Universities and Public Research Institutes

What is public sector research?

Public sector research refers to those R&D activities performed in institutions that are either publicly owned or operated or that depend to a large extent on government block funding for their research activities. Such institutions fall into two main categories: universities and public research institutes (PRIs). In addition to research, universities perform the important function of teaching, while PRIs usually solely provide direct R&D support to business firms and public authorities. Countries differ markedly in the proportions of public R&D performed in universities and PRIs: for example, some countries, such as Sweden and the United Kingdom, are university-centred, whereas others, such as Korea and Russia, perform a large part of their public R&D in PRIs.

Why are universities and PRIs important for innovation?

The research activities of universities and PRIs contribute to innovation in a number of ways. A traditional view sees such activities result in codified knowledge (e.g. publications) and knowledge embodied in technological inventions and innovations that are subsequently taken up by innovative business firms. Direct interaction with business, particularly through R&D collaboration with firms, can enable this knowledge transfer and uptake. Much policy assumes these channels to be the principal ways in which universities and PRIs contribute to innovation.

Furthermore, over the last few decades, it has become fashionable for policy makers to expect universities and PRIs to commercialise some of the knowledge they generate, e.g. through spin-off companies, or to at least seek intellectual property rights protection, such as licensing, with a view to earning incomes from their knowledge.

While these channels are important, perhaps the major contribution to innovation from public sector research comes from the person-embodied knowledge and skills it nurtures. This is especially obvious for research students, many of whom seek long-term careers in business firms. The result has been a gradual shift in many OECD countries toward more publicly funded R&D being performed in universities than in PRIs, because of the universities' teaching role. But businesses can also draw on the skills in universities and PRIs to support innovation activities, for example, through advice, consultancy and extension services. Often overlooked, yet critical for innovation are the metrology and standards activities of PRIs.

What key factors influence the contributions of universities and PRIs to innovation?

A number of factors influence the contributions to innovation that universities and PRIs can have:

- Universities and PRIs need to have the requisite capabilities and resources to perform useful research. This includes hard R&D infrastructures, but also soft organisational capabilities for managing and exploiting their research activities. The research specialisation of universities and PRIs will also influence the extent to which they can be expected to contribute to business firms' innovation activities in the economy.

- A critical though often overlooked factor for universities and PRIs to contribute to innovation is the demand for the knowledge they produce. Firms are more likely to directly benefit from public sector research if they perform R&D themselves. The extent to which firms in a given economy perform their own R&D is partly influenced by the industries in which they operate because some industries, such as pharmaceuticals, are more R&D-intensive than others. It is also influenced by prevailing market and competition conditions. Besides business firms,

governments can be an important point of demand for public sector research, as can the wider society.

- Recent decades have seen the emergence of various knowledge transfer infrastructures to facilitate and accelerate the commercial exploitation of public sector research. These include technology transfer offices (TTOs), incubators and science and technology parks, and various types of extension infrastructure. Other conditions that relate to knowledge transfer include intellectual property rights (IPR) regimes, open science infrastructures, the nature of innovation networks and clusters, and the state of international linkages.

- Scientists and engineers work under certain norms and incentive conditions that can also influence the types of research related activities they engage in. For example, peer review contributes to the quality of research and has a strong bearing on researchers' careers. In some settings, traditional scientific community norms, such as scientific autonomy, have a strong influence on the channels available for public sector research to contribute to innovation. Certain practices and traditions associated with different science and engineering disciplines can have similar influences.

- While the performance and exploitation of public sector research generates useful innovation skills, the existing availability of such skills is important. These include not only science and engineering skills, but also skill sets associated with business and entrepreneurship and research management. The attractiveness of research careers in universities and PRIs influences the availability of skills, as does the international mobility of scientists and engineers. Many countries fail to exploit female talent due to prevailing working conditions that discriminate against women.

- For exploitation through the spin-off channel, access to start-up finance is an important factor.

- Finally, given that universities and PRIs perform public R&D, public policy tends to have a major influence on their activities, and, by extension, on the ways in which they contribute to innovation. Policy expectations for the possible contributions of universities and PRIs can have a strong bearing on the rationales for intervention and the policy instruments used. Although many countries have similar expectations and choice of instruments, there is also variation which often reflects the policy-making context, particularly existing policy capacities and resources (including the availability of policy-relevant indicators), prevailing institutional governance arrangements and interactions between different policies.

What are the main policy issues?

Each of the key factors outlined above has its own set of "failures" and therefore rationales for policy intervention. The following are examples:

- **Renewal of research infrastructures.** Not only large research infrastructures but also entities like libraries need to be constantly renewed as they wear out or become outdated. Such rebuilding requires public investment, often in the form of block grants. Public funding might prioritise certain fields or select certain institutes for their investments, e.g. in centres of excellence. The extent of such prioritisation and selectivity of public sector R&D budgets is a perennial source of debate in many countries.

- **Demand failures.** While demand failures around public sector research are commonplace, policy has been relatively slow to address them. Policy support to networks and clusters of firms, universities and PRIs is common in many countries, while some schemes exist to incentivise firms to collaborate with universities and PRIs or to use their research services.

- **Inadequate knowledge transfer infrastructures.** Many countries have established different types of knowledge transfer infrastructures, with somewhat mixed results. Problems often arise when an overly supply-side perspective is taken when the success of such schemes also require attention be paid to market demand, which may be weak.

- **Norms and incentive structures.** In many, if not most countries, prevailing norms and incentive structures among researchers have proved to be formidable barriers to the use of certain exploitation channels, particularly of the more commercial type, e.g. spin-off creation by academic researchers.

- **Brain drain.** Many countries face net outflows of skilled people, which are difficult to stem.

- **Public policy cohesion.** In policy-making itself, coordination problems are commonplace, as many different agencies support public sector R&D. At the same time, public sector research accountability regimes remain weakly developed in most countries.