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Government support for business research and innovation in a world in crisis

What factors and trends have led to today's patterns of government support for innovation in OECD economies? How has this helped shape current innovation systems? How is it relevant towards addressing the causes and effects of the current crisis? This chapter reviews how governments allocate public resources towards research and innovation, drawing in part on recent evidence from OECD projects. These interact with other major public policy discussions on the nature of government intervention and the breadth of innovation activities, as well as international debate around which subsidies are permissible today across highly interconnected economies. The chapter explores how the COVID-19 crisis may result in shifts in the volume, nature and direction of public support for innovation. It concludes with possible scenarios and their impact on the way governments will sustain future innovation activity in their societies.

Key findings

- **The R&D and innovation business response to COVID-19 has been very heterogeneous.** While for some the crisis represents an opportunity to expand such efforts, innovation capabilities in many industries are under significant stress. Yet the mobilisation of business innovation resources and capabilities is crucial for tackling the current crisis and addressing long-standing economic and societal challenges. Since close to 70% of R&D in the OECD area is nowadays carried out by firms, how governments incentivise and influence research and innovation in firms can have major implications for our future and is a badly needed element of injecting resilience into the economy and society.
- **Public innovation support policies need to be able to guide private innovation efforts to where they are most needed,** especially where market signals prove to be insufficient and coordination is most challenging. Recent OECD data and analysis shows that governments' policy mix is not entirely consistent with that ambition. R&D tax incentives are effective in achieving their generic R&D-raising objectives as long as they are consistently designed and implemented. However, they are insufficient as a means to guide innovation to broader societal needs, and represent suboptimal instruments to encourage investment in knowledge at the interface between basic research and actual product or process development.
- **Many of the assumptions underpinning the global policy consensus on the appropriate role of government in funding and promoting innovation are likely to be further challenged in the coming years.** Business innovation support today is possible within a delicate balance of international agreements that shape what national governments can do to help their businesses innovate without triggering retaliatory responses by other countries. Governments need to build a clear appreciation of the trade-offs they face in redesigning their innovation support portfolios, in parallel with their partners and competitors in other countries. National self-interest, also when it comes to business support for innovation, will be most often best served by international collaboration.
- **Governments can learn from each other to improve the design and administration of innovation support during crises.** Public support for innovation comes in many forms and is not always easy to measure, track over time or compare to facilitate mutual learning. Governments also need to continue to invest, alongside other capabilities, in evidence about their innovation support policies in order to improve them. This requires breaking down silos and developing capabilities to exploit this information. This is an ongoing priority of the OECD, both in terms of measurement and policy analysis.

Introduction

Public support has always played a key role in shaping the extent, nature and direction of innovation in modern market economies. This chapter examines the factors and trends that have led to today's patterns of government support for innovation, which itself has helped shape current innovation systems. It explores the major debates prompting a review of how governments allocate public resources towards research and innovation, interacting with other major public policy discussions on the nature of government intervention, the breadth and specificities of innovation activity, and the international governance dimension, particularly which subsidies are considered permissible across highly interconnected economies. The chapter explores how the COVID-19 crisis may result in shifts in the volume, nature and direction of public support for innovation. It concludes by outlining possible future scenarios and their impact on the way governments enact their support to innovation.

