent is the proposed research high risk/high gain?

Scientific Approach

To what extent is the outlined scientific approach feasible bearing in mind the extent that the proposed research is high risk/high gain (based on the Extended Synopsis)?

To what extent is the proposed research methodology appropriate to achieve the goals of the project (based on the full Scientific Proposal)?

To what extent does the proposal involve the development of novel methodology (based on the full Scientific Proposal)?

To what extent are the proposed timescales and resources necessary and properly justified (based on the full Scientific Proposal)?

2. Principal Investigator

Intellectual capacity, creativity and commitment

Starting and Consolidator

Intellectual capacity and creativity

To what extent has the PI demonstrated the ability to propose and conduct ground-breaking research?

To what extent does the PI provide evidence of creative independent thinking?

To what extent have the achievements of the PI typically gone beyond the state of the art?

Commitment

To what extent does the PI demonstrate the level of commitment to the project necessary for its execution and the willingness to devote a significant amount of time to the project (min 50% for Starting and 40% for Consolidator of the total working time on it and min 50% in an EU Member State or Associated Country) (based on the full Scientific Proposal)?

Advanced

Intellectual capacity and creativity

To what extent has the PI demonstrated the ability to propose and conduct ground-breaking research?

To what extent does the PI provide evidence of creative independent thinking?

To what extent have the achievements of the PI typically gone beyond the state of the art?

To what extent has the PI demonstrated sound leadership in the training and advancement of young scientists?

Commitment

To what extent does the PI demonstrate the level of commitment to the project necessary for its execution and the willingness to devote a significant amount of time to the project (min 30% of the total working time on it and min 50% in an EU Member State or Associated Country) (based on the full Scientific Proposal)?

Outcome of evaluation

At each evaluation step, each proposal will be evaluated and marked for each of the two main elements of the proposal: the ground-breaking nature, ambition and feasibility of the research project; and the intellectual capacity, creativity and commitment of the Principal Investigator.

At the end of each evaluation step, the proposals will be ranked by the panels on the basis of the marks they have received and the panels' overall appreciation of their strengths and weaknesses.

At the end of **step 1** of the evaluation applicants will be informed that their proposal:

- **A.** is of sufficient quality to pass to step 2 of the evaluation;
- **B.** is of high quality but not sufficient to pass to step 2 of the evaluation;
- **C.** is not of sufficient quality to pass to step 2 of the evaluation.

At the end of **step 2** of the evaluation applicants will be informed that their proposal:

- **A.** fully meets the ERC's excellence criterion and is recommended for funding **if sufficient funds are available**;
- **B.** meets some but not all elements of the ERC's excellence criterion and will not be funded.

In addition, once the evaluation of their proposal has been completed, applicants will receive an evaluation report which will include the ranking range of their proposal out of the proposals evaluated by the panel.

Projects recommended for funding will be funded by the ERC if sufficient funds are available. Proposals will be funded in priority order based on their rank.

Applicants may also be subject to restrictions on submitting proposals to future ERC calls based on the outcome of the evaluation. Applicants will need to check the restrictions in place for each call (for 2015 calls see restrictions on submission of proposals under "Eligibility criteria" above).

Proof of Concept grants

for Principal Investigators of

ERC frontier research grants

Objectives

Frontier research often generates unexpected or new opportunities for commercial or societal application. The ERC Proof of Concept Grants aim to maximise the value of the excellent research that the ERC funds, by funding further work (i.e. activities which were not scheduled to be funded by the original ERC frontier research grant) to verify the innovation potential of ideas arising from ERC funded projects. Proof of Concept Grants are therefore on offer only to Principal Investigators whose proposals draw substantially on their ERC funded research.

Ethical Principles

All proposals will be subject to ethics review as with proposals for the ERC's frontier research grants.

Eligibility Criteria

Eligible Principal Investigator

All Principal Investigators in an ERC frontier research project, that is either on going or has ended[28] less than 12 months before the opening date of this call, are eligible to participate and apply for an ERC Proof of Concept Grant.

Eligible projects

All proposals must be complete and be submitted before the relevant call deadline. Incomplete proposals may be declared ineligible.

The content of the proposal must relate to the objectives and to the grant type set out in the call, as defined in this work programme. A proposal will only be deemed ineligible on grounds of 'scope' in clear-cut cases.

Where there is a doubt on the eligibility of a proposal, the peer review evaluation may proceed pending a decision following an eligibility review committee. If it becomes clear before, during or after the peer review evaluation phase, that one or more of the eligibility criteria has not been met, the proposal will be declared ineligible and not considered any further.

