

Annex 1: Literature Review

Initiatives to encourage Public Procurement for Innovation (PPI) are a key instrument in demand-side innovation policy.¹ Public Procurement for Innovation has been on the Government's agenda since the early 2000s. The UK has explored various PPI initiatives to pursue sustainable and innovation goals with procurement. Table A.1 outlines a number of key PPI schemes that have been pioneered in the UK.

Table A.1: Summary of Key PPI Initiatives that have been implemented in the UK

Initiative	When started	Policy purpose
SBRI: Small Business Research Initiative	Since 2001 and re-launched in 2009	Initially, the purpose was to increase access of SMEs to public procurement and to support the procurement of R&D with a potential to procure the innovation generated in the R&D contract. Since the re-launch in 2009, it has not been limited to SMEs. The primary policy purposes of SBRI are: (i) to stimulate innovation in the economy by supporting firms to develop and commercialise new technology-based products and solutions; (ii) to provide government departments and their agencies with new, cost-effective, technical and scientific solutions.
Forward Commitment Procurement (FCP)	2006	FCP is an early market engagement procurement model. The policy purpose of FCP is to aim to resolve the problem that arises when an organisation requires a good or service that is either not available on the market or is too expensive to purchase. FCP was originally developed for environmental innovation and then applied across wider areas..
IPP: Innovation Procurement Plans	2008	The policy aim was to provide government departments with an opportunity to fundamentally think about their procurement practices and to consider how these might be improved or used to drive innovation by requiring them to provide an indication of the types of activities being carried out by departments to obtain innovative solutions; and a plan to embed processes for the procurement of innovation in their procurement procedures.

¹ The European Research Area and Innovation Committee define PPI as any kind of public procurement practice (pre-commercial or commercial) intended to stimulate innovation through research and development, and the market uptake of innovation products and services.

Public-private Procurement Compacts	2012	<p>This was a pilot programme with the policy aim of helping large public and private organisations reduce their carbon footprint by aggregating their future demand for environmental products, sending clear signals to industry in order to both induce the generation of new innovations and to accelerate the diffusion of new products and services. This was piloted in in three areas: low carbon transport; zero-carbon catering; and heat and power from renewable biomethane – in order to:</p> <ul style="list-style-type: none"> a) To reduce the carbon footprint of private and public sectors; and b) To induce the generation of new innovations and to accelerate the diffusion of new products and services.
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Among these PPI policy instruments, the Small Business Research Initiative (SBRI) has been established as the main programme in the UK. The UK SBRI was inspired by the Small Business Innovation Research (SBIR) programme in the United States and has followed SBIR's principles. Among other EU countries, Netherland set up a similar SBIR initiative in 2005.

Next, in Table A.2, we turn to see key features of SBRI-like programmes implemented in these three countries, underlining similarities and differences between these programmes. Then we review existing literature for these programmes in Tables A.3-A.5.

Table A.2: Summary of key features of US SBIR, UK SBRI and The Netherlands SBIR programmes

	US SBIR	UK SBRI	The Netherlands SBIR
When started	Created in 1982 through the Small Business Innovation Development Act and reauthorised by Congress on a regular basis (in 1992, 2000, 2011 and 2016)	Initially introduced in 2001 and re-launched in 2008/2009	Piloted in 2004; fully rolled out in 2005. Then restructured/rebranded in 2011.
Objectives	<p>The SBIR program was instigated via legislation, the Small Business Innovation Development Act, in 1982. Its statutory purpose is to strengthen the role of innovative small businesses in federally-funded research or research and development (R/R&D) in order to:</p> <ul style="list-style-type: none"> • Stimulate technological innovation • Use small business to meet Federal R/R&D needs • Foster and encourage participation by socially and economically disadvantaged small businesses (SDBs), and by women-owned small businesses (WOSBs), in technological innovation • Increase private sector commercialisation of innovations derived from Federal R/R&D, thereby increasing competition, productivity and economic growth. 	<p>The primary purposes of SBRI are:</p> <ul style="list-style-type: none"> • Stimulate innovation in the economy by supporting firms to develop and commercialise new technology-based products and solutions • Provide government departments and their agencies with new, cost-effective, technical and scientific solutions. 	Set up for government to use its procurement power to mobilise the innovative capacity of Dutch companies to solve societal challenges.
Organisation(s) providing oversight / programme management	<p>The Small Business Administration Board oversees and administers the competitions.</p> <p>Each participating agency determines and administers its own SBIR funds – selecting R&D topics, issuing calls, evaluating proposals and making awards and the Small Business Administration (SBA) functions as the overall coordinating agency for SBIR.</p>	<p>Innovate UK, the UK Innovation Agency, oversees the competitions and collects competition data at aggregate level.</p> <p>Similar to the USA SBIR, each participating public body administers its own SBRI funds, launches and manages their own competitions.</p>	Formerly the Ministry of Economic Affairs Agriculture and Innovation then responsibility moved to the interdepartmental programme department Knowledge & Innovation.
Who can apply	For-profit companies with 500 employees or less and at least 51% commercially owned by US citizens or permanent residents.	Any organisations including companies of any size, pre-start up, universities and charities. A small number of competitions were won by non-UK	Any company (no size restriction), but there were originally three variants with the second targeted at start-

