**Literature Review for Competitive Funding Systems**

**Background**

This literature review is organized following the key policy questions raised in the terms of reference for an activity on “Effective Operation of Competitive Funding Systems”, which are:

-What are the advantages and disadvantages of different modalities?  
-What is the most appropriate competitive funding modality to use in a particular context?   
-What are the advantages and disadvantages of different proposal review mechanisms?  
-Are there alternative methodologies that can be implemented, and in which context?

**Setting the scene**

*The term “Competitive Funding System” needs to be clearly defined.*

The TOR proposes that the project will focus on “competitive research project funding schemes that that work through call for proposals mechanisms and have the scientific quality as the main (but not unique) evaluation criteria”, which is an important form of allocating funding competitively, as note in many literatures:

Competitive funds are an alternative to the more traditional approach of establishing categorical funds. These are usually funded on a project by project basis for the purposes of improving quality and relevance, promoting innovation and fostering better management objectives that are difficult to achieve through funding formulas or categorical funds. The allocation of competitive funds is based on peer reviews. (Strehl, Reisinger, & Kalatschan, 2007)

Project based funding: Project based funding gives funding organisations more control over research. One rationale for increasing the relative share of competitive funding is that it is expected to yield relatively higher returns in terms of knowledge creation and research output. (OECD, 2011)

Competitive funding includes contracts and grants coming from governmental authorities (national/regional) distributed on a competitive basis. It also includes research funds distributed through Research Councils or similar funding bodies on a competitive basis. (Dominicis, Pérez, & Fernández-Zubieta, 2011)

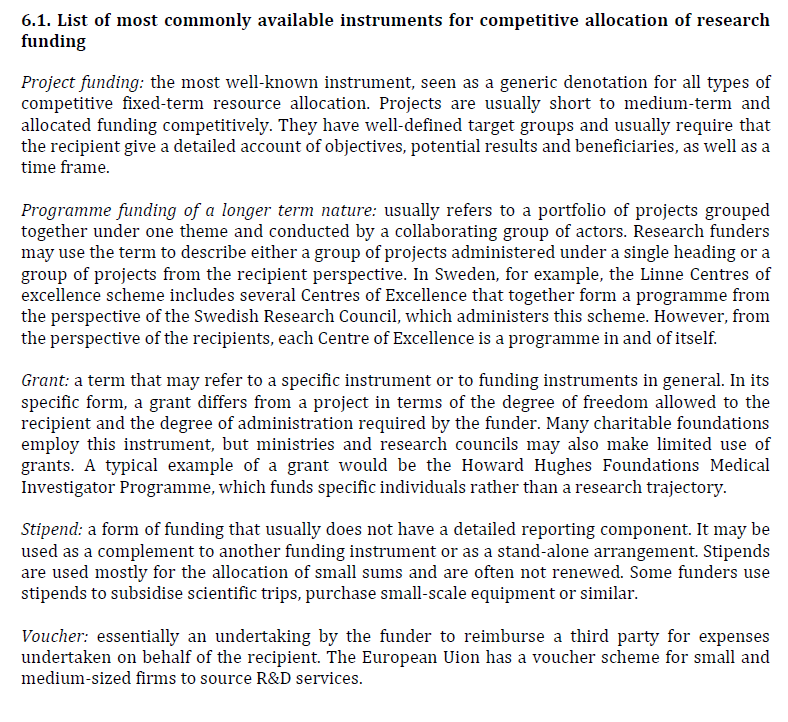
This refers to fellowships, projects, prizes and other awards that are given on a competitive basis to individual researchers and R&D groups or units. (Horta, Huisman, & Heitor, 2008)

Research project funding is not the only way for competitive allocation of research funding, and also block funding is increasingly competitive:

Performance based funding systems differ widely in nature and in terms of the type of assessments they use. Many countries use a funding formula which is partially based on the quantitative assessment of research outputs. Another set of countries rely instead on evaluations of research output through peer review. A subset of the latter mixes peer review with the quantitative assessments of research outputs. (Jonkers & Zacharewicz, 2015)

Several countries have introduced new performance based approaches to the distribution of institutional funding... Therefore, this approach introduces an element of competition for block funding. (OECD, 2011)