Applicants will need to demonstrate the relation between the idea to be taken to proof of concept and the ERC frontier research project (Starting, Consolidator, Advanced or Synergy) in question.

More than one Proof of Concept Grant may be awarded per ERC funded frontier research project but only one Proof of Concept project may be running at any one time for the same ERC frontier research project[29].

[28] Where the duration of the project fixed in the ERC Grant Agreement has ended.

[29] This limit also applies to Synergy projects.

Eligible Host Institution

The host institution (Applicant Legal Entity[30]) must engage the Principal Investigator for at least the duration of the proof of concept project as defined in the grant agreement and must be established in a Member State or an Associated Country[31].

Please also refer to Annex 3 - Countries Associated to Horizon 2020 and Restrictions Applying to Some Legal Entities Established in Certain Third Countries.

Maximum size of grant and grant assessment

The financial contribution will be up to a maximum of **EUR 150 000** for a period of **18 months**. The ERC expects that normally, proof of concept projects should be completed within 12 months. However, to allow for those projects that require more preparation time, projects will be signed for 18 months. Given this initial flexibility, extensions of the duration of proof of concept projects may be granted only exceptionally.

The overall level of the funding offered will be assessed during the evaluation. The funding requested by the applicant will be judged against the needs of the proposed activity before award. The funding requested by the Principal Investigator must be fully justified by an estimation of the actual costs for the proposed activities.

The Union financial contribution will take the form of the reimbursement of up to 100% of the total eligible and approved direct costs and of flat-rate financing of indirect costs on the basis of 25% of the total eligible direct costs[32]. The level of the awarded grant represents a maximum overall figure – the final amount to be paid must be justified on the basis of the costs actually incurred for the project.

The indicative budget for this call for 2015 is **EUR 20 000 000** (approximately one-third of which will be for each of the three evaluation rounds following three specific deadlines - proposals submitted before each cut-off date will be evaluated with the proposals submitted before the same cut-off date).

[30] Please see important information for Principal Investigators, Candidates, Tenderers and Grant Applicants on possible registration of legal entities in the Commission's Early Warning System (EWS) and Central Exclusion Database (CED) on final page.

[31] It may also be an International European Interest Organisation (such as CERN, EMBL, etc.), the European Commission's Joint Research Centre (JRC), or an entity created under EU law. Any type of legal entity, public or private, including universities, research organisations as well as undertakings can host the Principal Investigator and his/her team.

[32] Excluding the direct costs for subcontracting and the costs of resources made available by third parties which are not used on the premises of the host institution.

ERC Proof of Concept Grant proposal submission and description

Proposal Submission

Funding for the Proof of Concept Grant will be awarded through a call for proposals. Proposals are submitted by a single Principal Investigator, who has responsibility for the proposed activities, on behalf of the host institution which is the applicant legal entity.

Applications can be submitted at any time from the opening date of the call until the final deadline and will be evaluated and selected in three rounds, based on three specific deadlines. A Principal Investigator may submit only one application per call.

Proposal submission is made electronically. ***Early registration and submission is strongly recommended and should be done as early as possible in advance of the call deadline.***

Proposal description

The proposal will provide detailed descriptions of the project, its objectives, planning, execution, and required resources. It will comprise the following required elements:

- A short **description of the idea** to be taken to proof of concept. This should include an indication of the ERC-funded project from which the idea is substantially drawn and briefly demonstrate the relation between the idea and the ERC-funded project in question.

- Outline the **innovation potential of** the idea to be taken to proof of concept. This should include a clear description of how the proof of concept activities will lead to a commercial or social innovation.

- Outline the **economic and/or societal impact** expected from the project, including the identification of customer and societal benefits; definition of the process to be followed leading to concrete application; initial steps of analysis of the advantages of the project's outcomes over existing products, policies, or processes; and, where applicable, brief explanation of the activities to be undertaken in terms of clarification of IPR position and strategy, testing in real world contexts, plans for contacts with commercial and/or societal partners.

- Outline a reasonable and plausible **plan of the activities** proposed for establishing the feasibility of the project, including a list of requested resources necessary for the implementation of the proposed project and a full estimation of the real project cost.

- **Ethics Review** table.

