Scottish Enterprise

Public Procurement of Innovative Technologies

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- University of Glasgow Quantum Research Hub / Alecsandra Dragoi / DSIT
- National Robotarium, Edinburgh / Scottish Enterprise
- Sunamp thermal storage technology factory, Tranent, East Lothian / Scottish Enterprise

Introduction

Public procurement is a powerful tool to help governments accelerate the adoption of innovative technologies. It can give businesses their first substantial customer, help public bodies improve services, and create markets that private investment alone may not form. Scotland has high quality technology and tolerable procurement rules. The recurring problem in Scotland is that the system is good at funding pilots, but much weaker at adoption at scale, particularly deciding who will pay for that adoption.

This report draws together lessons from case studies across photonics, quantum technologies, defence, transport, health, space, net zero retrofit, and international cluster systems. The aim is to identify the practical conditions under which innovation moves from a promising project to routine use. This report is intended for organisations involved in the innovation sector, e.g. facilitators, and may also be relevant to public sector organisations interested in procuring innovative solutions and businesses interested in providing those solutions.

Executive summary

Public procurement can accelerate the adoption of innovative technologies. Evidence from across Scottish Enterprise (SE), Scottish and UK public sectors, and industry indicates that the primary barriers are organisational behaviour and system incentives. Across photonics, quantum technologies, defence, transport, health, and space, programmes supporting innovation (typically TRL 4-7) often generate technically viable solutions which never become routine purchases: there is a "handover gap".

This is mostly a demand-side problem. Procurers and suppliers consistently attest that innovation fails to scale because procurement systems do not sustain demand so as to create a path to adoption. Three things matter most for addressing this problem:

1. clear post-pilot budget holders,
2. sustained demand signalling, and
3. adequate risk appetite and capability of buyers.

Businesses consistently identify procurement complexity and limited buyer understanding of innovation possibilities as key barriers to participation. Developing complex technologies requires demand lasting beyond a single financial year; otherwise businesses are making multi-year investment decisions against uncertain public budgets.

A further constraint is fragmentation across funding and procurement systems. Responsibility is routinely spread across organisations, with few cases of a single organisation owning the pipeline from prototype to purchase. Successful adoption has often relied on non-routine steps, e.g. individual intervention or escalation.

For SE, this had two main implications:

1. Increasing innovation funding alone is unlikely to improve adoption outcomes. Instead, impact depends on whether systems support the transition from prototype to adoption.
2. Rather than additional support for innovation supply (grants, R&D), the focus should be on shaping demand and adoption pathways.

Effective intervention should be based on these principles: early engagement with suppliers and buyers, clear ownership of adoption, consistent demand over multiple funding rounds, procurement routes which can handle some uncertainty, and work with willing Scottish/UK public sector buyers to design (parts of) procurement pipelines.

Procurement works best when somebody expects to buy the technology at the end of the process. Buyers should define their problems early and plan for long-term adoption from the start.

Why innovation procurement often stalls

Innovation procurement is often discussed as though the obstacles are the procurement regulations and legislation. That is too narrow. The rules matter, but a bigger constraint is behaviour within the regulatory framework: risk aversion, late commercial involvement, unclear ownership, fragmented and short-term budgets, and weak demand signals. Public bodies can usually find a route to test new approaches within the current regulatory framework, but much less often build a pipeline from testing to purchase. In general, the failure point is usually the moment after the pilot, when a separate decision has to be make about adoption. In most cases, there is no guarantee, or even assumption, that the pilots will progress to procurement at scale.

Risk appetite and organisational structure help explain the issue: tests are seen as ‘low risk’ and may be relatively disconnected from a decision about adoption at scale. Testing is sometimes owned by a dedicated innovation team (e.g. a skunk works), which is not fully integrated into the general procurement system.