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		(EU) applicants.	ups/researchers.
Process	<p>SBIR funding is awarded in a stage-gate process with three phases:</p> <ul style="list-style-type: none"> Phase I: Concept development / feasibility studies. Short-term (typically 6 months) feasibility studies of proposed innovations. Normally not exceeding \$150k per award and competitively selected Phase II: Prototype development. A successful phase I award can compete for follow-on phase 2 funding to further develop, test or evaluate the innovation (e.g. creating a prototype). Phase II awards are typically up to \$1M for two years Phase III: Commercialisation. This can include transitioning to government acquisition programs. This is not funded by SBIR/STTR but agencies may provide non-SBIR/STTR funding under their own programs of support. 	<p>Similar to the USA SBIR, the UK SBRI has adopted a phased process:</p> <ul style="list-style-type: none"> Phase I: Concept development / feasibility studies – up to six months and range from £50k - £100k Phase II: Prototype development – approximately 2 years and worth between £250k and £1m <p>Use of a further stage, sometimes known as 'Phase III' for Commercialisation, is not part of the SBRI guidelines and is relatively rare in the UK compared with USA.</p>	<p>A ministry or public authority identifies a specific challenge or societal issue which requires innovation and then a procurement competition is launched. First an independent assessment is carried out, followed by::</p> <ul style="list-style-type: none"> Phase 1: feasibility; technique; marketing; organisation – max €50k per project Phase 2: research; development; prototype; test/demonstration (2 years) – if succeed phase 1 max €450k per project Phase 3: market development; product launch – not supported by government funding.
Budget target	<p>All Federal departments and agencies with extramural R&D budgets that exceed \$100M (currently 11 agencies) are required to allocate a small portion of their R&D budgets to SBIR.</p> <p>Initially set at 0.2% in 1982, the required allocation has slowly risen, reaching 3.0% in 2016 and will be 3.2% in 2017 and each subsequent year.</p> <p>In 2014 (the latest year for which figures are available) the total SBIR expenditure was \$1.99bn.</p>	<p>When the UK Government introduced an SBRI programme in 2001, the objective was set at 2.5% of external R&D to be spent with SMEs, with an overall target of £50m.</p> <p>Spending Round 2013 announced specific targets totalling £100m for selected departments for 2013/14:</p> <ul style="list-style-type: none"> Defence- £50m NHS (Health)- £30m Transport- £7m Home Office- £7m Energy and Climate Change- £3m 	<p>No mandatory budget allocations for departments or agencies.</p>

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		<ul style="list-style-type: none"> • Environment, Food and Rural Affairs- £3m <p>Targets doubled in 2014/15. However, the 2015 Manchester/ERC evaluation found most of these departments spent well below the targets. There are no current budget targets for SBRI.</p>	
Pre-application support	<p>Some departments (e.g. Department of Energy) and states provide Phase 0 funds.</p> <p>Phase 0 fund (up to \$5k) for bridging any extra gaps which may occur in making SBIR applications.</p> <p>A second form of pre-Phase funding is “Seed Grants” which are for up to \$10k. This funding is to provide support for early stages of planning or development of a technology¹.</p>	No such support for UK SBRI	No such support for The Netherlands SBIR.
How are applications assessed?	<p>Assessments are managed by the department / agency funding the competition. SBA Guidelines require that an agency should use the same selection process for its SBIR program as it does for its other R&D programs; as award selection processes differ across agencies, so do selection procedures for SBIR. For example, some departments /agencies use external peer-reviewers (e.g. National Institutes for Health, National Science Foundation) and others do not (e.g. Department of Defense, NASA</p> <p>The aim of the evaluation is to determine the scientific and technical merit and feasibility of the proposed project and the quality of performance of the small business.</p>	<p>The assessment of applications varies with department. Some are based on internal departmental assessment while others use external assessors. Some assessments are paper-based and others invite proposers to an interview panel.</p>	<p>Independent assessment to find the highest quality applicants that progress through each stage.</p> <p>Proposals reviewed on criteria: impact on the societal issue; entrepreneurship; innovation; economic prospects; ecological and societal aspects; quality of proposal and the project.</p> <p>Evaluation committee ranks all projects and advises contracting authority (relevant minister).</p>

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<p>End of Phase 1 assessment</p>	<p>Phase II funding is based upon the results of work performed under a Phase I award and the scientific and technical merit, feasibility and commercial potential of the Phase II proposal, with emphasis on the commercial potential. The exact details of the process vary with each department/agency.</p>	<p>Once phase I is completed successfully companies decide to apply for phase II funding and these bids are then assessed before Phase II contracts are offered.</p>	<p>Companies that are awarded a contract get €50,000 to research feasibility of their innovation (for maximum of 6 months). Assessment criteria are identical to the application stage with evaluation committee advising contracting authority.</p>
<p>Support beyond Phase 2</p>	<p>If Phase II is successful then projects may move to Phase III – pursuit of commercialisation activities. This phase is not given any financial assistance under SBIR. Some Federal agencies allow for follow-on funding from other non-SBIR R&D or procurement sources. . Some departments/agencies (e.g. National Institutes of Health and the National Science Foundation) provide post Phase II support, referred to as Phase IIB, to address the bridge the funding gap between the end of SBIR Phase II and the start of commercial revenues or investment.</p>	<p>In general there is no SBRI support beyond Phase II. However the SBRI Healthcare has provided Phase III support and intends to do this in the future where budgets and the flow of companies from Phase 1 and Phase II allow it.</p>	<p>Government has the opportunity to become a large customer of the innovation once it has commercialised and act as a first client of the SBIR products.</p>