The ratio between institutional block funding and project funding is often used in existing studies as a proxy for the degree of competition within a national research funding system: institutional funding being perceived as non-competitive and project funding as competitive. However when the various subtypes of funding are being considered, the simple dichotomy between ‘non-competitive’ and ‘competitive’ funding renders into a continuum. (Dialogic and Empirica, 2014)

 (Jacob, 2010)

Linking institutional assessment of performance with institutional funding is also a powerful tool for promoting competition in research and increasing the effectiveness of national expenditures. (European Commission, 2015)

There are serious difficulties in developing a practical definition of competition that can be related to funding flows. For any definition, the level, purposes and nature of competition change, especially as institutional identities shift (Rand Europe, 1999)

Whether the competitiveness within a funding system could be measured by the ratio of competitive project funding vs total funding is under question:

Indicators to track the implementation of Priority One: “Share of national GBAORD allocated as project-based funding”, “Share of project-based research and development budget allocated through peer-review”, and “Share of institutional funding allocated based on institutional assessment and/or evaluation”. (European Commission, 2012)

Elements of competition can be built into any type of funding and is therefore not related to either institutional block funding or project funding, as e.g. illustrated by the nature of institutional funding in the UK which is highly competitive (Dialogic and Empirica, 2014)

However, structuring the debate on the effectiveness of national research systems around funding models alone does not seem the best way to improve the quality of public research policy across the continent. (Science Europe, 2014)

*Terms of ‘modality’, ‘mechanism’ and ‘methodology’ need to be defined.*

Although the terms ‘modality’, ‘mechanism’ and ‘methodology’ are used regularly in the literatures in the context of funding, few documents have defined the terms.

The term modality may be defined as the means or specifications used to operationalise/implement a funding instrument. … Modality is the term used to refer to these differentiations during implementation. (Jacob, 2010)

*Competitive project funding shares some common features, most notably peer review.*

The distribution of funding among competing proposals is often based on a system of peer review where experts assess the quality of the proposal according to predefined criteria. These criteria may include scientific merit as well as socio-economic considerations. Peer reviewer’s opinions are collected and analysed by a committee consisting of scientists and/or administrators from the funding body. These committees make a final decision, which can be informed, although not solely determined, by the reviewers’ assessment (Besselaar, 2010)

Competitive mechanisms cover a wide range. They include: peer review screening of individual project proposals; selection based on criteria that include some mix of scientific merit, social benefit, nationality, seniority, disciplinary balance, cost and other economic factors; Higher Education institutional funding based past performance; head-to-head institutional or regional competitions for research infrastructure funding; and extended mechanisms in which a subset of bidders are provided limited support for concept development, preliminary work and proposals. (Rand Europe, 1999)

Allocating funding through open calls for proposals, evaluated by panels of leading independent domestic and non-domestic experts - this incites researchers to reach internationally-competitive levels of performance (European Commission, 2012)

Principles used when establishing competitive funding arrangements:  
Competition, Specific purpose, Autonomy and decentralization, Consistency in carrying out policies, Tiered competition, Objective selection process, Evaluation and monitoring, Incentive and disincentive. (Tadjudin, 2007)

The reasons which are most frequently quoted for adopting new methods are increasing excellence and quality of research, encouraging interdisciplinary research, overcoming institutional and structural rigidities, facilitating networking between different institutions and promoting young researchers.  
In most cases, more flexible and competitive funding mechanisms are attached to new and specific programmes which address specific priority subjects defined by governments or research councils. (OECD, 2003)

A significant part of the funding for research and development (R&D) is distributed through competitive programs, in which research proposals are compared and judged for their excellence, expected results and probability of completion. Many of these competitions rely on peer review to evaluate the proposed research projects. With its long-standing status in assuring high quality research (e.g. in checking the originality and quality of scientific publications, Merton 1973) (Sobkowicz, 2015)

*Differences exist among different countries in competitive project funding, and many literatures are done by reviewing measures in each country. A ’guide book’ kind of typology of competitive funding and its components is yet to be found.*

Some funding organisations, such as the US DARPA, take a different approach whereby a strong scientific manager is given the responsibility to decide which research projects to fund. (Hackett, 2010)

Obviously, the funding models that are in use in particular countries are the result of history and politics. (Jongbloed, 2009)

In many countries, however, modalities are historical artefacts (especially the breakdown between institutional and project funding) or are due to other factors. Even recent changes may have more of ‘modal shift’ than ‘modal choice’ about them. Thus it may be difficult to assess them as ‘best practices’ outside their specific historical, economic and organisational/institutional contexts. They may be slow to change or perverse in the ways they change. (Rand Europe, 1999)

