



Strategic advantage through science and technology: how can public procurement drive innovation in pursuit of national goals?

Summary

Public procurement accounts for around a third of all public expenditure with £292 billion spent a year¹, hence it has the potential to be a powerful lever to stimulate innovation.

Procurement of innovation can advance the pull-through to market of innovative solutions, drive the adoption of innovations across supply chains, create new markets and ultimately stimulate increased private investment in R&D and innovation.^{2,3} Crucially, procuring more innovative products and services can also result in improved and better value public services.

The UK government has ambitions to deliver UK strategic advantage through science and technology and to rise the R&D investment spending to £22 billion by 2026–27. Harnessing public procurement to stimulate innovation could be transformative in these endeavours.

However, public procurement of innovation is widely acknowledged as a missed opportunity in the UK.^{4,5,6} Engineering companies have found that decisions on public procurement tend to prioritise low cost over best value, and risk aversion hinders the introduction of innovative solutions. Extensive recommendations, advice and evidence already

exist on how public procurement for innovation could be improved, but to date, limited progress on implementation has been observed.^{7,8}

Changes to the Treasury's Green Book make important steps forward, but further change is still needed.⁹ There is a tendency for short-term thinking, which can hinder the development and implementation of long-term goals.

To understand the system, barriers and opportunities for successful change, the Royal Academy of Engineering, with the Prime Minister's Council for Science and Technology (CST), convened a workshop in June 2022 bringing together stakeholders including startups and large businesses from across different sectors, public agencies, and government innovation and procurement teams.

This paper summarises the rich and broad, although not exhaustive, discussion. The workshop took a systems approach to better understand the needs of users, and considered practical ways for government to successfully implement policies that use the bulk of its procurement spend on innovation in pursuit of national goals. The workshop informed advice developed by the CST for the Prime Minister.

Key themes



The **public procurement system is complex**, sometimes cumbersome, involving a wide range of stakeholders with different needs, priorities and languages. To incentivise and increase the procurement of innovation, change is required at multiple levels: leadership and incentives with a clear vision across government; practical tools and skills for procurement teams to engage effectively with innovation; and effective communication enabling diverse suppliers to participate in well-explained and timely processes. To encourage real culture change and innovation-friendly procurement processes, it is crucial to align incentives across the system and consider potential undesirable or unintended knock-on effects.



Culture and policy change is essential to leverage the opportunities from public procurement to drive innovation and deliver socio-economic benefit. Stakeholders described a culture of risk aversion and blame, creating a system that hinders and even prevents the procurement of innovation. Procuring innovation carries risk; however, mechanisms and good practice can be put in place to support risk management and account for the wider benefits of procuring innovation, delivering best value for money to the taxpayer.



Leadership and coordination are key to embed a new culture in this complex system. Examples of good practice and initiatives to procure innovation exist across government – appetite was high to share lessons, develop new tools and scale up good practice to deliver on the real opportunities of procuring innovation.

The workshop approach

The workshop was a facilitated discussion drawing on a systems approach, exploring the UK public procurement system, its stakeholders and their needs, and how procurement could better support and deliver innovation in pursuit of national goals. Participants included business of all sizes and across different sectors, public agencies, and government procurement and innovation teams.

What is a 'systems approach'?

A systems approach encourages evidence gathering that draws on the widest, most diverse and critical perspectives leading to a 'bigger picture' view of the system and its actors. It can help identify the different elements and actors that contribute to a system, how they interconnect and interact, to help build a shared picture of how different interventions or changes – for example, new policies – can affect the system as a whole. More information on the approach and question framework used for this workshop is outlined in the report 'Engineering better care'.¹⁰

The aims of the workshop were to:

- build an understanding of opportunities and challenges for government in using the bulk of its procurement spend to drive innovation towards national goals
- identify users and their needs in the UK public procurement system
- map connections and gaps across the system
- understand what good would look like for procurement that supports innovation in pursuit of national goals.