Table A.3: UK SBRI literature summary

Paper	Key findings
<p>Sainsbury Review of Science and Innovation Policy, 2007, <i>Race to the Top</i></p> <p>http://webarchive.nationalarchives.gov.uk/+http://www.hm-treasury.gov.uk/d/sainsbury_review051007.pdf</p>	<p>SBRI failed to achieve the success like its US counterpart (SBIR); almost every department claimed to exceed the mandatory target but it had made no difference to departmental behaviour and there was no active engagement with suppliers beyond the contract. The scheme had reproduced existing practice but with additional bureaucracy.</p> <p>SBRI has the potential to transform the financing of innovative SMEs, but it needs radical reform in order to achieve this. Key recommendations following principles of the successful USA scheme (based on proposals from David Connell and Anne Campbell):</p> <ul style="list-style-type: none"> • Departments should focus on active engagement with innovative businesses to fulfil their departmental objectives. • Departments should specify (up-front and in a simple/standard format) the technological areas in which they would like to see projects. • SBRI contracts should be two-phase process, tendering a larger, second award following successful completion of a smaller, early-stage development to minimise the innovation risk. • SMEs should retain the Intellectual Property associated with any new technology, boosting incentives for high-quality small businesses to bid for SBRI awards. • SBRI should be restricted to products/services meeting HMT's R&D tax credit criteria to maximise effect and exclude humanities and social science research – scheme never intended for these. <p>To ensure objectives are met, Innovate UK (Innovate UK - TSB at the time of the review) should have a central administrative role. Departments should biannually notify Innovate UK of the technological areas where they would like to support projects and Innovate UK should award contracts, with assessments made jointly with departments. SBRI targets for extramural departmental R&D should build up over three years, from 1.5% in the 1st year to 2% in the 2nd year and 2.5% in the 3rd year.</p> <p>The above recommendations were all accepted by the Government and shaped the re-launch of SBRI.</p>
<p>Centre for Business Research, University of Cambridge (CBR), 2010, <i>Exploding the Myths of UK Innovation Policy: How 'Soft Companies' and R&D Contracts for Customers Drive the Growth of the Hi-Tech Economy</i></p> <p>http://www.cbr.cam.ac.uk/fileadmin/user_upload/centre-for-business-research/downloads/special-reports/specialreport-</p>	<p>(SBRI was studied as part of a wider report on innovation policy and SMEs (Section 7.2 focuses on SBRI) commissioned by the East of England Development Agency on behalf of the East of England Science and Industry Council.)</p> <p>SBRI was first launched in 2001, re-launched in 2004 using a model more closely aligned with the US SBIR programme (for example by providing 100% of funding rather than partial funding as grants do) and then re-vitalised again in 2009 after the review by Lord Sainsbury (described above), but with no explicit ring-fenced budget. The study reported that the number of SBRI awards made so far was highly skewed by a number of very small awards and that questions remained over participation across government and how competitions were funded - some departments were not using SBRI, e.g. BIS and DECC and the level of commitment from some other departments for whom SBRI should be highly relevant, such as DfT and the Home Office, had been very small.</p> <p>With regard to other R&D funding mechanisms, SBRI contracts are ideally suited for prototype development during the exploratory development phase, whilst research councils and EU programmes generally fund pre-seed R&D far from market.</p> <p>The interviews with companies about the reformed SBRI found:</p> <ul style="list-style-type: none"> • Contracts still too academically orientated

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<p>explodingthemyths.pdf</p>	<ul style="list-style-type: none"> • Application process too slow and unclear • Departments, e.g. NHS, being too slow in taking on innovations • Not a clear set of objectives for SBRI – required for an evaluation to measure success • The problem is not lack of funding but small numbers of high-quality applicants • Emphasise peer-review development of businesses (following US SBIR more closely) <p>The study concluded / recommended that:</p> <ul style="list-style-type: none"> • Despite the well-managed effort of the TSB to promote the Small Business Research Initiative (SBRI) to government departments, the rate of adoption continues to disappoint, although EEDA has played an important catalytic role through its pilot scheme with NHS East. • The Government to make ring-fenced funds available so that the SBRI programme can be significantly expanded and extended to all major government spending departments, and to encourage other RDAs and local agencies to initiate their own pilot schemes. • To achieve that the TSB is allocated £75 million per annum to co-fund SBRI competitions by user and specifier departments. We also propose that €800 million per annum is switched from European Commission collaborative R&D programmes into co-funding.
<p>NESTA, 2010, <i>Buying Power?</i> https://www.nesta.org.uk/sites/default/files/buying_power_report.pdf</p>	<p>Original SBRI was hampered by limited public sector take-up and few contracts were for R&D. The revised SBRI launched in 2009 resembles US SBIR (in method, not yet in scale) and has a strong focus on technological R&D. The report is very optimistic about the future use of the programme and projected it to reach £100million of contract value by 2012.</p> <p>Impact of participation on public sector bodies is strikingly undervalued. The analysis indicates that SBRI can help transform the public sector approach to innovative procurement.</p> <p>Unlike other R&D funding, the 100% funded SBRI contract means that development is not held back while private match funding is sought; indeed it acts as an endorsement that helps companies attract more funding later. SBRI also allows government to back ideas that might not attract traditional venture capital funding. Also it has driven the development of wider supply chain; the expected value of these greatly surpasses the initial funding.</p> <p>Limitations: there is a need for clarity regarding SBRI process and ethos; failure to manage expectations can damage SBRI brand; and also it needs to be distinguished from other innovation tools, as well as ensuring there is a spectrum of tools driving demand for innovation that develops alongside SBRI.</p> <p>Three main recommendations:</p> <ul style="list-style-type: none"> • Scale up the SBRI scheme in the UK to optimise its impact on public bodies and to reach many more promising SMEs. • Research found the impact of SBRI varies according to how it is employed; those public sector users that engaged the SBRI process very early, particularly in designing and describing the problem area, were more likely to find the process transformative. Therefore focus on quality to ensure that SBRI remains an effective source of genuine innovation. • Recognise SBRI as a powerful tool in wider system of demand-side policy levers for driving innovation.
<p>OECD, 2010, <i>Public procurement programmes for small firms – SBIR-type</i></p>	<p>A short review of international SBIR-type programmes with a focus on US SBIR</p> <p>On the UK: The Department for Innovation, Universities and Skills (now BEIS) evaluation states that SBRI had “less positive results than expected in terms of strengthening technical and scientific research. Problems encountered in the United Kingdom were linked to: a lack of participation from government</p>