*In fairness to all applicants a **strict limit of seven pages** will be applied to the length of proposals. Only the material that is presented within this limit will be evaluated (peer reviewers will only be asked to evaluate, and will be under no obligation to read beyond, the material presented within the page limit).*

ERC Proof of Concept Grant evaluation

A single-step submission and evaluation procedure will be used. The evaluation will be conducted by independent experts. These experts may work remotely and may if necessary meet as an evaluation panel as set out below on the application of the evaluation criteria.

Evaluation criteria

Proof of Concept Grants are awarded in relation to an existing ERC-funded project which has already been evaluated on the basis of excellence as the sole criterion.

The activities to be funded shall draw substantially on this scientifically excellent ERC-funded research. However the additional funding is not aimed at extending the original research or predominantly concerned with overcoming obstacles to practical application.

The funding will cover activities at the very early stage of turning research outputs into a commercial or socially valuable proposition, i.e. the initial steps of pre-competitive development.

Proof of Concept Grants are not ERC frontier research grants and may be evaluated against other evaluation criteria than excellence. The evaluation criteria for selection of proposals for Proof of Concept Grants are excellence, impact and quality and efficiency of the implementation as below:

1. Excellence (Innovation potential)

Does the proposed proof of concept activity greatly help move the output of research towards the initial steps of a process leading to a commercial or social innovation?

2. Impact

2.1 Is the project to be taken to proof of concept expected to generate economic and/or societal benefits which are appropriately identified in the proposal?

2.2 Does the proposal indicate a suitable process that is designed to result in a concrete application, including outlining a process of commercialisation or a process of generating social benefits?

The proposal should include:
- plans for the analysis of whether the project's outcomes are innovative or distinctive compared to existing solutions;
- plans for seeking confirmation of the actual effectiveness of the project's results;
- plans to clarify the IPR position and strategy[33];
- plans for setting up contacts with industry partners, societal organisations or potential 'end users' of the projects' results.

3. Quality and efficiency of the implementation (Quality of the proof of concept plan)

Does the proposal provide a reasonable and acceptable plan of activities against clearly identified objectives and towards establishing the feasibility of the project?

This should include:
- a sound project-management plan, including appropriate risk and contingency planning;
- demonstration that the activities will be conducted by persons well qualified for the purpose;
-demonstration that the budget requested is necessary for the implementation of the project and properly justified.

[33] Any application for funding of IPR activities under the ERC Proof of Concept will not discharge beneficiaries from their prior obligations under their pre-existing ERC Grant Agreement in respect of protecting IPR capable of industrial or commercial application. If any foreground was potentially protectable in the pre-existing ERC project, beneficiaries had the legal obligation to seek for adequate and effective protection according to the Rules for Participation and the ERC Model Grant Agreement.

Outcome of evaluation

Peer reviewers will evaluate independently each eligible proposal on each of the three evaluation criteria above on a "pass/fail" basis.

In order to be considered for funding, proposals will have to be awarded a pass mark by a majority of peer reviewers on each of the three evaluation criteria. A proposal which fails one or more of the criteria will not be ranked and will not be funded.

If there is not enough budget to fund all the proposals which pass all three evaluation criteria, those proposals which pass all three evaluation criteria will be ranked according to the marks which they received from peer reviewers. Proposals will be funded in order of this ranking.

If necessary, the peer reviewers will meet as an evaluation panel in order to determine a priority order for proposals which have the same ranking.

Other actions

The different actions described in this chapter aim to allow the Scientific Council of the ERC to carry out its duties and mandate, including its obligations to establish the ERC's overall strategy and to monitor and quality control the programme's implementation from the scientific perspective.

Support to monitoring, evaluation, outreach and dissemination

1. Qualitative evaluation of frontier nature of ERC funded research

The ERC will analyse the scientific output of its funded projects with a particular focus on the frontier nature of the research, and any potential research breakthroughs and discoveries. During this analysis the ERC will be assisted by experts.

Type of action: Experts.

Indicative budget: EUR 200 000 from the 2015 budget.

2. Support for evaluation of Synergy Grant scheme

The ERC will analyse the pilot phase of the Synergy Grant before deciding on any future calls. During this analysis the ERC will be assisted by experts.

Type of action: Experts.

Indicative budget: EUR 130 000 from the 2015 budget.

3. Support for novel ways to highlight the work funded by the ERC and reach out to a wider public

The ERC wishes to support an ambitious series of communication actions to promote and raise awareness of ERC-funded projects and results across Europe to as wide an audience as possible, including: scientists, students, media, policy-makers, the business community and the general public.