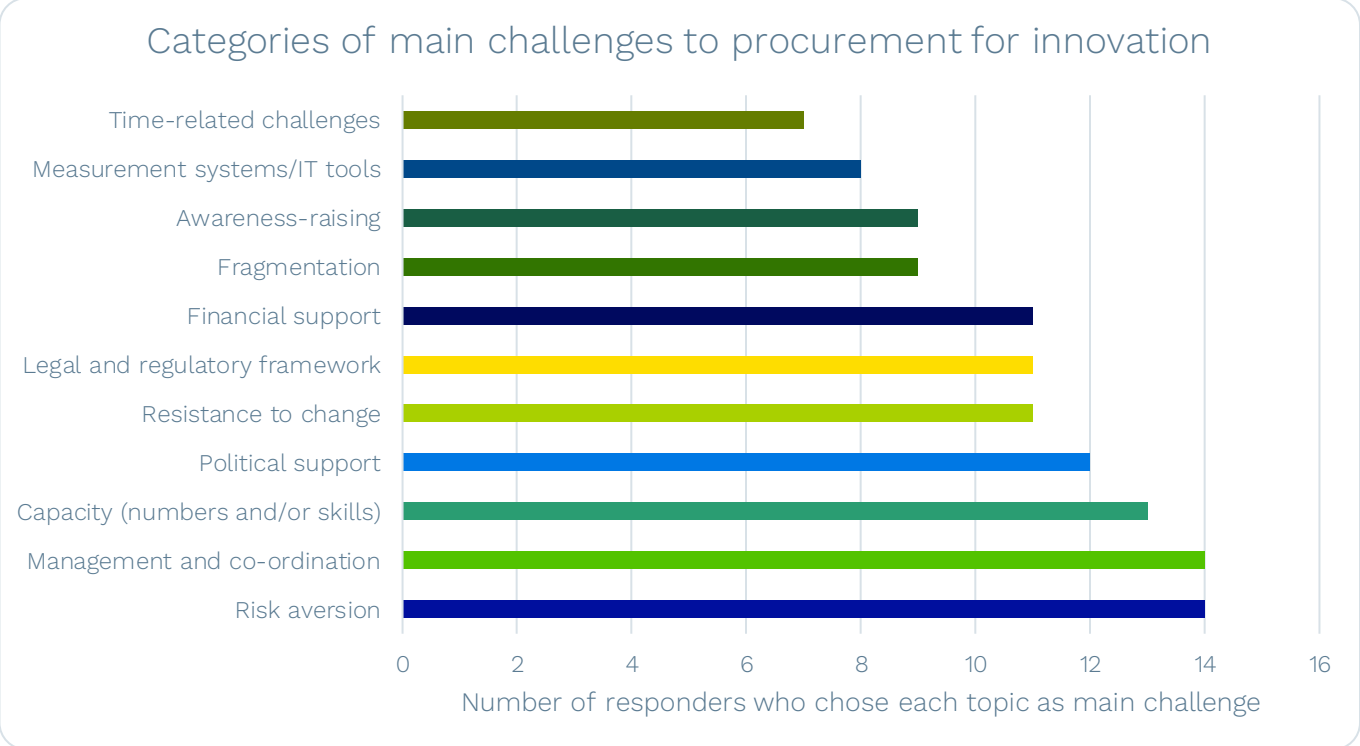

Figure 1: Categories of main challenges to procurement for innovation. In Country responses to OECD (2017), “OECD Survey on Strategic Procurement for innovation 2015”, in Public Procurement for Innovation: Good Practices and Strategies, Annex C, OECD Publishing, Paris. (Analysis of free-text responses (categorised); n = number of responses provided.)

The distinction between "push" and "pull" innovation is another part of the explanation. In a push model, public funding helps a technology move to market in the hope that a customer appears. In a pull model, a public body starts with a problem it wants solved, signals that demand clearly, and uses a procurement process to find viable solutions. The

second model is harder to organise, but is more likely to result in adoption. Due to its relative simplicity, there has been a historic tendency towards push innovation.