Support for business research and innovation today

The importance of public support for innovation

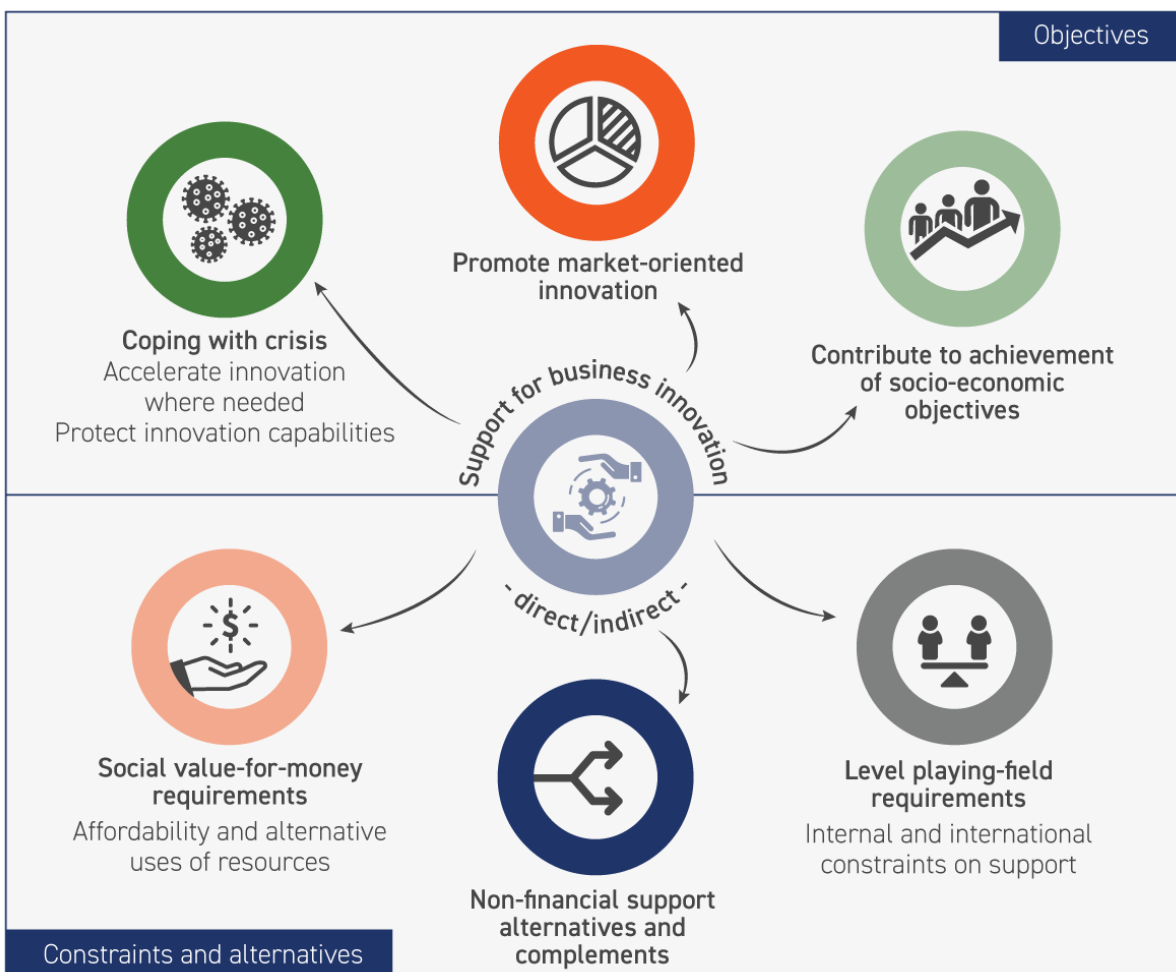
In decentralised market economies, businesses are key actors in research and innovation systems, selecting, developing and implementing new ideas in pursuit of economic opportunities. This is also largely true of other economies in which the government has a high degree of business ownership and control. In addition to providing a benign socio-economic framework in which firms can fulfil their socio-economic role, government policies also actively promote investment behaviours that are deemed beneficial to society but firms may otherwise be reluctant to adopt. Investments in knowledge and its application are riddled with uncertainty and are hard to co-ordinate; further, their benefits may quickly dissipate as others stand to benefit (OECD, 2010^[1]). Left to their own devices, markets may struggle to allocate resources towards such endeavours, even when they would be beneficial from a wide societal perspective.