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<p>programmes</p> <p>http://www.oecd.org/innovation/policyplatform/48136807.pdf</p>	<p>departments, the low total value of the contracts to small firms and the fact that these were very rarely linked to technical development. Studies still point to insufficient participation across government; they also state that awards are highly skewed by a number of very small awards for phase I demonstration projects" (CBR, 2010)ⁱⁱ.</p>
<p>MIoIR, 2013, <i>Review of Pre-commercial Procurement Approaches and Effects on Innovation</i></p> <p>(Compendium of Evidence on the Effectiveness of Innovation policy Intervention)</p> <p>https://www.escholar.manchester.ac.uk/api/datastream?publicationPid=uk-ac-man-scw:187662&datastreamId=FULL-TEXT.PDF</p>	<p>A review on Pre-commercial Procurement (PCP) schemes across different OECD countries with a focus on USA SBIR evaluation and comparison of SBIR and SBRI. It lists justifications for advanced PCP approaches in terms of: externalities generated from R&D support; reduction in market failures of information; lower public sector risk from testing innovations; increased quality of public services; Government develops technologies with a public good where private markets don't yet exist; wider private adoption from; new employment and new firms.</p> <p>The paper compares the UK SBRI with the US SBIR in a neat table, with the key findings:</p> <ul style="list-style-type: none"> • US SBIR was launched in 1982 and UK SBRI in 2001 with a re-launch in 2009 following a pilot in 2008 • The Technology Strategy Board (now Innovate UK) coordinates the UK initiative, whilst the Small Business Administration coordinates the US programme • SBRI is not mandated, it left to public sector bodies' discretion whether to take up the scheme or not. SBIR is mandated to 2.5% of federal R&D budgets over \$100m • All EU companies of all sizes are eligible for UK SBRI but for SBIR it has to be a small business (<500 employees) at least 50% owned by a US citizen • There were 1190 SBRI contracts worth £99.4m awarded between April 2009 and December 2012. However there are 4,000 SBIR contracts a year worth \$2bn (£1.4bn) • The UK SBRI has two stages whilst the US SBIR has three stages. The first two phases for each scheme are broadly similar. The phase 3 of SBIR follows through from sponsoring government department, but there are no additional funds committed.
<p>Birkbeck, 2015, <i>The shaky start of the UK Small Business Research Initiative (SBRI) in Comparison to the US Small Business Innovation Research Programme (SBIR)</i></p> <p>http://www.bbk.ac.uk/management/docs/workingpapers/WP10.pdf</p>	<p>A comparative analysis of SBRI and SBIR. Most of the issues with the original SBRI concerned streamlining the process and low participation among departments. Following reform of SBRI, the key difference between it and SBIR is the exclusion of Phase 3 (although even in USA this is not funded from SBIR) and there is no size restriction on participating companies.</p> <p>In its 1st year, following the re-launch of SBRI in 2009, 74% of contracts awarded by SBRI were given to SMEs. It received positive feedback from government departments however support still needs to be won over from people in some departments, especially as cut-backs began to happen – R&D first to be cut. In terms of number of awards, the first 5 years of each programme were compared (after adjustments for inflation, exchange rate and population): there were consistently more contracts being awarded by the US SBIR than UK SBRI but there was not much difference between numbers of phase 2 contracts.</p> <p>Potential improvements include:</p> <ul style="list-style-type: none"> • Clearer structure of who deals with SBRI between departments and TSB (now Innovate UK). • Clarification of what Phase 3 could look like, as the end of Phase 2 is a worrying period for involved companies. • Continuity in budget could be improved, as departments are suggesting funding may be cut due to the recession. <p>The report noted that</p>