In some sectors, there is a particular issue where the public sector *must* be the first customer. In general, first customers are proof that the product can survive public-sector requirements, allowing future buyers to see a worked example. In government-dominated sectors like health and defence, a public sector first customer is effectively a precondition on a business's ability to win overseas work.

A further barrier is the mismatch between technology timescales and public funding cycles. Companies may need confidence over several years before investing in product development or market entry. Public bodies, however, often work within annual budgets and short confirmation windows. Procurement teams routinely have much less than a full year to make procurement decisions, as the budget decisions are slow to reach them. That makes it difficult for them to give the long-term signals that innovative suppliers need.

Suppliers also highlighted the transaction costs created by multiple procurement platforms and processes across government, requiring businesses to monitor numerous systems and repeatedly provide similar information. The innovation procurement system already has numerous well-intentioned facilitators, and it is key to avoid duplication or adding unhelpful complexity.

What good looks like

Successful innovation procurement usually follows a relatively simple sequence:

1. A public body identifies an operational problem with no off-the-shelf solution.
2. The public body engages the market early so that suppliers to understand the need.
3. Suppliers iteratively develop and test solutions.
4. The public body evaluates whether the solution works in their context.
5. A named buyer decides whether to adopt and fund a solution.
6. The solution moves into routine procurement.

Most Scottish and UK innovation programmes can define challenges, fund (pilot stage) competitions, and support prototype development. They are weaker at the beginning and the end: whether the problem reflects real demand, and whether the successful solution has somewhere to go.

A handful of practical improvements came up consistently. Regular challenge cycles help suppliers plan, either at set intervals (e.g. annually), or very frequent (including the "always open" approach). Early notices on the kind of challenge/tender and clear pipelines reduce the advantage of incumbents and traditional solutions. Outcome-based specifications create space for different technologies to compete. Multi-stage procedures allow learning rather than forcing a finished answer too early. Accreditation support allows businesses to access regulated sectors (e.g. health, defence, clean energy). Pilots should be built around the assumption to procure. Most importantly, adoption needs to be owned by someone with the authority and budget to buy.

Often, well-intentioned facilitating bodies default to offering advisory support, peer learning, and knowledge transfer. These can help businesses navigate the system, but they are not substitutes for a long-term funded customer.

Rules are not the whole problem

Scotland's procurement legislation is formed largely from the Public Contracts (Scotland) Regulations 2015 and 2016, and the Procurement Reform (Scotland) Act 2014. These are based on the earlier EU framework, with voluntary Forward Plans rather than a statutory pipeline requirement to inform potential suppliers of intended procurements. The Procurement Act 2023 has introduced new tools in England and Wales, including Pipeline Notices and the Competitive Flexible Procedure. Pipeline Notices require early visibility of larger intended procurements, while the Competitive Flexible Procedure gives buyers more formal scope for staged, iterative processes.

These differences are relevant, but they do not explain adoption outcomes. To ape Drucker, culture eats regulation for breakfast. A public body can have a flexible procedure and still avoid using it. It can publish a pipeline and still fail to connect that pipeline to innovation funding. Conversely, a buyer with a clear problem and budget who is willing to engage early can often make progress within existing rules.

Pipeline Notices are required 18 months ahead of any project over £2 million for large contracting authorities (over £100 million annually) in England and Wales. This presents an opportunity for Scottish companies, and SE could support companies to be 'procurement ready' for these project tenders.

Defence: adoption is expected, not exceptional

Defence is the clearest outlier sector because innovation is tied to capability need. The Ministry of Defence both funds speculative technologies and look for ways to solve operational problems. In terms of supplier incentives, there is a clear pathway to capabilities, i.e. a large focus on pull demand. Suppliers can see a potential end user, and the buyers can treat early-stage work as part of a process resulting in scaled adoption. There is also a different attitude to risk, if the need is clear.

The defence model is also close to "always on" . There are very regular challenges, but promising technology can be considered outside their frequent competition windows, if the need is strong enough. This reduces the stop-start problem created by sporadic competitions and short application windows.