There exist multiple ways for governments to provide financial support for innovation (OECD/Eurostat, 2018^[2]). For instance, public support can focus on the inputs (e.g. firms' research and development [R&D] efforts) or outputs of the innovation activity (e.g. by reducing the taxes owed on the economic returns to R&D). The support may involve a subsidy, i.e. a net transfer of resources, more or less explicitly connected to specific innovation activities.¹ Several instruments can be used to help channel resources to firms in order to incentivise or reward innovation efforts. Governments can buy (or promise to buy) goods or services that either require or result from business innovations. They can provide finance in the form of grants or loans, or encourage others to provide such loans by providing guarantees when firms cannot repay. They can defer or forgo tax liabilities, or they can inject capital into firms in return for equity. Governments can pay third parties to provide services that firms require to innovate, or they can provide such services themselves through institutions they control, such as government labs. The transfer of technology sponsored or held by governments, or preferential access to data such as health or mobility records, are examples of in-kind support, as is the award of exclusive rights on inventions through intellectual property rights. Public investment and support for innovation is not necessarily limited to a country's territorial boundaries. For example, sovereign wealth funds and related investment vehicles buy shares in companies around the world in order to own a stake in their new technologies. Governments also provide implicit support for business innovation through the activities of state-owned enterprises, which are also part of the business sector.

Public support for innovation has played a major role in the design of industrial and economic development strategies worldwide, albeit with rather uneven approaches and results. While public support remains a hotly contested issue (Warwick and Nolan, 2014^[3]) and growth-promoting industrial policies have been insufficient without complementary reforms, most successful economies have relied on them at some point in their history (Rodrik, 2010^[4]). As indicated in the top part of Figure 4.1, the objectives of innovation

support policy are multiple. Innovation policy makers care about identifying the most appropriate portfolio of support instruments that encourage and guide business R&D and innovation; generate solutions that transform or even create new markets; advance economic growth; and overcome long-standing societal challenges, such as health, energy and the environment, or address short-term crises. This multiplicity of objectives often calls for using a portfolio of support instruments rather than relying on a limited set of policy tools.

Figure 4.1. Confluence of objectives and constraints to government support for business innovation



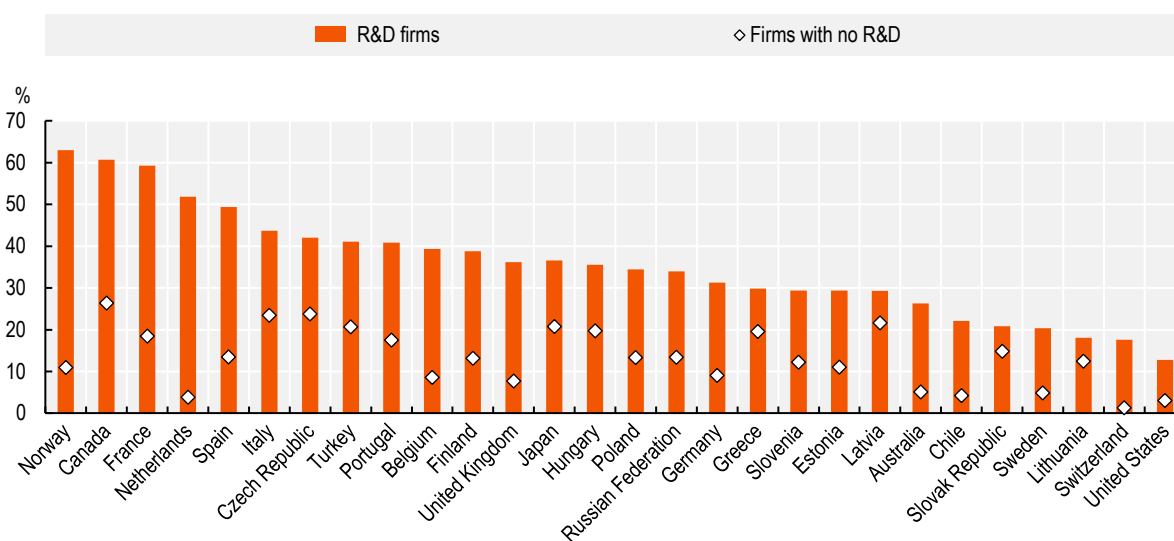
Innovation policy makers also need to take into account a number of constraints including the implications across a much wider group of policy areas, as this chapter will later discuss. In particular, finance ministries and society at large demand evidence that investments supporting business innovation yield as high a social return as investments in public infrastructure or other discretionary areas of spending. Controls need to be put in place to prevent business innovation support from becoming a form of “corporate welfare” through regulatory capture. Alternatives to support always need to be considered.