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	<ul style="list-style-type: none"> • SBRI was introduced in a very different context to when SBIR introduced because of substantial changes in the modern economy such as the rise of venture capital and the ICT sector; so SBRI can be expected to differ considerably in terms of scope, scale and objectives. • It would be beneficial to better understand the complementarity of SBRI with venture capital markets and the other innovation supports available in the UK as this is different to the US context.
<p>Envision, 2015, <i>Fostering Innovation Through Public Procurement – a research study</i></p> <p>http://www.nicva.org/sites/default/files/d7content/attachments-resources/nicva_cee_report_eleven_finalwebv.pdf</p>	<p>Report focused on how public procurement encourages innovation in Northern Ireland. The research found examples of innovation being fostered through public procurement but there is a perceived lack of cross-departmental budgeting which could facilitate cost savings.</p> <p>SBRI has been perceived as the most prevalent example of pre-commercial procurement in Northern Ireland, although the specific procurement processes available under EU directive to procure innovative goods/services is not being widely used. SBRI provides a risk-managed environment for the public sector to incentivise them to develop new products/ services whilst also providing funding to SMEs to develop their ideas.</p> <p>Recommendation: government departments should trial specific Meet the Commissioner Days or innovation open days to facilitate supplier engagement with departmental users. Or launch an innovation fund – an alternative to SBRI – similar to the Police Innovation Fund. It would allow public sector bodies to consider and trial innovative products/services. The fund could be ring-fenced and made available to organisations who can demonstrate a genuine need for new products/services not yet adopted in the public sector.</p>
<p>SBRI Healthcare, 2015, <i>Annual Review: Accelerating the development of innovation for NHS need</i></p> <p>http://sbrihealthcare.co.uk/wp-content/uploads/2016/09/SBRI-Annual-Review-2.pdf</p>	<p>Review explaining the impact SBRI has had on patients, businesses and clinicians. Funded by NHS England to support efficiency, improved health and business growth. SBRI Healthcare supports over 100 companies with 20 SBRI-backed companies whose products have reached maturity and available in the NHS market place. Independent health economic assessments suggested that the savings to the NHS from the innovations supported could be as much as £1bn. In 2015/16 contracts worth £17.5m were awarded to 44 companies. An NHS challenge is identified, then a competition launched and companies' applications are rigorously assessed before a development contract is agreed between the company and the NHS. The process is designed to be especially suitable for SMEs and early-stage businesses. They are keen to help businesses test cross-over innovations from other sectors.</p> <p>Impact of SBRI Healthcare after four years:</p> <ul style="list-style-type: none"> • Over 420 jobs created or safeguarded – value to UK economy estimated to be £33.6m; • Estimated £1bn cost saving value of pipeline to the NHS; • £45m of additional funding leveraged through grants and venture capital; • £57m total funds awarded through 168 contracts awarded to businesses across phases 1,2 and 3; • 20 products already on the market with many more to come, and 40 patents, copyrights and trademarks and scientific publications applied for or awarded; and • 9 companies exporting their products to international markets. <p>The 15 Academic Health Science Networks (AHSNs) are critical to the success of SBRI healthcare as they lead on innovation between health services, research and business. The report lists specific examples of how SBRI has had an impact on patients; business and the economy; clinicians and the NHS.</p>

Table A.4: USA SBIR literature summary SBIR

Paper	Key findings
<p>Committee on Capitalizing on Science, Technology and Innovation, 2008, ,: <i>An Assessment of the Small Business innovation Research Program</i></p> <p>https://www.nap.edu/catalog/11989/an-assessment-of-the-sbir-program</p>	<p>This is the most recent comprehensive review of SBIR across all departments /agencies that participate. It concluded:</p> <ul style="list-style-type: none"> • That the program is sound in concept and effective in practice and is meeting most of its congressional objectives. • It is stimulating technological innovation and meeting agency procurement needs of diverse federal agencies and enables flexible adaptation to agency missions. It noted that: <ul style="list-style-type: none"> ○ The commitment of upper management to the effective operation of the program appears to be a key element in its success. ○ The flexibility in the programme management and modes of operation is one of the great strengths of the program • There is increasing private sector commercialization of innovations from Federal R&D. <ul style="list-style-type: none"> ○ Over two-thirds of SBIR projects (70%) would not have taken place without SBIR funding ○ SBIR funding encourages company formation, alternative development paths and enables partnering with academia and other companies ○ A survey of SBIR participants reported that 47% of projects reach the marketplace (i.e. report sales), however a small percentage of projects account for most of the sales. ○ Most major commercialization successes require substantial post-SBIR research and funding from a variety of sources. • Key recommendations: <ul style="list-style-type: none"> ○ Preserve the basic programme structure, retain program flexibility (at SBA and departmental/agency level), conduct regular evaluations ○ Continue to focus on commercialization. Agencies should be encouraged to develop (and pilot) programs that seek to improve commercialization. Mission agencies need to create a Phase II pull.
<p>Committee on Capitalizing on Science, Technology and Innovation, 2015, <i>SBIR/STTR at the National Institutes for Health, : An Assessment of the Small Business innovation Research Program – Phase II,</i></p> <p>https://www.nap.edu/</p>	<p>The 2015 review of SBIR/STTR at NIH reported that the program is having a positive overall impact, meeting three of its four legislative objectives – stimulating technological innovation, using small business to meet Federal R&D needs and increasing private sector commercialization of innovations derived from Federal R&D. However, as for SBIR in other departments, more needs to be done to increase participation socially and economically disadvantaged small businesses and women-owned businesses. Key findings include:</p> <ul style="list-style-type: none"> • SBIR/STTR² projects commercialize at a substantial rate: <ul style="list-style-type: none"> ○ 49% of SBIR/STTR survey respondents reported some sales or licensing revenue. The distribution is skewed with 6% reporting sales over \$10 million and 39% reporting sales less than \$100,000. ○ 80% of respondents reported further investments. ○ SBIR/STTR projects have not resulted in an overall substantial job growth but some awardees grew very rapidly. ○ SBIR/STTR played a key role: 74% reported that the project probably or definitely wouldn't have proceeded without the funding. • SBIR/STTR supports the development and adoption of technological innovations that advance the agency's mission. SBIR/STTR projects

² The reviews of SBIR include the Small Business Technology Transfer (STTR) Program (that supports collaboration between small businesses and universities), however SBIR is a much larger program, making up 88% of total NIH SBIR/STTR funding in 2014.