This is not an exhaustive or comprehensive exercise. The workshop provided insight and an overview of the UK public procurement system to inform further evidence and data gathering, discussion and policy development, and approaches policymakers should explore.

The UK policy context

The UK government has a target of increasing investment in R&D to 2.4% of GDP by 2027.¹¹ The *Innovation Strategy*, published in 2021, committed to "use the weight of public procurement to drive innovation", which was also identified as one of the key lessons from the COVID-19 pandemic and the work of the Vaccine Taskforce.¹²

As part of its science superpower agenda and ambitions for the UK to "[sustain] a strategic advantage through science and technology"¹³, the UK government has set out four areas of focus to build science and technology capability. These national goals are:¹⁴

- to create an environmentally sustainable and resilient UK, delivering net zero through innovation and green growth
- to lead the world in health and life sciences businesses, helping citizens enjoy better physical and mental health, and improving global health
- to strengthen security and defence at home and overseas
- to drive growth and security through digital technologies that generate productivity across the whole economy.

The UK government is reforming public procurement: a new Procurement Bill had its first reading in the House of Lords on 11 May 2022.^{15,16} The new Bill was introduced following the consultation on the Green Paper 'Transforming public procurement' and the change to the Green Book from 'most economically advantageous tender' to 'most advantageous tender'.¹⁷ The Royal Academy of Engineering's response to the consultation is available on the website.¹⁸

Defining the problem and scope

The workshop sought to explore the question: 'how can government use the bulk of its procurement spend to drive innovation in the pursuit of national goals?'. The national goals referred to in the question are those set out by the UK government (see 'Policy context'). Definitions for innovation maturity were provided to participants to ensure a shared language was available to facilitate discussion.

Innovation maturity: definitions for the workshop

- **Proof of concept:** first tests completed in a laboratory environment.
- **Prototype:** built and tested in different environments, improving performance to intended level.
- **Demonstrator:** operating in intended environment at pre-commercial scale.
- **First of a kind:** manufacturing issues solved.

Participants identified the current challenges with public procurement for innovation and what good would look like (Figure 1). This exercise built a picture of the current challenges and barriers for the procurement of innovative solutions towards national goals and outlined the desirable outcomes changes to the procurement system should enable.

Setting out the current problems with the procurement system (Figure 1), participants identified the following challenges across different levels:

- **Culture and vision:** appetite for risk and experimentation in public procurement is low. Short-term thinking, plus a lack of targets, knowledge and sharing of good practice contribute to creating an environment that isn't conducive to procuring innovation, with participants reporting that the system won't let them do it. Risk is part of innovation.
- **In practice:** numerous examples of barriers to the procurement of innovation were highlighted, including complexity, lack of joined-up government goals, lack of data and capability, difficulties in quantifying the benefits of innovation as opposed to risks, and a lack of understanding of innovation. A language barrier between government and the civil sector also hinders effective communication with the private sector.
- **Knock-on effects:** the processes in place currently discourage innovative small companies, for example, and lead to a lack of market diversity.

When defining what good would look like, participants envisioned a system with a clear strategic direction (Figure 1). Experimentation would be supported, and trust and transparency built in, to nurture collaborative relationships between government and industry. This system would promote social value and operate in such a way that it could be leveraged to transform industries for the better.

Participants suggested practical solutions including data gathering and impact assessments aligned with BEIS sector deals and networks that support the establishment of connections. For example, this could be bringing together procurement teams with a problem to solve and innovative companies, defined budgets or targets for innovation, and tools to demonstrate the value of innovation.



Figure 1 | Problems or barriers for public procurement of innovation, and what an ideal or good system would look like

The UK procurement system: understanding users and their needs

Who are the users?

Understanding and identifying users can help build a map of the system, understanding how users are connected to one another and how their different perspectives and needs come together or diverge. It's a valuable resource for further evidence-gathering activities, including identifying perspectives yet to be brought into the discussion. Users of the public procurement system were identified as those stakeholders and organisations involved in government procurement and those developing innovative solutions.