Government support for innovation before the COVID-19 crisis

Public policies promote innovation by supporting different types of firms and activities. Around the world, firms that perform R&D are far more likely to receive innovation support from the government (with a median 36% chance) than firms that only undertake non-R&D based innovation (13% median chance) (Figure 4.2). As a result, a majority of firms that receive innovation support are R&D active firms, even though they represent a minority of firms active in innovation.

Figure 4.2. R&D active firms are more likely to receive public support for innovation

Firms receiving public support as percentage of firms active in product/process innovation, 2014-16



Note: Data on public support for innovation apply to firms reporting a product or process innovation as well as firms with innovation activities related to product or process innovation. For Canada, data refer to product/process innovative firms. For Chile and Japan, data on public support apply to firms with innovation activities, whereas product/process innovation-active firms refer to firms reporting product or process innovations or with ongoing/abandoned innovation activities related to product, process, marketing or organisational innovation. For Spain, R&D status refers to 2016 only.

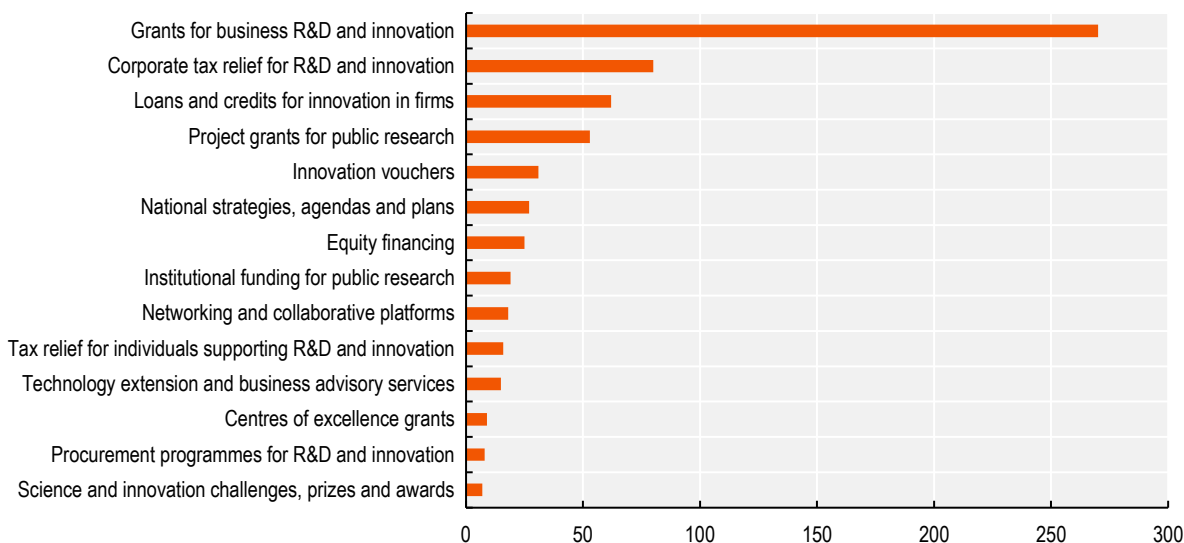
Source: OECD Innovation Indicators 2019 (database), <http://oe.cd/inno-stats> (accessed in October 2020)

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The OECD Science, Technology and Innovation Policy (STIP Compass) portal, a repository of innovation support schemes (EC-OECD, 2020^[5]), shows that direct funding schemes are the most often reported instruments of financial support for R&D and innovation in terms of counts of initiatives (Figure 4.3). 40% of reported instruments in this area refer to grants for business R&D and innovation. An examination of the underlying information about these instruments shows they are highly fragmented and customised to specific target groups, compared to corporate tax incentive schemes (11% of reported support schemes). R&D tax incentive schemes tend to be unique for an entire country, echoing the tax on which those concessions apply, although these also exhibit considerable variations (Appelt, Galindo-Rueda and González Cabral, 2019^[6]). Few countries report on the availability of procurement programmes for R&D and innovation, as well as the use of prizes and awards.