The actions will go beyond traditional scientific conferences and take a novel and creative approach with the following characteristics:

- spreading new ideas in science;
- reaching a very wide public of specialists and non-specialists and new audiences at both European and local levels;
- holding frequent, regular events throughout the duration of the campaign;
- being based on carefully selected ERC projects and grantees, from a range of countries and disciplines;
- ensuring visibility across Europe, covering different countries and languages;
- ensuring further dissemination and strong follow-up beyond events through audio-visual, web and social media activities.

Actions may include:

- events to showcase selected ERC-funded results in the form of short, powerful and engaging talks given by ERC grantees;
- popular science activities linked to science festivals, centres and/or museums, which are successful platforms to popularize and disseminate science among non-specialists;
- cooperation with existing networks of universities, learned societies and science academies to establish ERC online lectures involving ERC grantees.

Because of the scope and ambition of these actions, each of them will be implemented by an external organisation or by a consortium of organisations, that should ensure the necessary scientific and communications capacity.

The maximum duration of the project will be 48 months. Up to two proposals will be selected.

Type of action: Call for proposals.
Indicative timeline[34]: opening date 16 September 2014; deadline 16 December 2014; date to inform applicants 28 February 2015; indicative date for signature of grant agreement 31 May 2015.

Indicative budget: EUR 1 600 000 from the 2015 budget.

Support to Open Access

4. Support to the Europe PMC initiative

PubMed Central (PMC) is a US-based digital archive for biomedical research publications which are made accessible at no charge. In Europe, Europe PMC provides access to PMC's content and offers additional services. In 2012, the ERC joined the Europe PMC initiative in order to enable ERC funded researchers to use the Europe PMC repository for their manuscripts, as recommended in the 'Open Access Guidelines for researchers funded by the ERC'[35].

The Europe PMC initiative is currently financed by a group of 25 funding bodies, primarily from the biomedical field, from different European countries. The main contributor is the Wellcome Trust which is leading the initiative. The Wellcome Trust (acting through its trustee the Welcome Trust Limited) has entered into an agreement with NLM, the US National Library of Medicine, which operates PMC. The agreement is renewed automatically on an annual basis.

Since the beginning, the technical aspects of the initiative have been developed by

[34] The opening date and call deadline are indicative. The Director-General responsible for the call may open it up to one month prior to or after the envisaged opening date. The Director-General responsible may delay the envisaged deadline by up to two months.

[35] For the revised version of October 2013 see: http://erc.europa.eu/sites/default/files/document/file/ERC_Open_Access_Guidelines-revised_2013.pdf

the European Bioinformatics Institute (EMBL-EBI). EMBL-EBI is an academic research institute located on the Wellcome Trust Genome Campus in Hinxton near Cambridge (UK), and is part of the European Molecular Biology Laboratory (EMBL). Building on more than 20 years' experience in bioinformatics, the EMBL-EBI maintains the world's most comprehensive range of molecular databases.

ERC funding has been awarded to the initiative under the 2013 and 2014 Work Programmes, covering the period up to and including March 2016. The ERC intends to continue its participation in the Europe PMC initiative beyond 2016. Based on the unique expertise and experience that EMBL-EBI offers, the funding bodies represented in the Europe PMC initiative intend to provide financial support to EMBL-EBI. The amount of each funder's contribution is calculated based on the proportion of their annual research spend (in the life sciences domain). For this purpose the ERC Executive Agency will provide a grant to the Wellcome Trust, whose sole objective will be to provide financial support to EMBL-EBI as a third party[36], in order to:

– support the running of the Europe PMC initiative beyond the end of March 2016, in particular the operation and maintenance of the Europe PMC repository, the manuscript deposition service and the helpdesk; and to
– contribute to the further development of the Europe PMC repository, and to associated technical services to implement those developments.

Based on the ERC's research spend in 2013, the funding rate of the financial support to EMBL-EBI, which should correspond to the sole eligible cost for the Wellcome Trust, will be 14%, amounting to a maximum of 850 000 EUR.

The maximum duration of the project will be 72 months.

Type of action: Grant to an identified beneficiary.

Legal entity: The Wellcome Trust Limited, Euston Road, London, UK.

Indicative budget: Up to EUR 850 000 from the 2015 budget.

5. Support to the OAPEN initiative

The ERC supports the principle of open access to the published output of research as a fundamental part of its mission. This requirement includes monographs, which are particularly important in the Humanities and Social Sciences. However, the concept of open access monographs is still relatively new and suitable repositories for their deposit are not always easily found.