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<p>catalog/18944/sbir-at-the-national-science-foundation</p>	<p>generate substantial knowledge-based outputs - about two-thirds of companies report at least one patent and 79% report at least one published paper.</p> <ul style="list-style-type: none"> • SBIR/STTR fosters innovative companies – it supports the formation of new innovative companies and reduces the risk for subsequent investors. • The flexible approach to program management is viewed as a strength of the program. • Recommendations for NIH SBIR/STTR include: <ul style="list-style-type: none"> ○ There are particular challenges to commercializing biomedical technologies such as the costs and timescales to gain regulatory approval and support for commercialization needs to improve. ○ Improving data collection for monitoring, evaluation and assessment to understand and improve outcomes
<p>Committee on Capitalizing on Science, Technology and Innovation, 2015, <i>SBIR/STTR at the Department of Energy: An Assessment of the Small Business Innovation Research Program – Phase II</i>, https://www.nap.edu/catalog/23406/sbirsttr-at-the-department-of-energy</p>	<p>The 2015 review of SBIR/STTR at DoE reported that the program is having a positive overall impact, meeting three of its four legislative objectives – stimulating technological innovation, using small business to meet Federal R&D needs and increasing private sector commercialization of innovations derived from Federal R&D. However, as for SBIR in other departments, more needs to be done to increase participation socially and economically disadvantaged small businesses and women-owned businesses. Key findings include:</p> <ul style="list-style-type: none"> • Commercialization: <ul style="list-style-type: none"> ○ Nearly half of the respondents to the National Academies' 2014 Survey reported some sales. The distribution is skewed - 25% had sales less than \$100,000. 6% had sales over \$10 million, and 26% had sales over \$1 million. ○ 78% of survey respondents reported receiving additional investment ○ SBIR/STTR played a key role - 71% reported that the project probably or definitely would not have proceeded without SBIR/STTR funding • SBIR/STTR supports the development and adoption of technological innovations that advance the agency's mission. <ul style="list-style-type: none"> ○ SBIR/STTR fosters innovative companies – encouraging new firm start-up (45% reported that the company was founded entirely or in part because of the SBIR/STTR programs) and having a highly positive or transformative effect on companies. • Recommendations <ul style="list-style-type: none"> ○ Improve monitoring, evaluation, and assessment – including improving data collection approaches ○ DoE should support the commercialization of SBIR and STTR supported technologies beyond the completion of Phase II and it should review the effectiveness of its commercialization support ○ Improve program management – this includes improving DoE's topic development process ○ DoE should extend past and current efforts to foster the participation of underserved population.
<p>Committee on Capitalizing on Science, Technology and Innovation, 2015, <i>SBIR/STTR at the National Science Foundation: An Assessment of the Small Business Innovation Research</i></p>	<p>The 2015 review of SBIR/STTR at NSF reported that with one exception the NSF SBIR program is meeting its overall legislative and mission-related goals. The exception is the goal to foster and encourage participation by women and minorities, which has not been met. Key findings include:</p> <ul style="list-style-type: none"> • Commercialization: <ul style="list-style-type: none"> ○ SBIR projects at NSF commercialize at a substantial rate. About 70% of respondents to the 2011 SBIR/STTR survey of Phase II projects reported some sales. ○ NSF's Phase IIB program supports the accelerated commercialization of SBIR-funded research. Information from surveyed recipients and from case studies strongly suggests that the program serves as a catalyst, attracts additional funding, and has a positive effect on company activities and outcomes. • Stimulating technological innovation. SBIR projects generate substantial knowledge-based outputs – more than 70% of survey respondents

Annex 1: Literature Review

<p><i>Program – Phase II,</i> https://www.nap.edu/catalog/18944/sbir-at-the-national-science-foundation</p>	<p>reported filing at least one patent and about 80% reported at least one resulting peer-reviewed publication. The program connects companies and universities in a variety of ways, with nearly 60% of survey respondents reporting a link to a university</p> <ul style="list-style-type: none"> • Fostering Innovative Companies. 45% of respondents indicated that the company was founded entirely or in part because of the SBIR program and 35% indicated that SBIR had a “transformative” effect on the company • Recommendations <ul style="list-style-type: none"> ○ NSF should continue to operate the Phase IIB program and consider expanding it. ○ NSF should improve its efforts in data collection, assessment, and reporting ○ NSF should enhance efforts to improve participation of underserved populations
<p>The Air Force, 2014, <i>Impact to the Economy via SBIR/STTR</i> https://www.sbir.gov/sites/default/files/USAF%20SBIR-STTR%20Economic%20Impact%20Study%20FY2015.pdf</p>	<p>The US Air Force (USAF) commissioned a study to assess the economic impact of its SBIR/STTR program. It covered Phase II awards completed between 2000 and 2013, a total investment of nearly \$4 billion awarded via 4,524 SBIR contracts. The study found:</p> <ul style="list-style-type: none"> • 58% of the USAF SBIR/STTR contracts resulted in sales. With total sales reported of \$14.7 billion.³ 73% were sales of new product and services to both civilian markets (43%) and the US military (30%). These figures are viewed as an underestimate due to limited data for royalties, licencing, spin-out sales • The SBIR/STTR investment of \$4 billion and the \$14.7 billion (in 2013 prices) in sales generated are estimated (via economic impact modelling) to result in wider economic impact: <ul style="list-style-type: none"> ○ \$47.9 billion total economic output nationwide ○ £24.7 billion in value-added ○ £15.5 billion in labor income ○ 16,751 average new full-time jobs per year with an average wage of \$65,968 (29% higher than the average US wage) • Total outside investment (including venture capital and angel funding) directly related to SBIR/STTR contracts was \$1.9 billion and 447 companies were acquired largely as a result of technology developed under SBIR/STTR with an acquisition value of \$6.8 billion. • 180 technologies developed under SBIR/STTR were licensed to other companies and 125 spin-outs were created. • Other findings: <ul style="list-style-type: none"> ○ Commercialization success was inversely proportional to the number of awards received by companies. ○ On average, underserved states were more successful at commercialization but received substantially fewer awards.