Figure 4.3. Policy instruments providing financial support for business R&D and innovation

Number of active policy initiatives reported by countries, top 14 instruments



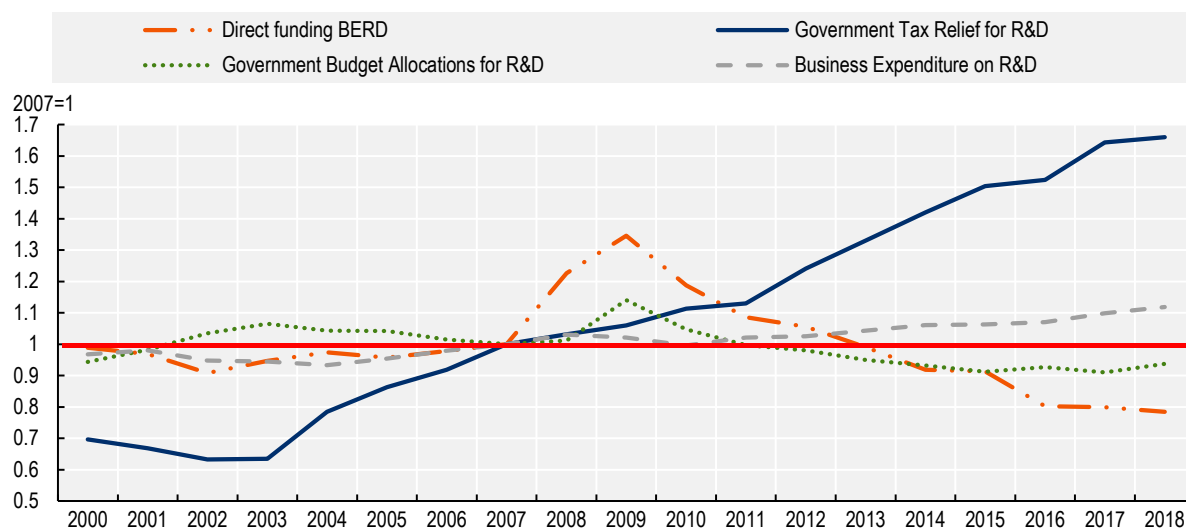
Source: (EC-OECD, 2020^[5]), *OECD STIP Compass* (database), <https://stip.oecd.org/stip/themes/TH31> (accessed October 2020).

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With the increasing proliferation and generosity of R&D tax incentives across OECD countries and partner economies over the last decades (Figure 4.4), the measured R&D support policy mix (Box 4.1) has shifted towards a greater reliance on tax compared to direct support instruments (Figure 4.5).

Figure 4.4. Shift in R&D support policy mix, 2000-18

Government funding of R&D in the OECD area, indexed values for key figures normalised by GDP, 2007=1



Note: For general and country-specific notes on the estimates of government tax relief for R&D expenditures (GTARD), see <http://www.oecd.org/sti/rd-tax-stats-gtard-ts-notes.pdf>. This chart displays figures for 37 OECD countries with the exception of GTARD figures, which exclude Israel where relevant data are not available. Direct support estimates include government R&D grants and public procurement of R&D services, but exclude loans and other financial instruments that are expected to be repaid in full.

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, November 2020.