There are still big differences between Member States in the way research funding is being allocated. While competitive project-based funding occurs in all Member States, the extent of it varies significantly between countries. (European Commission, 2015)

**Advantages and disadvantages of competitive funding modalities**

*The term ‘competitive funding modality’ needs to be further defined, as varies modalities are mentioned in the literatures.*

The first responsive mode refers to broad calls for investigator-driven, bottom-up proposals in which researchers apply for funding. A second thematic mode is for research funding bodies to dictate predefined areas in which researchers can apply. A third mode offers funding for predefined research projects. Finally, another type of public research funding which is often grouped with project funding is the funding of individual (especially younger) researchers through fixed term grants and fellowships.   
…  
This inventory should also consider eligibility conditions; objectives and evaluation systems; initial funding conditions ‘on paper’; final allocation of funds; and differences across research disciplines in addition to qualitative information about the perceptions of researchers about funding schemes. (OECD, 2011)

Some examples of currently used funding modalities applied to some of the funding instruments include:  
·One-step call: open call with no or very few limits on the type of topic (e.g. call for research in the natural sciences or humanities);  
·One-step call: thematic (e.g. global challenges);  
· Two-step call: no limits on topics with very brief proposals for the first step and a full proposal for the second;  
·Two-step call: thematic focus with very brief proposals for the first step and a full proposal for the second;  
·Restricted eligibility: proposals must include specific partners (e.g. firms, public sector actors, international partners); and  
·Co-financing: applicants must be able to finance a previously agreed percentage of the costs of the proposed research to be eligible for funding. (Jacob, 2010)

*Competitive funding modalities are usually discussed within one certain programme or country, or in relation to the goals expected to achieve.*

Turning from principles to methodology, there are broadly speaking two main approaches to peer review for funding proposals: the one-stage and two-stage methods. Smaller schemes tend to adopt the one-stage process, whereby proposals are only reviewed by members of the panel that will adjudicate on behalf of the funding body. ... The two-stage process typically distributes proposals to a number of external and remote assessors (with specific expertise in the relevant subject area) who comment and in most cases score proposals according to their viability, quality and compliance with funding requirements. (Kubler, 2013)

Policy actions to achieve these goals involve for example: i) The creation of more flexible and competitive funding mechanisms attached to new and specific programmes which address specific priority areas; ii) Finance support for competitive research projects in research areas that call for inter-institutional and interdisciplinary Public Sector Research Funding collaboration that are designed to encourage the establishment of emerging research fields and new research teams; iii) To involve industry in more basic research; to facilitate private and public cooperation; and the transfer of research results to innovation. (OECD, 2011)

the Deutsche Forschungsgemeinschaft has recently modified its procedures to insulate scientific merit assessment from ‘budget’ pressure. It uses a process that changes the selection and funding modality in response to market conditions. The underlying idea is to prevent higher competition from conflating different dimensions (Rand Europe, 1999)

*Detailed studies on advantages and disadvantages of competitive funding modalities are yet to be found. Most of existing studies are on advantages and disadvantages of competitive project funding as a funding instrument, such as following:*

*Advantages of competitive project funding are usually discussed in relation to the goals that it is expected to achieve.*

The rationale for government intervention in support of public research goes beyond a simple market failure argument. It implies the need to embed policies in a broader context, and a shift from top-down to network steering in order to deal with systems imperfections or failures. (OECD, 1998) (Arnold, 2004)

By tying funding to specific objectives, increased project funding is expected to overcome rigidities in the discipline-based research system of the higher education sector in many OECD countries and enable funding of interdisciplinary and emerging areas that reflect national priorities. (OECD, 2003)

These failures are generally associated to particular research system’s interaction structures which are characterised by: i) a lack of key participants (absence of actors with specific capabilities) and/or ii) a lack of or a low effectiveness of the existing interactive behaviour within the research system. (OECD, 2011)