This approach is not problem-free. Defence procurement often works through prime contractors, and smaller companies may need to enter prime-led supply chains rather than sell directly to government at scale. Liability can cascade down the chain, leaving SMEs exposed to financial risk that is difficult to insure and may discourage investment.

Despite appearing as a ‘single customer’, there are internal structures within the MoD, meaning businesses may have to deal with different teams (e.g. DSTL and UK Defence Innovation). Novel products may also be delayed or diluted as they are integrated into larger systems, and there is a high risk of duplication between siloed branches. Nevertheless, defence shows the power of a clear customer and a tolerance of uncertainty.

CivTech: problem definition vs scale-up

CivTech is one of Scotland’s strongest examples of problem-led innovation. It helps public bodies move away from fixed specifications and towards clearly framed problems. This is a major strength: if the problem is properly described, smaller and newer suppliers can propose approaches that a traditional procurement may never have anticipated.

A harder question is what happens after the accelerator. CivTech can help produce viable products, but it does not automatically create a market. A successful challenge still needs repeat demand and a route to scaled adoption. Without these, progress depends on the energy of individual sponsors and intermediaries rather than a designed adoption pathway.

Scale also remains a challenge. CivTech is resource intensive, and is limited to approximately 10 projects a year, on a wide range of public sector needs. This means CivTech alone is not the solution to procurement of innovation, even as a strategic shift in a single sector. But using components of the CivTech process in procurement more broadly is likely to have a positive effect.

Space: contracts vs grants

The space sector has both defence and civilian markets. The UK Space Agency (UKSA), European Space Agency (ESA), and defence customers all shape demand, while businesses also sell satellite data or services directly into international markets. Space is useful because it demonstrates the difference between grants and contract-led development.

ESA funding, a form of indirect UK public funding, is structured as contracts rather than grants. Project funding is linked clearly to procurement and operational use. SMEs can bid directly for ESA contracts under dedicated SME arrangements, creating a first customer. For a company developing complex hardware or satellite-enabled services, this can be a significant signal for later national or commercial buyers.

By contrast, grant-led routes, such as UKSA funding, can support strong technical progress without proving that any future buyer will purchase the result. A project can reach technical readiness and still sit outside of any procurement route. For Scotland, there is a question of how R&D support connects companies to their first customer in ESA, UKSA, defence, public agencies, or overseas governments.

Photonics and quantum: strong supply, unclear demand

Photonics and quantum technologies underscore the limits of a supply-led approach. Scotland and the UK have strong technical capability in lasers, sensors, optical systems, quantum technologies, and related components. The difficulty is that public procurement demand for these is often indirect. Photonics products may sit inside larger platforms bought through primes, which themselves may be exotic or at the cutting edge. Examples include instruments based on photonics (or quantum) sensors, e.g. dead-reckoning navigation or air quality monitoring. For quantum technologies, there may be funding through research and demonstration programmes, whilst large-scale procurement remains episodic.

This creates a difficult market signal. The public sector may value the capability in principle, but individual buyers can struggle to describe the use case due to complexity or lack of knowledge, or may have difficulty carrying the risk of adoption. Demand-side knowledge is therefore as important as supplier readiness. Procurers need enough understanding to ask better questions of these advanced technologies; suppliers need enough visibility to decide whether a public-sector route is worth pursuing.

Some early markets exist. Universities and research institutions can buy specialist equipment and tolerate technical uncertainty. Defence, space, and overseas public contracts can provide stronger routes to scale. But these routes do not yet amount to a coherent domestic adoption pathway. Scotland may end up helping to develop technologies whose first substantial customers are found elsewhere.

Transport: an internal pipeline?

Transport shows how a public body can start to build a more deliberate innovation pathway. The innovation activity in the Department for Transport (DfT) includes regular competitions and a push for good practice with tools such as an Innovation Directory and Innovation Opportunity Framework. Early-stage competitions, including transport research innovation grants, can feed into pipelines with delivery partners such as the Connected Places Catapult and Innovate UK involved at different stages.