³ Where ‘sales’ includes: sales of new product and services both civilian sales and sales to US military; follow-on R&D contracts for specific applications ; royalties to award recipients licences; sales by licencees of SBIR/STTR technologies; sales by spin-out companies commercializing SBIR/STTR developed technologies

Table A.5: Netherlands SBIR Literature Summary

Paper	Key findings
<p>Netherlands Ministry of Economic Affairs Agriculture and Innovation, 2011, <i>SBIR The power of public procurement: innovative solutions to societal challenges</i>.</p> <p>https://www.rvo.nl/sites/default/files/bijlagen/SBIR%20the%20Power%20of%20public%20procurement.pdf</p>	<p>Booklet examines the Dutch SBIR five years on from its inception in 2005 with lots of examples of its success. It is targeted at other Dutch companies encouraging them to get involved in SBIR, for that reason there may be a skewed sample of case studies in the booklet. The Dutch SBIR was set up for the government to use its procurement power to mobilise the innovative capacity of Dutch companies to solve societal challenges.</p> <p>SBIR is used if there are no ready-to-use products/services to address the challenge – in this instance innovation is necessary to make the products available. It works by a ministry or public authority identifying a specific challenge or societal issue which requires innovation and then a procurement competition is launched. There is first an independent assessment phase followed by three stages:</p> <ul style="list-style-type: none"> • Phase 1: feasibility; technique; marketing; organisation (6 months) – max €50,000 per project. • Phase 2: research; development; prototype; test/demonstration (2 years) – if succeed phase 1 max €450,000. • Phase 3: market development; product launch – not supported by government funding. <p>Since SBIR consists of several phases with only viable projects progressing and receive funding, this limits risk to the government. It has been particularly beneficial to early-stage & SMEs, due to its simple, fast procedure, accessible registration and low administrative costs. Its budget has increased from €1.1m in 2005 to €26.3m in 2010.</p> <p>Report references the first evaluation undertaken (see below).</p>
<p>Technopolis, 2010, <i>Eerste evaluatie Small Business Innovation Research (SBIR) programma's in Nederland [First Evaluation of SBIR in the Netherlands]</i></p> <p>https://www.rijksoverheid.nl/documenten/rapporten/2010/03/04/eerste-evaluatie-small-business-innovation-research-sbir-programma-s-in-nederland</p>	<p>Report is in Dutch with Executive Summary in English. First evaluation into the three SBIR variants: departmental SBIR, the STW Valorisation Grant and the TNO-SBIR programme. Too early for an impact assessment, therefore just a process evaluation. Each variant has its own specific intervention logic and position in the policy mix with similarities and differences, e.g. SBIR and TNO-SBIR award contracts whilst STW Valorisation awards grants.</p> <p>Departmental SBIR involves pre-commercial procurements that combine solving societal issues and stimulating innovation among SMEs – focus is on existing SMEs although not restricted to. STW Valorisation Grant is valorisation of knowledge that has been developed by universities, e.g. focusing on researchers employed by Dutch uni who aim to start-up a business or transfer knowledge to existing firms – the aim of this is to address the 'Valley of Death' after academic research. TNO-SBIR emphasises on valorisation of knowledge developed by TNO (Netherlands Organisation for Applied Scientific research – a research institute combining features of Innovate UK and IPO in the UK) – focus on existing SMEs that have sufficient absorption capacity to commercialise product ideas of TNO.</p> <p>Departmental SBIR findings:</p> <ul style="list-style-type: none"> • Since 2004 28 SBIR competitions worth €71.5m – amounts for phase 1 & 2 varies by competition. • It succeeds in attracting the right target group of companies – used intensively by SMEs who didn't have prior involvement with departments. • Participating companies are satisfied with low barriers, low admin costs, programme implementation, and SBIR's