*Advantages of competitive project funding include:*

… there is clear evidence in the academic literature that excellence in science is linked to competition between researchers (Franzoni, Sclelatto and Stephan, 2011).Scientists evaluated through comparable international benchmarks (e.g. analysing their international publication patterns) achieve higher research quality. The literature also demonstrates a clear link between a more competitive funding environment for universities and the productivity of the whole research system in terms of the number of publications per euro invested (Auranen and Nieminen, 2010). Competition for funding acts as a strong incentive for research institutions a) to improve their financial capacities, b) to increase the visibility of individual research institutions, c) to attract and retain the best brains and d) to attract more students, access additional funding etc. (Harris, 2005, p.36). (European Commission, 2012)

Pros  
• Increases quality and relevance through competitive processes that seek to identify the highest quality proposals.  
• Ensures that research proposals are viable (or worthy of a high risk investment) before they are funded.  
• Can direct funding toward specific research priorities.  
• Provides researchers with an opportunity to test their ideas among their peers.  
• Is a catalyst for the development of well-run systems that are viewed as transparent and accountable.  
• Is generally supported by the academic community as a more equitable way of distributing funds than the rather patrimonial systems where decision-making is concentrated in the hands of very few, often non-specialist, individuals.  
• Tends to be flexible and can thus respond to changing priorities.  
• Requires application processes which (especially if combined with training) can have broader systemic benefits, developing skills in the areas of proposal preparation and project management – crucial skills in a competitive environment. (Kubler, 2013)

On the one side, the stakeholders in general point to a number of advantages in relation to the use of competition grants, namely that competition:  
• raises quality, when grants are given to broad areas and in large shares. In particular, the model used by the Danish National Research Foundation seems to be popular with relatively large allocations, a long time horizon and a bottom up approach in the selection of research areas. The model has though been most fruitful in relation to certain scientific areas;  
• involves higher attention to relevance and applicability;  
• offers an alternative possibility of funding for research, which cannot be funded internally;  
• strengthens collaboration. (Schmidt, Langberg, & Aagaard, 2006)

The extremely rich competitive funding landscape, which is a positive feature of the Swedish system, empowers researchers who are able to acquire funds directly (OECD, 2013)

… after the implementation of the new funding system the research sector made significant progress. For instance, in recent years the number of new PhD holders has been increasing at an annual growth of 12%, while in terms of publications, Portugal presented between 1995 and 2000 an average annual growth rate of almost 16%. (Rosa, Tavares, & Amaral, 2006)

Observations showed that there is a change in the mindset of university administrators, a change from bureaucratic thinking to more academic thinking, from passive to proactive and creative, and a more competitive drive. (Tadjudin, 2007)

The share of competitive-based government funds increases with increasing levels of institutional financial autonomy. (Dominicis, Pérez, & Fernández-Zubieta, 2011)

There are several benefits to the use of such competitive funding to promote institutional diversity in higher education rather than direct funding. One of them is the partly, but strong, competitive nature associated with a well-consolidated evaluation framework. But this competitive framework has to be very well established in terms of the evaluation process, sinceit needs to take into account the missions of higher education institutions in order to allow differentiation (Horta, Huisman, & Heitor, 2008)

Preliminary research indicates a variety of effects of competitive higher education funding including: concentration of research resources and agendas; attention to intellectual property rights; co-operation between public and private entities; research labour mobility; higher proportions of contract researchers among University personnel; and spill-over effects on teaching and knowledge diffusion. One particular consequence is pressure on institutional infrastructure - as the contract proportion rises, so do claims on shared resources. This would occur even if contracts were additional money - downward pressures on public institutional funding exacerbate it. (Rand Europe, 1999)

*Disadvantages of competitive project funding are often discussed in relation to block funding, which resembles a short-term vs long-term conflict.*

There is debate about whether the increasing reliance on competitive project or program funding at the expense of block grant and long-term institutional funding has pressured public sector research resulting in an emphasis on short-term, low-risk projects and away from longer term fundamental research. (OECD, 2011)

On the other hand, the proportion of basic funding that can be used without restrictions is decreasing while the proportion of programme-linked earmarked funding is increasing. This effect contributes to split up the universities’ foundation of finances and can affect the strategic aim of a research university to promote outstanding research by concentration on research and not by short-term pressure to acquire funds. (Hartwig, 2006)

A university's ability to develop its strategic research activities with respect to its profile and objectives could be restricted by over-relying on competitive funding sources. While competitive funding for research might be important for ensuring quality, it is also clear that core funding is essential to support universities' long-term strategic planning. (Dominicis, Pérez, & Fernández-Zubieta, 2011)