The most useful feature is the possibility of a pipeline entirely within DfT. When suppliers know roughly when competitions will appear, what themes are likely, and how one stage might lead into another, they can invest in preparation. That is very different from a short-notice tenders that rewards whoever already has a bid nearly ready, or the complex pipelines businesses often experienced of being passed between different public sector organisations as their product develop.

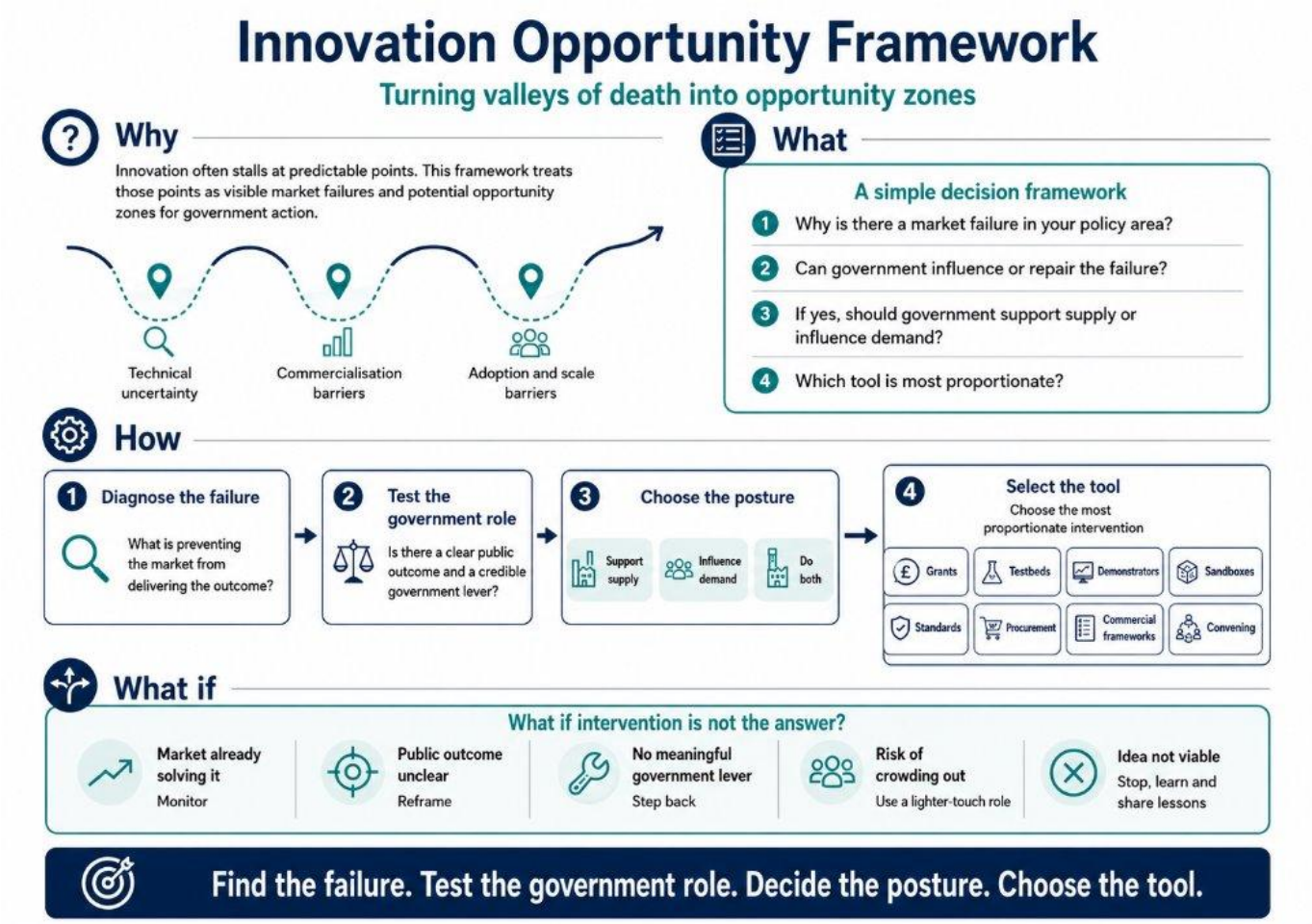

Figure 2: Department for Transport Innovation Opportunity Framework

However, transport also highlights the complication of arm's-length delivery. DfT itself does not procure most transport systems at scale; this is handled by bodies such as Network Rail, HS2, or DVSA (and its work with local/combined mayoral authorities). The innovation team can create promising routes, but adoption still depends on the autonomous bodies that own budgets and risks. A useful opportunity may be to connect Scottish challenges and companies, such as in transport, to existing UK challenge mechanisms.

Health: effects of fragmentation

Health offers a large but fragmented market. NHS Scotland sets national priorities, then Scotland Innovates and the Accelerated National Innovation Adoption (ANIA) pathway help organise activity. Yet individual boards and clinical teams retain autonomy over many adoption decisions. A company may therefore have an NHS customer without having system-wide adoption.

This fragmentation cuts both ways. It makes national rollout harder, because engagement with one board or clinician does not automatically lead to wider adoption. Suppliers may face multiple evidence requests and localised procurement decisions. But it also creates an entry point: a smaller-scale NHS contract can help a company prove credibility, including when selling into overseas health systems that may not distinguish between one board and the whole service.

The Cytosponge example is instructive. It moved into use during the pandemic and showed that adoption can happen in a crisis. The difficulty came later, as normal approaches resumed. That pattern is common in health technology, where evidence of usefulness is necessary, but not sufficient. Adoption needs a funded pathway through the system as well. Cytosponge also required senior intervention, rather than using a routine procurement route. Scotland Innovates and ANIA may help provide a more routine pathway in future.

Routine public services

Routine public services are often overlooked in discussions of innovative technologies, but they account for large amounts of public spend, despite budgetary pressures. Local authorities can create important markets for mid-tech products, e.g. monitoring systems, energy controls, sensors, robotics, low-carbon heating, or digital inspection tools.