Participants identified a non-comprehensive list of users (Figure 2). Users could be grouped into categories: local and central government and teams; regulators; businesses of all sizes and supply chains; innovation funders and finance; end users of the procured service or product; and enabling services such as legal advice. It's worth noting that even within one organisation, multiple users may have different needs.

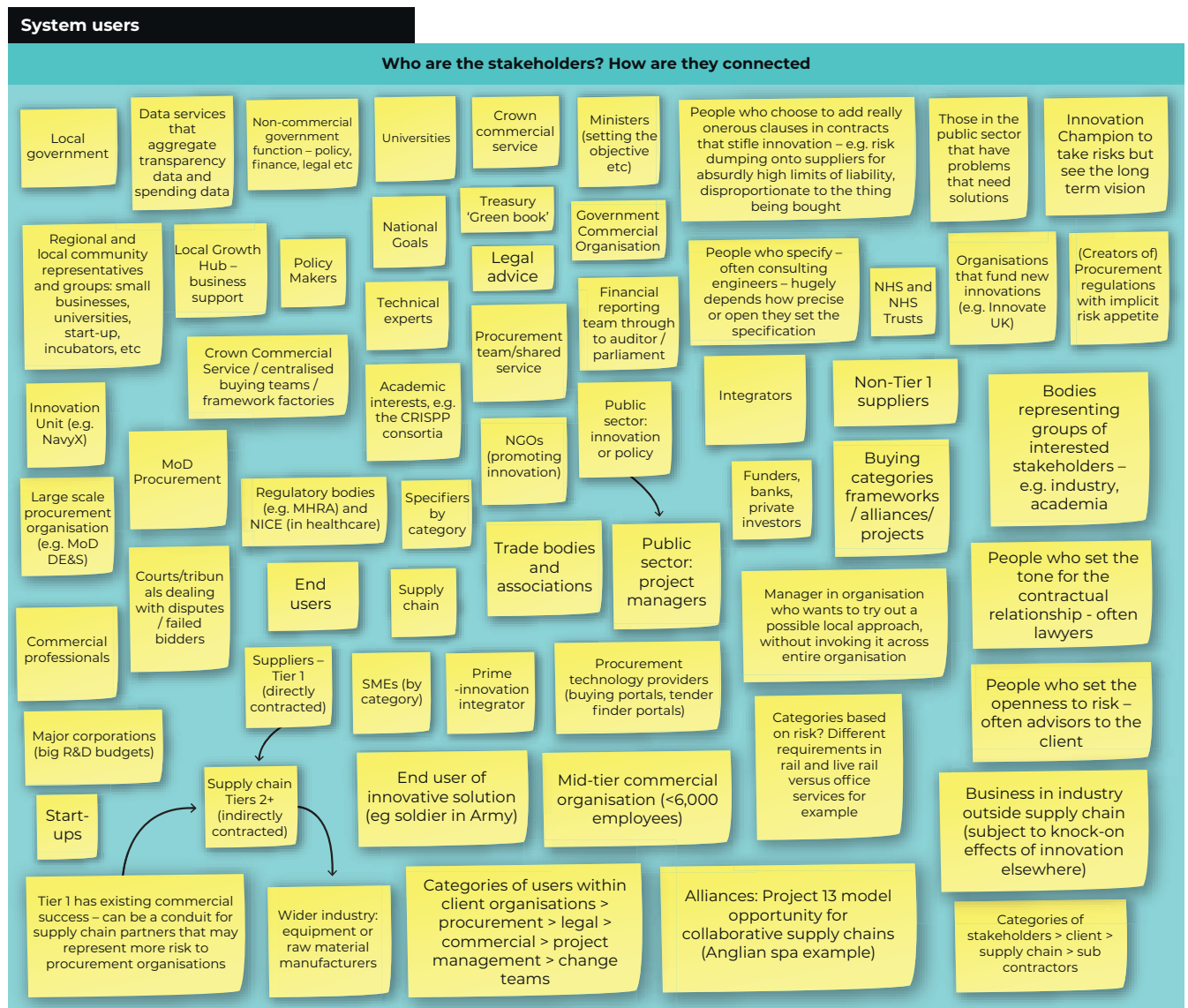


Figure 2 | Users of the procurement for innovation system identified by workshop participants

What are the users' needs?