Each country should therefore strike the right balance between core, competitive and outcome-based funding (underpinned by robust quality assurance) for higher education and university-based research. Competitive funding should be based on institutional evaluation systems and on diversified performance indicators with clearly defined targets and indicators supported by international benchmarking for both inputs and economic and societal outputs. (COMMISSION OF THE EUROPEAN COMMUNITIES , 2006)

The conceptual arguments for dual streams of funding of higher education research are sound. They encourage researchers to compete on quality and impact (competitive grants), while providing institutions with a base research funding level intended to allow them to make their own strategic choices (block grants) with reduced transaction cost burdens compared with external grant applications. But changes to funding for higher education research have increasingly eroded the share of block grants. The Commission assesses that further shifts away from block grants would risk undermining their important role. (Department of Education and Training, Australian Government, 2015)

However, in a comprehensive evaluation of these questions, the opinions on the strategic research programmes as a whole among the stakeholders were positive. In general, no signs of damaging effects on basic research were found. Similarly, it was emphasised that no weakening of quality norms or short term change of direction could be observed. (Schmidt, Langberg, & Aagaard, 2006)

Our results show that public agricultural research and agricultural extension have statistically significant positive impacts on state agricultural productivity. In addition, Hatch formula funding has a larger impact on agricultural productivity than federal competitive grant funding, and a reallocation of Hatch formula funds to competitive grant funding would lower agricultural productivity. (Huffman & Evenson, 2006)

*Other disadvantages of competitive project funding include:*

For example, project-based funding on very large scales may: (1) cause researchers to spend a significant amount of their time writing or reviewing research proposals instead of doing research; (2) push publicly-funded research to mimic privately-funded research in terms of short termism and risk tolerance; and (3) amplify the risks associated with peer review. (Science Europe, 2014)

Cons  
• Can tend toward becoming conservative and unreceptive to more experimental, high risk or multidisciplinary research.  
• Creates systems that may not meet the needs of higher education sectors characterised by major differences in institutional and structural capacity, which can lead to a concentration of funds among a handful of stronger, better-resourced institutions.  
• May not produce the necessary competition to drive up quality in countries with small research systems.  
• May stifle collaboration (where collaboration is not actively encouraged within the designated funding scheme).  
• Can require time-consuming, labour intensive and costly grant-making procedures for both the funding body and for institutions.  
• Poses the challenges of identifying, recruiting and incentivising peer reviewers and ensuring the quality of their assessments (discussed in more detail in the next section) and restricting conflict of interest. (Kubler, 2013)

On the other side, stakeholders point out the weaknesses in the use of competition grants:  
• competition grants are often (too) narrow in scope and do not promote originality, creativity and novelty;  
• not all scientific areas have the same possibilities of attracting such funding;  
• applying for competition grants is resource demanding and time-consuming;  
• an increasing proportion of competition grants limits the possibilities of long time planning for the HEIs;  
• despite a recent reform of the system, quality assurance needs to be improved;  
• there are major problems with the embedment of competition grants;  
• competition grants often contribute only marginally to long-term institutional objectives;  
• universities get forced to focus on areas where funding is available rather than on areas where they have high competence;  
• strategic management of universities moves from the institutions to funding agencies;  
• increased bureaucracy and administration  
• low overheads, which imply that institutions often cannot afford to attract external funds. (Schmidt, Langberg, & Aagaard, 2006)

It was mentioned that the existent highly competitive system could easily lead to the promotion of certain research areas, more output oriented, instead of others, traditionally less appealing for the global market and consequently less financially attractive. (Rosa, Tavares, & Amaral, 2006)

… a highly competitive system which does not maintain a sufficient degree of security can hinder the process of creating ground-breaking research. The stoking of ‘‘animal spirits’’ leads to a survivalist approach and a more direct focus on getting cited and funded as goals in themselves, and in so doing creates conditions that foster conservatism rather than the sort of aggressive innovation and creativity that leads to breakthrough results. (Young, 2015)

… increasingly it has become the responsibility of faculty to generate the resources to support research, either indirectly by building reputation or directly by submitting grants.  
Such a system has led faculty, and the government agencies that support faculty, to be risk averse..  
The system, at least in the U.S., has particularly failed young investigators. (Stephan, 2010)

Apparent disadvantages of competitive funding include: neglect of the long-term research agenda, limited attention to capacity development (including possible neglect of the research infrastructure), high transaction costs, and the possibility of 'rent-seeking' in the resource allocation process (Echeverria, 1998)