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Box 4.1. Addressing measurement gaps in government support for business innovation

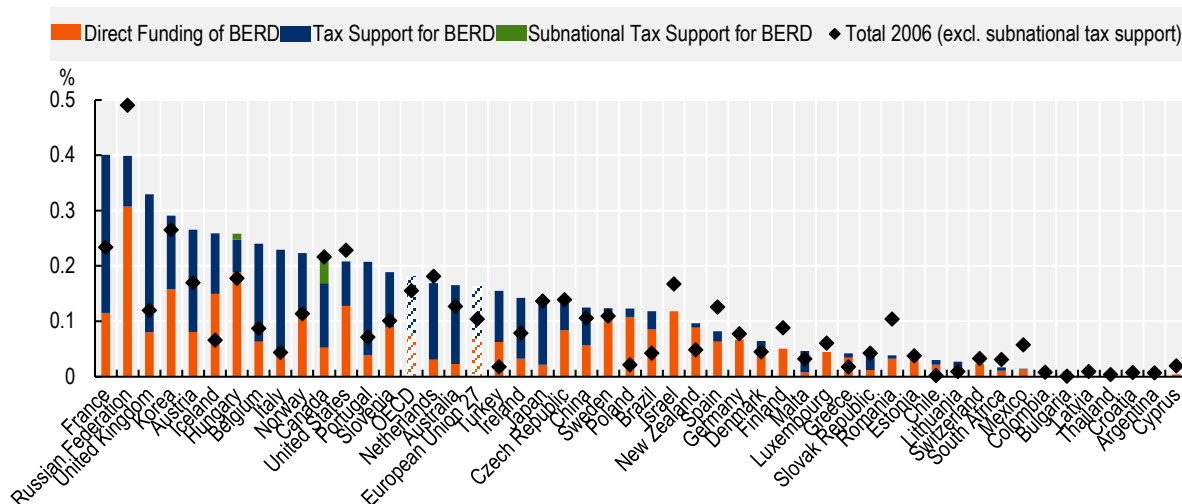
Despite sustained OECD efforts, comparative statistical information on the landscape of government support for business innovation across countries is rather incomplete. The available aggregate statistics on support for R&D focus on direct support for business R&D without distinguishing between different support types, and have only recently incorporated tax support measures. In that regard, they understate the role governments play in supporting R&D by providing explicit or implicit support to financial intermediaries or committing to purchase goods or services that implicitly requires firms to invest in R&D. The 2015 *Frascati Manual* (OECD, 2015^[7]) introduced a taxonomy for tracking different forms of government support for R&D by separating grants from procurement of R&D services, pointing to the importance of capturing other indirect support mechanisms in an internationally comparable fashion. Further methodological guidance is now being prepared on means to quantify government measures of financial support, such as income-based tax incentives and innovation loans. Drawing on previous OECD efforts to document the magnitude of support for innovation, which were discontinued for lack of collaboration and evidence exchange (OECD, 1995^[8]; OECD, 2001^[9]), this new work takes into account:

- the need to capture the full spectrum of innovation activities, including not only R&D activities, but also diffusion activities, in line with the proposals in the 2018 Oslo Manual (OECD/Eurostat, 2018) for a more ambitious and comprehensive approach;
- the commercially sensitive and often confidential nature of the supported business activities;
- the political sensitivity of documenting support to industry, especially in light of international regulations such as international trade agreements or competition rules on state aid;
- the inherent difficulty of identifying the innovation scope of government support, given the overlap of innovation with other government strategic objectives, coupled with the general lack of a requirement to use innovation as a descriptor/classifier in administrative processes within many public authorities;
- the technical challenge of evaluating and interpreting the explicit or implicit financial flows between government and business, separating between exchanges and transfers (not all support for innovation is necessarily state aid), accounting for assets and liabilities, etc.;
- the diversity of intermediate organisations channelling government funds to business beneficiaries and their agents, which may not be businesses themselves;
- the lack of co-ordination and common standards for compiling administrative data on innovation support across and within agencies;
- the need to reconcile sponsor and beneficiary perspectives when collecting and interpreting data; and
- the policy analysis interest in inter-linking information on different support measures by recipient and with business characteristics and outcomes such as jobs, investment and productivity.

Across OECD countries, tax support represented around 56% of total government support of business R&D in 2018, compared to 36% in 2006 (Figure 4.5). The shift in the policy mix has been even more pronounced in the European Union (EU27), with tax support doubling over ten years, from 26% of total government support in 2006 to 57% in 2018. The evolution has not been uniform across countries, as it has been dependent on several factors, including how countries have seen themselves compared to their peers. For instance, Canada decided to rebalance its federal support portfolio shortly after these international comparisons became first available and showed its high reliance on tax support.