A user needs analysis helps draw out how different stakeholders use the systems and what their needs are. Understanding different user perspectives and motivations may help develop and test the implications of any changes to the system. This could be new regulations, and how those changes might affect different users. The analysis will also help to identify risks to manage, or practical considerations to ensure success during implementation.

Figure 3 (page 8) shows the users' needs captured during the workshop.

The following themes emerged from the users' needs analysis:

- **Culture:** government stakeholders need a culture that allows exploration and accepts that innovation carries risk, shifting away from a culture of blame to that which can incentivise procurement, which drives innovation and delivers economic returns.
- **Demand signal:** government strategies, policy and regulation can set out the direction of travel for the market and signal areas of demand for upcoming procurement. Clearly communicated and joined-up government strategies would give confidence to businesses of all sizes to invest in innovation.
- **Risk:** stakeholders have different, often unmet, needs to manage the risks of procuring innovation. Government procurement teams need skills and tools to understand innovation and gauge associated risks to best manage risk through the procurement process and achieve desired outcomes. The Treasury needs to see the strategic case for investment, to ensure best use of public money and maximise return to the economy. Innovative businesses like startups and SMEs need to be viewed as less risky contractors than they currently are and be able to engage in procurement processes with timelines and agility that align with their business' growth. Recognition of successfully delivered projects or grants by SMEs with other government departments could help speed up processes. For businesses, having a procurement contract and customer is a mechanism to manage the risk of developing innovative products and services; certainty of processes and timelines is crucial to ensure the business risk can be managed.
- **Fit-for-purpose processes:** government officials would benefit from flexible processes that provide time to plan and develop options to adapt to different procurement requirements, enabling them to address issues throughout the process. Businesses need clarity and a streamlined process to avoid wasted effort and deliver innovative solutions, grow their business and attract more customers. The next section further explores procurement processes and practical solutions.
- **Capability:** users across the system need access to the people, data, skills, knowledge, and innovation infrastructure to deliver innovative solutions and understand each other and the language of innovation.