We conclude that a further reduction or elimination of federal formula funding of agricultural research will significantly impact  
• Future research priorities and the research agenda,  
• The composition of short- versus long-term research,  
• The mix of national versus local needs research,  
• The transactions costs of undertaking research,  
• The distribution of research funds across the states,  
• The distribution of research benefits across states,  
• The rate of return that society earns from its research investments,  
• The discovery risk faced by society, and  
• The sustainability of future research funding. (Huffman, Norton, Traxler, Frisvold, & Foltz, 2006)

*Doubts have also been raised, especially in more recent literatures, on the connection between competitive funding and research performance.*

In many cases the underlying assumption of introducing competition in research funding is that there is a direct positive effect on research performance...However, when we look at available data, this relation seems not clear…  
The link between competitive research funding (Structure) and the outcome of the system (Performance) is only indirect: it is mediated by the strategic behaviour (‘Conduct’) of the various agents….   
One striking observation is that the three European countries that are clearly in the lead in terms of research performance (Switzerland, Denmark, the Netherlands – see Figure 2) all three still rely relatively heavily on institutional block funding…  
The bottom line is that these indicators do not support the hypothesis that there is a positive relationship between competitive funding and scientific performance, or even that a relationship exists at all. (Dialogic and Empirica, 2014)

We find no relationship between the level of ex-ante funding and the scientific production or efficiency within our sample of countries. A higher degree of fixed funding seems to be associated with more research output in terms of the number of publications and citations. (Dalen, Mehmood, Verstraten, & Wiel, 2014)

The available evidence on the effect of this funding mechanism is mixed. However, all countries which did not experience a consistent improvement in impact scores did not have a PBF system in place. These countries recently also received recommendations by international organisations to implement a PBF system…   
… none of the systems which have implemented a PBF (Performance based funding systems) have experienced strong negative effects of these systems on the indicators considered. (Jonkers & Zacharewicz, 2015)

First of all, the share of institutional funding does not correlate with competitiveness, overall performance, and top performance. And, more competitive systems do not result in larger differences between performances of universities...  
Obviously, there is a lack of understanding concerning the nature of competition, and how competitive mechanisms manifests themselves at the level of university, in order to establish a relationship between national systems’ performance, and national systems’ competitiveness (Sandström, Hayman, & Besselaar, 2014)

The broad conclusion from these studies is that while increased competition is associated with higher performance levels, the underlying situation is complex includes other incentives and environmental factors. (Georghiou, 2013)

**The most appropriate competitive funding modality to use in a particular context**

*It is yet to find literatures that recommend the most appropriate competitive funding modalities to particular contexts, except some general observations:*

the parallel eligibility of both public and private recipients is in many cases desirable, in particular for measures aiming to improve commercialization and address local needs...  
support for science-industry co-operation was applied in a too simplistic manner and based on outdated spill-over and linear transfer assumptions..  
range of programs should not become too broad and outdated or unsuccessful programs should eventually be discontinued…  
there is in inherent danger in support programs that run for a very long time (as e.g. some of FINEP) and individual allocations that are guaranteed for a long time (Kroll & Stahlecker, 2012)

**The advantages and disadvantages of different proposal review mechanisms**

*Peer Review Mechanism: peer review is one of the most important and common components of competitive project funding. However, it is also under constant debate and lots of literatures exist. Some discussion on the advantages and disadvantages of peer review include:*

Best-practice performance in this respect which all Member States should attain involves:  
• Allocating funding through open calls for proposals, evaluated by panels of leading independent domestic and non-domestic experts (peer review) - this incites researchers to reach internationally-competitive levels of performance  
• Assessing the quality of research-performing organisations and teams and their outputs as a basis for institutional funding decisions - peer review can form a part of such assessment and, in the long-term, lead to organisational change (European Commission, 2012)

We construct new data to track publication, citation, and patenting outcomes associated with more than 130,000 research project (R01) grants funded by the U.S. National Institutes of Health from 1980 to 2008. We find that better peer-review scores are consistently associated with better research outcomes and that this relationship persists even when we include detailed controls for an investigator’s publication history, grant history, institutional affiliations, career stage, and degree types. (Li & Agha, 2015)