Net zero heating retrofit illustrates the challenge. Feasibility studies throughout Scotland often identify plausible technical solutions. As in other sectors, the blockage is confirming budget-holders and sharing risk. A technically sensible option can sit unused if no procurement decision follows.

There is also a role for smaller sub-threshold purchases. A facilities team buying a monitoring system or a council testing energy controls may face less procedural burden than a large framework procurement. These purchases can be less visible, but they can still give a supplier a first customer.

Schiphol Airport's lighting-as-a-service model is a different kind of approach to innovative technology: changing what is bought. Rather than buying lightbulbs as assets, the buyer pays for the outcome of appropriate lighting. In this 'service-over-product' system, the supplier retains lifecycle responsibility, creating incentives for continuous improvement. Not every technology should be procured as a service, but it shows that procurement can change incentives as much as product choice.

This is not to recommend a general move towards the "subscription"-like service model. But there are situations in which a service (reliable lighting) is more appropriate for a public body than an asset (many limited-lifespan lightbulbs). This is beneficial environmentally, and may be closer to what is done in practice, where facilities management hire a contractor to provide reliable lighting, whilst leveraging this for innovation purposes. There may be other examples of places where innovation in procurement business models themselves can drive technical improvements.

International lessons

Better-performing international systems tend to organise demand more consistently. They use various approaches to make the market easier for businesses to deal with, including: regular procurement cycles, clearer forward priorities, strong clusters, more local adoption routes (e.g. at municipal level), and clear strategic customers.

Finland and Denmark are useful examples because municipalities and clusters play a stronger role in connecting practical problems with suppliers. Finland's emphasis on preparedness and supply-chain understanding also gives public bodies a clearer view of what they may need and where vulnerabilities sit.

Catalonia and Flanders demonstrate the value, and limits, of clusters. Mature cluster systems like these can provide business support; but clusters do not automatically create public procurement contracts. They are most useful when connected to demand that already exists or can be clearly articulated.