	<p>alignment to their own business processes. Also enthusiastic about solving societal challenges.</p> <ul style="list-style-type: none"> • Firms perceive SBIR accelerates time-to-market and mobilises funding for early-stage innovation – without SBIR innovation may not have started or would've taken a longer time frame. • The fact a contract is awarded, rather than a grant, with 100% funding is a key success factor of SBIR – firms have an obligation to deliver a result and this causes the project to have high priority. • Being awarded an R&D contract from the government helps them achieve a stronger position in relation to collaborating partners, clients, backers etc. <p>Some departments took up SBIR quickly, others more hesitant or reluctant as unfamiliar with its functioning or lack of understanding of the value added with regard to other instruments. Slow start of SBIR attributed to its use being dependent on enthusiasm of individual civil servants. In 2008, to broaden SBIR's use, it was relabelled as an instrument to help departments realise policy objectives, rather than an innovation policy instrument of the Ministry of Economic Affairs.</p> <p>The Valorisation Grant has a high success rate; resulting in 48 new companies (with total employment of 120 FTE by end of 2008), and knowledge transferred to eight existing companies. TNO-SBIR programme has succeeded in generating a sufficient amount of product ideas, and TNO has become more effective in targeting companies that could commercialise TNO's innovative ideas.</p>
<p>Technopolis, 2015, <i>SBIR in The Netherlands</i> http://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga_160624.pdf</p>	<p>Inspiration from SBIR came from the US programme, however unlike US counterpart there is no mandatory budget allocations for departments or agencies. Also the Dutch SBIR is seen mostly as a public procurement instrument not as a grant programme.</p> <p>The programme peaked in 2011: it fitted well with government's policy for societal challenges; it had broad interest from wide range of departments; and these departments had ample budgets. After 2011 SBIR still exists but at a smaller scale: austerity led to cuts in all departments' budgets; the new government had no agenda for societal challenges; and all major grant instruments for innovation were abolished.</p> <p>Original SBIR had three strands/variants (see above): first is still running in its current form, the second no longer exists; whilst the third run by TNO is now an independent initiative.</p> <p>90% of participants in SBIR are SMEs. Recommends that SBIR should get back on the political agenda post-austerity and create synergies with other SME instruments.</p>
<p>KETS Observatory, 2012, <i>The Netherlands</i> https://ec.europa.eu/growth/tools-databases/kets-tools/sites/default/files/policy/NETHERLANDS.pdf</p>	<p>Booklet summarising the innovation policy mix in the Netherlands. There is a section on the SBIR pilot programme and its evaluation carried out in May 2007.</p> <p>The pilot evaluation was carried out on the first 6 competitions – 88 companies (80 of them SMEs) sent in 97 proposals.</p> <ul style="list-style-type: none"> • All SBIR companies are small – all were given to companies with less than 100 employees. • Firms that received an SBIR phase 1 contract have more often strategic cooperation in an SBIR project than companies that did not receive a contract: 89% vs. 47%; with other SME companies (42% vs. 7%); with research institutes (18% vs. 17%); or both 29% vs. 23%. <p>Companies experience the phasing of SBIR as logical and corresponding closely to their own operational management.</p>

	<p>They consider being granted an assignment at a fair market price for phases 1 and 2 – a key success factor of SBIR.</p> <p>Booklet references a 2010 pilot peer review report, which made the following conclusions about the SBIR programme:</p> <ul style="list-style-type: none"> • SBIR is more than just funding – also brokerage, coaching, etc. • PR and communication has helped to position the instrument. • SBIR is a contract to deliver, not a subsidy • Short time to contract (6-8 weeks after submission deadline) is a strength. • Unique place in policy context – SBIR doesn't overlap or duplicate other mechanisms in the Dutch innovation system. • There is a buzz around the programme – companies are eager to participate. • Innovation is placed in a broader context, i.e. SBIR is an example of problem oriented or demand driven innovation policy. <p>However, it notes there is a gap between R&D and procurement (from phase 2 to phase 3) and there is a need to look at exploitation earlier on. Also the measure doesn't create any new markets as there is very little, if any government procurement of the eventual product/service.</p>
<p>Sci-Network, 2011, <i>Case Study: Small Business Innovation Research (SBIR) in the Netherlands</i></p> <p>http://www.sci-network.eu/fileadmin/templates/sci-network/files/Resource_Centre/Case_Studies/Case_Study_-_Dutch_SBIR_-_Final.pdf</p>	<p>SMEs engaged in SBIR contracts develop the most innovative products and services, giving them a chance to grow and create jobs; whilst the government gains a variety of innovative solutions to its social and environmental problems.</p> <p>Evidence indicates that both users and government appreciate the process and find it highly valuable. The process directly addresses the traditional financial restrictions which often prevent SMEs from carrying out R&D.</p> <p>It is estimated that an annual investment of 1 billion euros in the EU could lead to 2,000 new products yearly.</p>
<p>Technopolis, 2013, <i>Developing an evaluation and progress methodology</i></p> <p>https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwial47z6pHSAhXFKcAKHRIDABcQFggaMAA&url=http%3A%2F%2Fec.europa.eu%2FdocsRoom%2Fdocuments%2F5489%2Fattachments%2F1%2Ftranslations%2Fen%2Frenditions%2Fnative&usq=AFQjCNEqANlpuNtrTcil6Agi6im7CmD9Sg&bvm=bv.147134024,bs.2,d.d24&cad=rja</p>	<p>Report focusing on evaluations of demand-side innovation policies in Europe, with a chapter dedicated to the Dutch SBIR and references the Technopolis evaluation (above).</p> <p>As of June 2011 SBIR: SBIR used by seven ministries; total budget spend on SBIR is over €69m; over 30 SBIR procurements started; over 370 contracts closed; about 750-1000 man-year innovation development in SMEs; 20 completed phase 2 contracts; 65% of supported companies make business from their SBIR development within a year; new industry policy developed in the Netherlands.</p>

ⁱ The shaky start of the UK Small Business Research Initiative (SBRI) in Comparison to the US Small Business Innovation Research Programme (SBIR), E. Tredgett and A. Coad, Birkbeck Management Working Paper , June 2015

ⁱⁱ Connell, D. and Probert, J. (2010), Exploring the Myths of the UK Innovation Policy: How “Soft Companies” and R&D Contracts for Customers Drive the Growth of the Hi-Tech Economy, Centre for Business Research, University of Cambridge.