For this reason the ERC will provide a low value grant of EUR 50 000 to the OAPEN Foundation to support the running and further development of the OAPEN

[36] In line with the provision of Annex 4 to this Work Programme and Article 15(1) of the general model Grant Agreement for Horizon 2020.

initiative, which provides a platform for the full text dissemination of open access books.

The grant will contribute to building a quality controlled collection of open access books, mainly in the area of Humanities and Social Sciences, and to the development of services for publishers, libraries and research funders in the areas of dissemination, quality assurance and digital preservation.

The maximum duration of this project will be 24 months.

Type of action: Low value grant to an identified beneficiary.

Legal entity: Stichting OAPEN (OAPEN Foundation), Prins Willem-Alexanderhof 5, 2595 BE The Hague, The Netherlands.

Indicative budget: EUR 50 000 from the 2015 budget.

Support to the ERC Scientific Council

6. ERC Scientific Council Standing Identification Committee

Future members of the Scientific Council shall be appointed by the Commission following an independent and transparent procedure for their identification agreed with the Scientific Council, including a consultation of the scientific community and a report to the European Parliament and the Council. For this purpose, a high level standing Identification Committee of independent experts has been set up as an expert group with honoraria of EUR 450 per day charged to the operational budget allocated to the ERC.

Type of action: Experts. This activity will be directly implemented by the Commission services (DG RTD).

Indicative budget: EUR 45 000 from the 2015 budget.

7. Support to the Vice-Chairs

Support will be provided to the three Vice-Chairs of the Scientific Council to ensure adequate local administrative assistance at their home institutes for their tasks of assisting the President of the ERC in representing the ERC and organising its work. For this purpose, the ERC Executive Agency will provide a grant to an identified beneficiary.

Type of action: Grant to an identified beneficiary.

Legal entity: Universitat Pompeu Fabra, Plaça de la Mercè 10-12, Barcelona, 08002, Spain.

Indicative budget: EUR 300 000 from the 2015 budget.

8. Honoraria and meeting expenses for Scientific Council members

In recognition of their personal commitment, the Scientific Council members shall be compensated for the tasks they perform by means of an honorarium for their attendance at Scientific Council plenary meetings, reflecting their responsibilities and benchmarked against similar provisions in similar entities and Member States. The honoraria and those travel and subsistence expenses related to the performance of tasks of the Scientific

Council shall be charged to the operational budget allocated to the ERC.

Type of action: *Experts.*

Indicative budget: *EUR 555 000 from the 2015 budget.*

Union Contribution

The Union financial contribution will take the form of the reimbursement of up to 100% of the total eligible and approved direct costs and of flat-rate financing of indirect costs on the basis of 25% of the total eligible direct costs[37]. The level of the awarded grant represents a maximum overall figure – the final amount to be paid must be justified on the basis of the costs actually incurred for the project.

Proposal Evaluation

Proposals for grants under this part will be evaluated as follows.

Eligibility Criteria

Proposals under this part must be focused on requirements specified in the work programme and/or call for proposals.

Actions under this part are open to legal entities[38] established in a Member State or an Associated Country as a legal entity created under national law, International European Interest Organisations (such as CERN, EMBL, etc.), the European Commission's Joint Research Centre (JRC) or an entity created under EU law. Legal entities established in countries outside the EU or Associated Countries and international organisations are also eligible.

Please also refer to Annex 3 - Countries Associated to Horizon 2020 and Restrictions Applying to Some Legal Entities Established in Certain Third Countries.

All proposals must be complete and be submitted before the relevant deadline. A complete proposal entails all requested elements. Incomplete proposals may be declared ineligible.

The content of the proposal must relate to the objectives of the grant and/or call for proposals, as defined in this work programme and/or call. A proposal will only be deemed ineligible on grounds of 'scope' in clear-cut cases.

Where there is a doubt on the eligibility of a proposal, the evaluation may proceed pending a decision following an eligibility review committee. If it becomes clear before, during or after the evaluation phase, that one or more of the eligibility criteria has not been met, the proposal will be declared ineligible and not considered any further.

[37] Excluding the direct costs for subcontracting, the costs for financial support to third parties and the costs of resources made available by third parties which are not used on the premises of the host institution. Exceptionally, the low value grant to the OAPEN Foundation will take the form of a lump-sum (covering direct and indirect costs).

[38] Please see important information for Principal Investigators, Candidates, Tenderers and Grant Applicants on possible registration of legal entities in the Commission's Early Warning System (EWS) and Central Exclusion Database (CED) on final page.