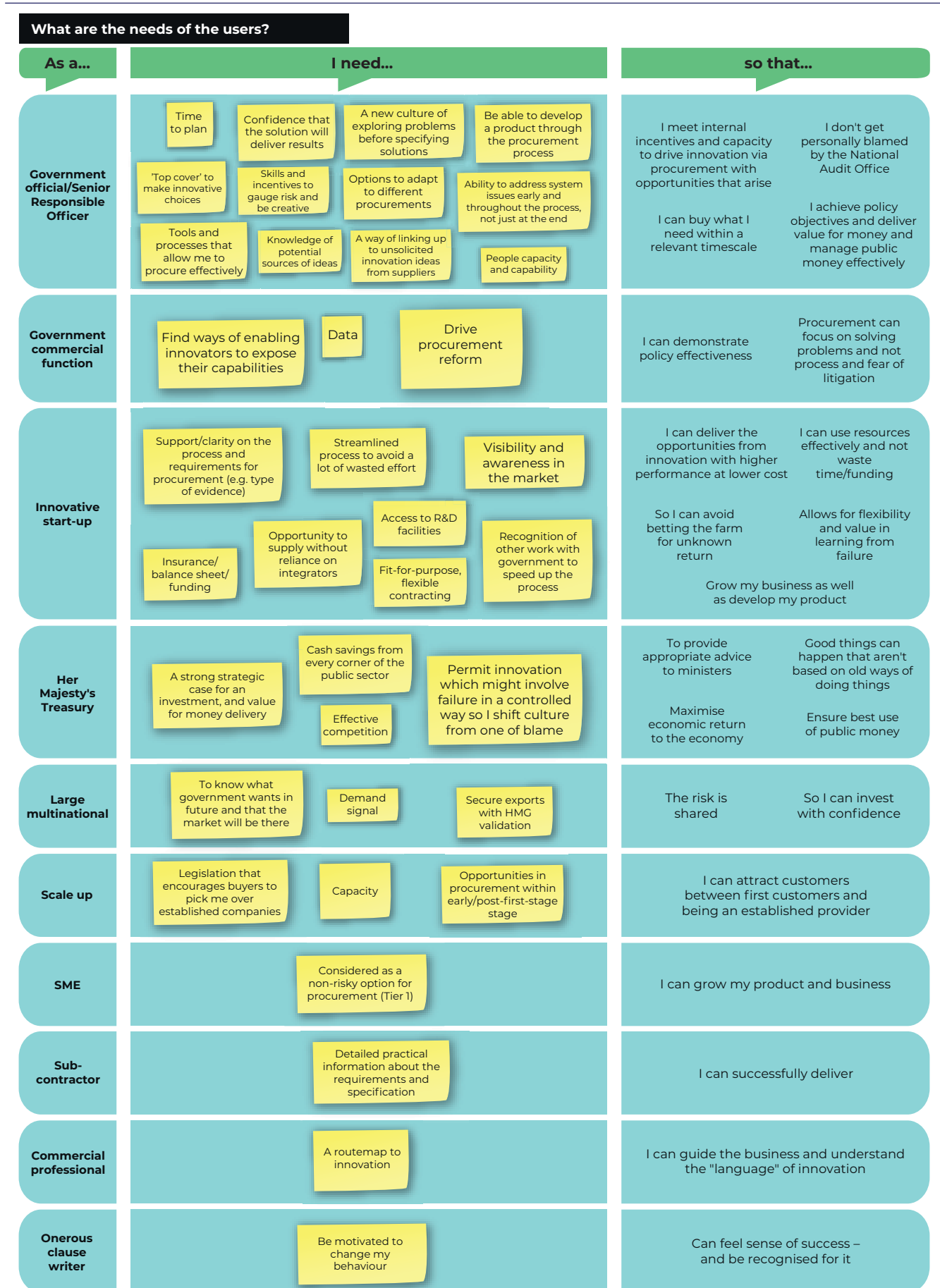


Figure 3 | Users' needs

Exploring different scenarios and solutions for the procurement of innovation

The workshop explored opportunities, risks, uncertainties, and possible solutions. Participants were presented with three scenarios, addressing different levels of innovation maturity. The scenarios were relatively simple and open to interpretation to draw out opportunities and challenges from the perspectives of different users. This process can be helpful to identify practical and pragmatic solutions, as well as risks or potential effects of implementation to manage and consider successful implementation of new policies.

Scenario 1

Government is the first customer for an innovative product or service

Opportunities: government would be seen as an early adopter and establish an ecosystem that generates long-term advantages for the UK by delivering cost, time and performance enhancements through innovation, de-risking technology and contributing to making the case for wider use of products and services. For small businesses, this first customer opportunity is incredibly valuable.

Uncertainties: time to market, feasibility and total cost of innovative products or services is uncertain, especially in comparison to off-the-shelf solutions. Changing government timelines and moving between different parts of government when delivering innovation introduces uncertainty on timings and possible delay for industry.

Risks: the procurement of innovative technology was recognised as carrying commercial and delivery risk, with failed initiatives generally heavily criticised as not being value for money. Short-term priorities and contracts that do not reflect stakeholders' needs and requirements to successfully deliver introduce risks at later stages with possible lack of flexibility. Maintaining a genuine level playing field and avoiding preferential treatment for any individual market participant is a challenge to consider.