With its long-standing status in assuring high quality research (e.g. in checking the originality and quality of scientific publications, Merton 1973) peer review is considered a good method to ensure that the right proposals would get financial support. The main arguments were (and still are) the ability to use the expertise already in the field and the democratic – in the sense of the decisions originating, at least partially, within the research community – nature of the process (Rennie 1999; Benos et al. 2007). (Sobkowicz, 2015)

The trouble with peer review:  
• Cost and bureaucracy.  
• Lack of national expertise to assess a diverse range of proposals.  
• Conservatism – getting peer reviewers who endorse multi-disciplinary and high-risk research as well as new researchers with little academic track record.  
• Difficult to incentivise often poorly paid academics to provide their services as reviewers for little or no remuneration, especially where a culture of paid external consultancy is the norm and ‘extra-curricular’ academic duties are not firmly established.  
• Potential for over-burdening reviewers.  
• Anonymity and conflict of interest, especially where research communities are small. (Kubler, 2013)

Peer review may not be the appropriate mechanism for all types of funding allocation in a research system, not even for all competitive funding.   
Moreover, on a large scale, peer review is costly and it can be difficult to find truly independent researchers …  
Finally, while peer review can clearly identify excellent proposals and poor proposals, panels often struggle with ranking average quality proposals (Science Europe, 2014)

Peer review is practiced in all Member States. However, there is an absence of agreed standards on the core principles of international peer review. (European Commission, 2015)

In our opinion, a combination with social network studies and openness of the review to statistical oversight, might improve the quality and capacity to recognize ideas worth taking the risk…  
An additional measure, proposed by Leijten et al. (2010), has already been mentioned: improving the capacity for stop-and-go decisions for existing projects and for flexibility in the research, including the opportunities to test new ideas, not described in the original proposals. (Sobkowicz, 2015)

*Further studies on proposal review mechanisms, other than peer review, of competitive project funding are yet to be found.*

Some countries have introduced ongoing measurements of performance, sometimes in the form of periodic assessment reviews. Ex post evaluation of projects is less frequent. (OECD, 2003)

Performance based funding systems differ widely in nature and in terms of the type of assessments they use. Many countries use a funding formula which is partially based on the quantitative assessment of research outputs. Another set of countries rely instead on evaluations of research output through peer review. A subset of the latter mixes peer review with the quantitative assessments of research outputs. (Jonkers & Zacharewicz, 2015)

**Alternative methodologies**

*‘Alternative methodologies’ need to be further defined. In the literatures they may refer to instruments other than competitive project funding and block funding, and may include centre of excellences, other forms of performance based funding, etc.*

We also find a number of similarities in the instruments used, such as centres of excellence, large programmes within the fields of information technology, genetics, nano-tech and so on …  
However, this composite model leaves room for national specificities concerning the share of the different instrument types, as well as for maintaining instruments reflecting national needs and production (Lepori, et al., 2007)

At the same time, because research requires a degree of stable funding, national systems strive for a balance between competition and stability (OECD, 2012, p. 177f.) … It is in this context that “research excellence initiatives” (REIs) have emerged. The REI is an instrument designed to encourage outstanding research by providing largescale, long-term funding to designated research units, with an emphasis on research of exceptional quality (OECD , 2014)

Countries that allocate more resources through ex-post funding spend, on average, less public research money per citation and publication. This suggests that a greater degree of ex- post funding may lead to a more efficient scientific production. A possible disadvantage of this type of funding is that strong incentives to provide measurable research output can be detrimental to immeasurable output. (Dalen, Mehmood, Verstraten, & Wiel, 2014)

**And other relevant questions raised in the literatures**

• What indicators for measuring competition (at various levels) in research funding and more widely the key characteristics of a national research funding system can be used or developed?  
• What is an optimum level of competition in research funding?  
• Strengthen the validity of our model by demonstrating that, other structural factors (like HRM-policy, academic climate, educational system etc) being equal, competition-based allocation of public research funding does not necessarily leads to enhanced research performance.  
• How important is research funding as a structural factor affecting research performance next to other structural factors (such as the research climate, HRMpolicy) and conduct factors?  
• How important are funding and non-funding policies affect conduct variables and how do they subsequently relate to research performance? (Dialogic and Empirica, 2014)

·What is the optimum balance between competitive and block funding in a research system?  
·What measures can be taken to improve national approaches to peer review?  
·What is the most effective way to incentivise institutions to improve their research performance? (Georghiou, 2013)

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