Evaluation Criteria

1. Excellence

Are the objectives of the proposed project consistent with the requirements specified in the work programme and/or call for proposals? Do they, where appropriate, correspond to, or go beyond, best current practice?

2. Impact

Will the project have a substantial impact in the context of the ERC objectives?

3. Quality and efficiency of the implementation

Is the proposed methodology and work plan effective in reaching the goals of the project? Do they ensure the highest quality and/or utility of results?

Application of Evaluation Criteria

Each evaluation criterion will be marked on a scale of 0 to 5 and an overall quality threshold of 80% will be used to establish the retained list of proposals which will be ranked in order of priority for funding.

Budget

	2015 budget in EUR million (rounded)
Main Calls	
ERC-2015-StG	*430*
ERC-2015-CoG	*585*
ERC-2015-AdG	*630*
ERC-2015-PoC	*20*
Other Actions	
Experts[39]	*11.90*
Grants to identified beneficiaries	*1.20*
Other calls for proposals	*1.60*
Estimated total budget	***1 679.7***
Contribution to horizontal activities[40]	
Dissemination of results (CORDIS support)	*1.35*
Estimated total budget including horizontal activities	***1 681.05***

[39] EUR 10.97 million of this amount correspond to the cost of experts involved in the evaluation of proposals.

[40] These activities are subject to the 2014-2015 work programme adopted in the framework of the Specific Programme Implementing Horizon 2020 – The Framework Programme for Research and Innovation (2014-2020).

The budget amounts for 2015 are subject to the availability of the appropriations provided for in the draft budget for 2015 after the adoption of the budget for 2015 by the budgetary authority or if the budget is not adopted as provided for in the system of provisional twelfths.

Budgetary figures given in this work programme are indicative. Unless otherwise stated, final budgets may vary following the evaluation of proposals. The final figures may vary by up to 20% with respect to those indicated in this work programme for the following budgeted activities:

- Total expenditure for each call for proposals;
- Any repartition of the call budget within a call, up to 20% of the total expenditure of the call;
- Evaluation and monitoring, up to 20% of the total expenditure for all these activities;
- Each other individual action not implemented through calls for proposals.

The budget figures given in this table are rounded to two decimal points.

Annexes

Annex 1

Primary panel structure and description

Physical Sciences & Engineering

PE1 Mathematics
All areas of mathematics, pure and applied, plus mathematical foundations of computer science, mathematical physics and statistics.

PE2 Fundamental Constituents of Matter
Particle, nuclear, plasma, atomic, molecular, gas, and optical physics.

PE3 Condensed Matter Physics
Structure, electronic properties, fluids, nanosciences, biophysics.

PE4 Physical and Analytical Chemical Sciences
Analytical chemistry, chemical theory, physical chemistry/chemical physics.

PE5 Synthetic Chemistry and Materials
Materials synthesis, structure-properties relations, functional and advanced materials, molecular architecture, organic chemistry.

PE6 Computer Science and Informatics
Informatics and information systems, computer science, scientific computing, intelligent systems.

PE7 Systems and Communication Engineering
Electrical, electronic, communication, optical and systems engineering.

PE8 Products and Processes Engineering
Product design, process design and control, construction methods, civil engineering, energy processes, material engineering.

PE9 Universe Sciences
Astro-physics/chemistry/biology; solar system; stellar, galactic and extragalactic astronomy, planetary systems, cosmology, space science, instrumentation.

PE10 Earth System Science
Physical geography, geology, geophysics, atmospheric sciences, oceanography, climatology, cryology, ecology, global environmental change, biogeochemical cycles, natural resources management.

Life Sciences

LS1 Molecular and Structural Biology and Biochemistry
Molecular synthesis, modification and interaction, biochemistry, biophysics, structural biology, metabolism, signal transduction.

LS2 Genetics, Genomics, Bioinformatics and Systems Biology
Molecular and population genetics, genomics, transcriptomics, proteomics, metabolomics, bioinformatics, computational biology, biostatistics, biological modelling and simulation, systems biology, genetic epidemiology.

LS3 Cellular and Developmental Biology
Cell biology, cell physiology, signal transduction, organogenesis, developmental genetics, pattern formation in plants and animals, stem cell biology.

LS4 Physiology, Pathophysiology and Endocrinology
Organ physiology, pathophysiology, endocrinology, metabolism, ageing, tumorigenesis, cardiovascular disease, metabolic syndrome.