Possible solutions to manage risk and uncertainty and deliver on opportunities included:

- fastracking innovative products and services that have already been assessed for quality and feasibility, for example by Innovate UK, through to procurement. Following business and technology journeys with grants and contracts with public sector support can help inform and de-risk procurement decisions. Public sector research establishments could also play a role here
- introducing certificates with credits for lawful justification of award, recognising innovation and delivery capability of businesses
- enabling procurement from innovative companies, not just procurement of innovation per se
- establishing contracts and a system that reflects the desired outcomes and allows flexibility
- drawing from existing good practice including the innovation partnerships that are included in existing procurement legislation
- increasing connectivity across the public sector and supply chains
- identifying an innovation champion in the public procurement system
- setting clear innovation targets with a horizon in a few years' time.

Scenario 2

Government sets an innovation target as part of a large infrastructure (physical or digital) project

Opportunities: innovation targets could incentivise culture change, for example with a set percentage spend on innovation, a defined problem to solve as part of a contract or a number of small innovative companies awarded contracts. Targets act as a clear signal to the market, reducing the risk for businesses and generating the incentive to innovate during the life of the contract. This may be particularly relevant to the requirement to decarbonise, where innovative solutions are needed.

- A successful example is High Speed Rail 2 (HS2), which included a target for low-carbon cement and incentivised the construction industry to come up with solutions.¹⁹

Risks: the target is arbitrary without the innovation culture; it risks being seen as a tick box exercise. With any target setting, we must also be alert to bad behaviours or perverse incentives that targets can engender. This procurement system risks crowding out new or small suppliers. Public perception of failure is a risk to manage, but not innovating also carries the risk of no improvement.

Consideration for successful implementation:

- Procurement may not be the right tool. Depending on the challenge to solve, grants or regulation may be more effective to drive the market.
- The knock-on effects of the target should be considered, identifying what it means for the rest of that system and working with the supply chain.
- Liability for failure should enable innovation in a controlled way, ensuring it doesn't lead to unacceptable consequences.
- Social good targets must be carefully thought out to avoid creating a tick box exercise, especially if the innovation needed is not clear at the time of writing the contract.
- The specificities of the industry sector and the whole affected system should be considered.

Possible solutions to manage risk and uncertainty and deliver on opportunities included:

- setting objective targets for supply chains to reduce carbon emissions with the National Procurement Policy Statement. Targets should be well thought out and understood to support the supply chain to achieve them
- recognising and allowing for flexibility in contracts to accommodate change during the delivery of the contract and include in-contract incentives and milestones to innovate
- simplifying the system with a plain English guide and coordinated channel or contact point for communications
- adapting the role of the procurer to test and challenge the status quo, not just act as a backstop.

Scenario 3

Government has defined a desired outcome for a procurement contract

Opportunity: the move to outcome-based procurement was viewed as an opportunity to build a public sector culture welcoming of innovation. This culture change was deemed necessary for the success of this scenario.

Risks: the outcome might not necessarily encourage innovation, especially if it places too much risk on the supplier or is trumped by external factors that the suppliers aren't able to influence. Small companies in particular may face challenges winning the single supplier framework.²⁰

Considerations for successful implementation:

- The person(s) or supply chain who are innovating need to be rewarded.
- The right outcomes are challenging to pick. Good practice guidance exists but generally there is not enough time or resources in place to gain all the benefits.
- Outcome-based procurement should be couched in risk sharing and collaboration, getting closer to the innovators and what they need.

Possible solutions to manage risk and uncertainty and deliver on opportunities included:

- building a trusted collaborative partnership across procurers and contractors, including through better outreach to stakeholders on the supply side. Both government and industry will need upskilling to work efficiently and deliver value for money with greater agile and flexible contracting approaches. Professional engineering institutes, public sector research establishments (PSREs) and other fora can support translation into practice
- learning from existing good practice, such as Department for Transport guidance, G-cloud and the Small Business Research Initiative^{21,22,23}
- evaluating and validating contracts and procurement processes in government
- sharing case studies and scenarios to drive culture change, giving people the confidence to operate differently and remove siloes, making the procurement profession more diverse and inclusive.