Figure 4.5. Direct government funding and government tax support for business R&D, 2018

As a percentage of GDP



Note: For general and country-specific notes on the estimates of government tax relief for R&D expenditures (GTARD), see <http://www.oecd.org/sti/rd-tax-stats-gtard-ts-notes.pdf>. Estimates of total OECD direct funding of BERD cover 37 OECD countries, whereas estimates of total OECD R&D tax support (central government level) cover 36 OECD countries, excluding Israel, where R&D tax relief estimates are not available. Direct support figures refer only to intramural R&D expenditures, except for Brazil. Estimates of total OECD (EU) direct funding of BERD cover 27 OECD (27 EU) countries, whereas estimates of total OECD (EU) R&D tax support (central government level) cover 36 OECD (26) countries, excluding Israel (Croatia), where R&D tax relief estimates are not available. EU government-financed BERD in 2018 based on OECD estimate.

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2020.

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Two notable factors have contributed to this shift. First, international trade and competition rules governing state aid have restricted support to specific firms or industries, while generic tax incentives are more likely to pass state aid tests. The progressive development of multilateral institutions to promote trade and investment flows has had a significant impact, shaping the current legal frameworks for government support to innovation (Box 4.2). Peace and economic growth required lifting barriers to trade and competition, but also sustained investment in new knowledge and its applications. Compromises were required. Policy consensus built around the idea of exempting both undirected support and support for pre-competitive innovation activities from bans on subsidies. Such bans are designed to promote competition and open markets. Where a subsidy is widely available within an economy, i.e. it is not restricted to a given enterprise or group of enterprises, international agreements tend to presume there exist no unintended distortions in the allocation of resources. Non-specific (or selective or discretionary) subsidies are therefore looked upon more leniently, but quantitative restrictions still apply on how far downstream governments can go in supporting innovation activities as the innovation activity gets closer to the market.

Second, within a majority of OECD member countries, proponents of non-specific R&D tax support have successfully argued that firms and not governments are best placed to decide which projects to invest in, thereby downsizing on bureaucracies in charge of identifying which business projects exhibit greater potential and need of support. Such laissez-faire attitudes have tempered beliefs in governments' capacities to select the best projects, deeming the business sector better apt to assess markets and technologies, predict demand, and choose which projects and companies are worthy of investment. Budgetary pressures have also led to lighter-touch funding mechanisms that appear to require less administrative overhead.

Therefore, industrial policy progressively became more “horizontally” oriented, focusing on business-friendly framework conditions and generic public support for innovation, without abandoning altogether the sectoral dimension (Hutschenreiter, Weber and Rammer, 2019_[10]). These shifts have resulted in an overall re-organisation of innovation support portfolios, reducing the use of governments’ discretionary powers in selecting the firms and projects to be supported.

Box 4.2. International rules shaping government support for business research and innovation

In today’s globalised economies, national and supranational competition and trade authorities play a key role in setting and enforcing rules that ensure a level playing field among firms, industries and countries. The World Trade Organization (WTO) rules on subsidies have been traditionally permissive of public support towards private R&D costs. In the first years of the Agreement on Subsidies and Countervailing Measures signed in 1995, R&D subsidies were presumed not to distort trade and hence classified in the “green light” or “non-actionable” category (Maskus, 2015_[11]). As this category lapsed in 2000, R&D subsidies became actionable, either by dispute settlement (which have been rare and focused on support for the aircraft industry) or unilateral countervailing duties, subject to demonstrating that the subsidies met specific criteria and had injurious effects on another WTO member. The system appears to have successfully encouraged governments to shift their public support towards non-specific instruments. This means support is not limited to an individual firm or group of enterprises, and the amounts of support provided is regulated by objective criteria for which eligibility is automatic.