LS5 Neurosciences and Neural Disorders
Neurobiology, neuroanatomy, neurophysiology, neurochemistry, neuropharmacology, neuroimaging, systems neuroscience, neurological and psychiatric disorders.

LS6 Immunity and Infection
The immune system and related disorders, infectious agents and diseases, prevention and treatment of infection.

LS7 Diagnostic Tools, Therapies and Public Health
Aetiology, diagnosis and treatment of disease, public health, epidemiology, pharmacology, clinical medicine, regenerative medicine, medical ethics.

LS8 Evolutionary, Population and Environmental Biology
Evolution, ecology, animal behaviour, population biology, biodiversity, biogeography, marine biology, eco-toxicology, microbial ecology.

LS9 Applied Life Sciences and Non-Medical Biotechnology
Applied plant and animal sciences, food sciences, forestry, industrial, environmental and non-medical biotechnologies, bioengineering, synthetic and chemical biology, biomimetics, bioremediation.

Social Sciences & Humanities

SH1 Markets, Individuals and Institutions
Economics, finance and management.

SH2 The Social World, Diversity, Institutions and Values
Sociology, political science, law, communication, education.

SH3 Environment, Space and Population
Sustainability science, demography, geography, regional studies and planning, science and technology studies.

SH4 The Human Mind and Its Complexity
Cognitive science, psychology, linguistics, philosophy of mind, education.

SH5 Cultures and Cultural Production
Literature, philology, cultural studies, anthropology, arts, philosophy.

SH6 The Study of the Human Past
Archaeology and history.

Annex 2

ERC policy on PhD and equivalent doctoral degrees

1. The necessity of ascertaining PhD equivalence

In order to be eligible to apply to the ERC Starting or Consolidator Grant a Principal Investigator must have been awarded a PhD or equivalent doctoral degree. First-professional degrees will not be considered in themselves as PhD-equivalent, even if recipients carry the title "Doctor". See below for further guidelines on PhD degree equivalency.

2. PhD Degrees

The research doctorate is the highest earned academic degree. It is always awarded for **independent research** at a professional level in either academic disciplines or professional fields. Regardless of the entry point, doctoral studies involve several stages of academic work. These may include the completion of preliminary course, seminar, and laboratory studies and/or the passing of a battery of written examinations. The PhD student selects an academic adviser and a subject for the dissertation, is assigned a dissertation committee, and designs his/her research (some educators call the doctoral thesis a dissertation to distinguish it from lesser theses). The dissertation committee consists usually of 3-5 faculty members in the student's research field, including the adviser.

3. Independent research

Conducting the research and writing the dissertation usually requires one to several years depending upon the topic selected and the research work necessary to prepare the dissertation. In defending his/her thesis, **the PhD candidate must establish mastery of the subject matter, explain and justify his or her research findings, and answer all questions put by the committee**. A successful defence results in the award of the PhD degree.

4. Degrees equivalent to the PhD:

It is recognised that there are some other doctoral titles that enjoy the same status and represent variants of the PhD in certain fields. All of them **have similar content requirements**. Potential applicants are invited to consult the following for useful references on degrees that will be considered equivalent to the PhD:

- EURYDICE: "Examinations, qualifications and titles - Second edition, Volume 1, European glossary on education" published in 2004[41]. Please note that some titles that belong to the same

41 http://eacea.ec.europa.eu/education/eurydice/thematic_studies_archives_en.php

category with doctoral degrees (ISCED 6) may correspond to the intermediate steps towards the completion of doctoral education and they should not be therefore considered as PhD-equivalent.

- List of research doctorate titles awarded in the United States that enjoy the same status and represent variants of the PhD within certain fields. These doctorate titles are also recognised as PhD-equivalent by the U.S. National Science Foundation (NSF)[42].

5. First Professional Degrees (for medical doctors please see below):

It is important to recognise that the initial professional degrees in various fields are **first degrees, not graduate research degrees**. Several degree titles in such fields include the term "Doctor", **but they are neither research doctorates nor equivalent to the PhD**.

6. Medical Doctors (or applicants holding a degree in medicine):

For medical doctors (or applicants holding a degree in medicine), **a medical doctor degree will not be accepted by itself as equivalent to a PhD award**. To be considered an eligible Principal Investigator, medical doctors (or applicants holding a degree in medicine) need to provide the certificates of **both a medical doctor degree and a PhD or proof of an appointment that requires doctoral equivalency** (e.g. post-doctoral fellowship, professorship appointment). Additionally, candidates must also provide information on their research experience (including peer reviewed publications) in order to further substantiate the equivalence of their overall training to a PhD. In these cases, the certified date of the medical doctor degree completion plus two years is the time reference for calculation of the eligibility time-window (i.e. 4 - 9 years past the medical doctor degree for Starters, and over 9 - 14 years past the medical doctor degree for Consolidators).