The United States adds another lesson for businesses trying to access international government procurement, which continues to be a key market for advanced technologies. US federal procurement is often hard for international businesses to access directly, but state-level and sub-federal procurement can be more open. Bodies such as the US National Association of State Procurement Officials (NASPO) create routes into cooperative purchasing across smaller collections of states. For Scottish companies, there are opportunities to sell satellite data, software, and other offerings less exposed to rules of origin and tariff issues. It is also an area where targeted trade support could connect innovation companies to real public buyers rather than general investor audiences. There may also be opportunities for defence/dual use companies which bypass some of typical restrictions.

Implications

The strongest implication for SE is that adoption needs as much attention as innovation. Scotland has business and research strengths in important technology areas. Public intervention will have greater impact if it helps those businesses reach real customers, rather than only moving them further up the TRLs.

SE could focus on a small number of willing buyers rather than trying to change the whole system. Local authorities, housing bodies, transport organisations, NHS boards, infrastructure owners, and defence-facing/dual-use bodies may all have problems where innovation could help. This would involve finding buyers with enough operational need and budget ownership to make long-term adoption realistic.

Before funding a project, SE could focus more explicitly on the route to a first customer. That means asking: who is the likely first customer, what budget would adoption come from, what evidence will the buyer need, what procurement route is plausible, and what happens if the pilot works? If those questions aren't answered at the outset, the project may still be worth supporting, but it should not be treated as having a route to adoption.

SE can also help suppliers navigate the system, but this should not be confused with creating demand. For example, early engagement and support for working with primes can reduce friction. But they will only improve adoption when they are linked to real procurement opportunities and sustained budgets.

Finally, SE can help build longer-term demand signals. Regular challenges, sector-specific pipelines, service-over-product, and problem statements with committed buyers would do more for adoption than isolated competitions. A pathway needs to give companies enough confidence to invest over several years, rather than provide another pilot. SE can support companies to work in parts of the procurement ecosystem which have explicit long-term signals, e.g. Pipeline Notices in large English and Welsh contracts, collate early procurement contract information where it is available in the rest of the public sector, or encourage contracting authorities to release information about tenders early (even if this is not a legal requirement).

Examples of practical interventions include:

1. Service-over-product pilot, in partnership with a public sector organisation

A public sector organisation defines a continuous outcome rather than a technology, such as reduced operating theatre infection risk, reduced building energy consumption, or improved reliability of road-inspection activities. Suppliers compete on delivery of the outcome, individually or in consortia. Successful pilots create a direct route into ongoing service contracts rather than requiring a separate procurement exercise.

2. ‘Handover sponsor’ model

Before funding an early-TRL project, SE and partners identify a prospective first customer, adoption sponsor, and budget holder. Innovation projects would include agreed handover points from innovation funding into operational trials and procurement, reducing the risk of promising technologies stalling after successful pilots – a sort of ‘CivTech-lite’. SE would support the company’s accreditation for the sector (e.g. health, defence, or environmental accreditation). For example, a photonics air-quality monitoring project could begin with an identified pathway into operational trials with a local authority or SEPA, if technical milestones are met.

3. Strategic buyer partnerships

SE works intensively with a small number of willing public-sector buyers to identify operational challenges and create repeatable adoption pathways, as in “seek-and-solve”. The aim would be to build procurement pipelines around pre-existing customers and competitions, rather than funding new projects in isolation. For example, SE could work with Transport Scotland/DfT to develop challenge areas where Scottish companies can progress through existing DfT innovation pathways and into adoption.

Final thoughts

The hard problem in public procurement of innovative technologies is adoption. Across sectors, the same lesson keeps returning: innovation funding can create promising solutions, but procurement only happens when demand is visible and ownership is clear. Scotland has many innovative technologies, but often lacks a predictable route from prototype to procurement. The next step is to make adoption a planned part of the system rather than something that happens occasionally through individual effort.

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