A notable gap in the discussion exploring scenarios and solutions for the procurement of innovation is pre-procurement processes. The lessons, opportunities and challenges from examples of pre-procurement processes deployed across the UK could be shared across government and joined up to increase reach, awareness and deployment of these processes. This would support building

the pipeline of innovation going into procurement tenders.²⁴ Examples of pre-procurement processes include the Small Business Research Initiative, the Highways England Innovation Fund, living labs and demonstrators, the Defence and Security Accelerator, and innovation schemes in large infrastructure projects such as the HS2 Innovation Accelerator.

Concluding remarks

The workshop was a rich, although not exhaustive, discussion, highlighting possible solutions to leverage public procurement to drive innovation towards national goals. Participants had real and significant appetite to be a part of positive change. The public procurement system is complex and brings together a diversity of stakeholders with different needs, capabilities, and motivation – a systems approach will be required to enact successful change and ensure unintended negative consequences are avoided or mitigated for.

References

- 1 UK Innovation Strategy, Department for Business, Energy and Industrial Strategy (BEIS) (2021)
- 2 Consultation response to the Green Paper: Transforming public procurement, Royal Academy of Engineering (2021)
- 3 Decarbonising construction: building a new net zero industry, National Engineering Policy Centre (2021)
- 4 Public projects and procurement in the UK, Royal Academy of Engineering (2014)
- 5 Increasing R&D investment: business perspectives, National Engineering Policy Centre (2018)
- 6 Late-stage R&D: business perspectives, National Engineering Policy Centre (2021)
- 7 Increasing R&D investment: business perspectives, National Engineering Policy Centre (2018)
- 8 Consultation response to the Green Paper: Transforming public procurement, Royal Academy of Engineering (2021)
- 9 Government investment programmes: the 'green book', House of Lords Library (2021)
- 10 Engineering better care, Royal Academy of Engineering (2017)
- 11 Industrial Strategy, BEIS (2017)
- 12 Innovation Strategy, BEIS (2021)
- 13 Integrated Review 2021, Cabinet Office (2021)
- 14 UK's quest to be a global science superpower, Sir Patrick Vallance FRS FMedSci, 8 February 2022
- 15 Transforming Public Procurement, Government Commercial Function [Accessed on 4 July 2022]
- 16 Procurement Bill, Parliamentary Bills [Accessed on 4 July 2022]
- 17 Green Paper: Transforming public procurement, Cabinet Office [Accessed on 4 July 2022]
- 18 Consultation response to the Green Paper: Transforming public procurement, Royal Academy of Engineering (2021)
- 19 HS2 uses new pioneering low carbon concrete to reduce carbon emissions in construction, HS2, 27 September 2020
- 20 Government's spending with small and medium-sized enterprises, National Audit Office (2016)
- 21 An evaluation of the Small Business Research Initiation, UKRI (2022)
- 22 Good practice guidance: managing the commercial lifecycle, National Audit Office (2021)
- 23 Electronic monitoring – a progress update, National Audit Office (2022)
- 24 Consultation response to the Green Paper: Transforming public procurement, Royal Academy of Engineering (2021)



The Royal Academy of Engineering is harnessing the power of engineering to build a sustainable society and an inclusive economy that works for everyone.

In collaboration with our Fellows and partners, we're growing talent and developing skills for the future, driving innovation and building global partnerships, and influencing policy and engaging the public.

Together we're working to tackle the greatest challenges of our age.

What we do

TALENT & DIVERSITY

We're growing talent by training, supporting, mentoring and funding the most talented and creative researchers, innovators and leaders from across the engineering profession.

We're developing skills for the future by identifying the challenges of an ever-changing world and developing the skills and approaches we need to build a resilient and diverse engineering profession.

INNOVATION

We're driving innovation by investing in some of the country's most creative and exciting engineering ideas and businesses.

We're building global partnerships that bring the world's best engineers from industry, entrepreneurship and academia together to collaborate on creative innovations that address the greatest global challenges of our age.

POLICY & ENGAGEMENT

We're influencing policy through the National Engineering Policy Centre – providing independent expert support to policymakers on issues of importance.

We're engaging the public by opening their eyes to the wonders of engineering and inspiring young people to become the next generation of engineers.