For medical doctors who have been awarded both an MD and a PhD, **the date of the earliest degree that makes the applicant eligible** takes precedence in the calculation of the eligibility time-window (2 - 7 years after PhD or 4 - 9 years past the medical doctor degree for Starters, and over 7 - 12 years after PhD or 9 - 14 years past the medical doctor degree for Consolidators)

42 http://www2.ed.gov/about/offices/list/ous/international/usnei/us/edlite-structure-us.html

Annex 3

Countries Associated to Horizon 2020 and Restrictions Applying to Some Legal Entities Established in Certain Third Countries

Please check the online manual for up-to-date information on the current position for Associated Countries[43].

The eligibility criteria formulated in Commission notice Nr. 2013/C 205/05[44] shall apply for all actions under this Work Programme**,** including with respect to third parties receiving financial support in the cases where the respective action involves financial support to third parties by grant beneficiaries in accordance with Article 137 of the EU's Financial Regulation.

Some entities from third countries are covered by the Council sanctions in place and are not eligible to participate in Union programmes. Please see: the consolidated list of persons, groups and entities subject to EU financial sanctions[45].

Given that the EU does not recognise the illegal annexation of Crimea and Sevastopol, legal persons established in the Autonomous Republic of Crimea or the city of Sevastopol are not eligible to participate in any capacity. This criterion also applies in cases where the respective action involves financial support given by grant beneficiaries to third parties established in the Autonomous Republic of Crimea or the city of Sevastopol in accordance with Article 137 of the EU's Financial Regulation. Should the illegal annexation of the Autonomous Republic of Crimea and the City of Sevastopol end, this Work Programme shall be revised.

[43] http://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/international-cooperation_en.htm

[44] OJEU C 205 of 19.07.2013, pp.9-11.

[45] http://eeas.europa.eu/cfsp/sanctions/consol-list_en.htm.

Annex 4

Financial support to third parties

Where this possibility is explicitly indicated in this work programme, proposals which foresee a financial support to third parties[46] shall clearly detail the objectives and the results to be obtained and include at least the following elements:

- a closed list of the different types of activities that qualify for financial support;
- the persons or categories of persons which may receive financial support;
- the criteria for awarding financial support;
- the criteria for calculating the exact amount of the financial support;
- the maximum amount to be granted to each third party (may not exceed EUR 60 000 for each third party unless it is necessary to achieve the objectives of the action).

Further boundary conditions regarding the above listed elements or other elements may be laid down in the relevant call allowing a financial support to third parties.

The grant beneficiary must ensure that recipients of the financial support allow the ERC Executive Agency, the Commission, the European Anti-fraud Office and the Court of Auditors to exercise their powers of control, on documents, information, even stored on electronic media, or on the final recipient's premises.

[46] Article 137 of the Financial Regulation.

Prior Information of Principal Investigators, Candidates, Tenderers and Grant Applicants - registration of legal entities in the Commission's Early Warning System (EWS) and Central Exclusion Database (CED).

The Commission uses an internal information tool (EWS), as well as a database available to public authorities implementing EU funds (CED) to flag identified risks related to beneficiaries of contracts and grants with a view to protecting the EU's financial interests.

Principal Investigators, candidates, tenderers, grant applicants and, if they are legal entities, persons who have powers of representation, decision-making or control over them, are informed that, should they be in one of the situations mentioned in:

Commission Decision of 16.12.2008 on the Early Warning System (EWS) for the use of authorising officers of the Commission and the executive agencies (OJ L 344, 20.12.2008, p. 125); or

Commission Regulation of 17.12.2008 on the Central Exclusion Database – CED (OJ L 344, 20.12.2008, p. 12);

their personal details (name, given name if natural person, address, legal form and name and given name of the persons with powers of representation, decision-making or control, if legal person) may be registered in the EWS only or both in the EWS and CED, and communicated to the persons and entities listed in the above-mentioned Decision and Regulation, in relation to the award or the execution of a procurement contract or a grant agreement or decision.

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Mina Kairit Šor (sünnikuupäev: 19.06.1982)

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