The European Union’s state aid rules are another case in point. These rules consider that state aid for R&D and innovation can be compatible with the internal market when it can be expected to alleviate a market failure or facilitate the development of certain economic activities, and where the ensuing distortion of competition and trade is not contrary to the common interest. The use of the selectivity criterion under this framework is akin to the WTO notion of specificity. A scheme is considered selective if the authorities administering the scheme enjoy a degree of discretionary power. By affecting the balance between certain firms and their competitors, selectivity differentiates state aid from so-called general measures that do not need to be notified. Even among measures considered to be state aid, as is often the case for R&D tax incentives, the proportionality requirement for approval is more likely to be met if the aid is awarded on the basis of transparent, objective and non-discriminatory criteria (European Commission, 2014_[12]).

Restricted tendering by public authorities can also be considered an implicit form of targeted business support, even if it does not represent state aid. The WTO Revised Agreement on Government Procurement of 2012 (to which China, for example, is not yet a signatory) aims to open up government contracts to international competition, but a number of exemptions are allowed (WTO, n.d.a_[13]). Individual signatories also indicate limits to the scope of application of the agreement, e.g. with respect to “set-aside” quotas for small and medium-sized enterprises (SMEs) in Canada and the United States. Most countries also exclude the provision of R&D services from the agreement’s scope.

Other recent trends influencing current innovation support systems

In the past decades, the globalisation of economic activity, manifest as goods, services, capital, people, technology and knowledge have become easier to transfer across national borders, has led to a marked fragmentation of economic activity, with goods and services produced and heavily traded in international production networks known as global value chains (GVCs). Innovation support turned to be designed with a view on where countries wished to see themselves positioned in the resulting, complex global production and innovation networks (OECD, 2017_[14]). Within this highly interlinked setup, business innovation activity supported by governments can have significant implications not only within the countries themselves, but

also globally. To some extent, the emergence of China and other Asian economies shaping today's GVC system is a consequence of past decisions on public support. In China, public support (e.g. the Torch programme) was instrumental in the establishment of innovation clusters and the subsequent development of venture capital (VC) firms that are now investing internationally. The Made in China 2025 plan, released in 2015, became the country's blueprint for supporting its pursuit of technological autonomy while securing access to international markets in priority areas. Since then, said strategic considerations have become an increasingly regular feature of policy debate even before the onset of the COVID-19 crisis. As later discussed in the forward-looking section of this chapter, technological mistrust and trade tensions could become a mainstay of future economic relationships, both driven by and influencing decisions on public support for innovation.

Companies that push the boundary of knowledge to create workable solutions are ultimately destined to operate globally in order to reap the benefits of their innovations, unless they sell their rights to third parties. This makes multinational enterprises (MNEs) key actors in the globalisation of innovation, accounting for the bulk of R&D performance within OECD member countries. In Sweden, for example, only 10% of R&D is performed by companies without a presence in other countries; the remainder is more or less equally shared between Swedish affiliates of foreign-owned companies and Swedish majority-owned companies with subsidiaries abroad (Swedish Agency for Growth Policy Analysis, 2019^[15]).

MNEs are therefore major direct recipients of government support. They can consider national incentives as one of several criteria for locating (and retaining) innovative activities in a particular territory. Innovation support systems may be designed to favour independent firms, particularly SMEs and start-ups, which face bigger barriers. While promoting new entry into R&D to new companies, concentration of R&D and R&D assets appears to have been rising recently. In the United States, firms with more than 1 000 employees have gone from accounting for 76% of all business R&D performance in 2008 to 82% in 2017.

The filings of large R&D corporations include as R&D expenses most of the costs of R&D acquired as part of takeovers of typically smaller R&D performers. The authorities responsible for merger control activities are therefore increasingly paying increased attention to their effects on overall innovation, as platform based incumbents can use their information resources to identify and acquire potential rivals early in their lifecycle before they become a competitive threat.

As MNEs operate across national jurisdictions, they have considerable flexibility in structuring their tax liabilities across the territories, moving intellectual property and associated profits. This accentuates pressures on governments to offer, within the existing rules, incentives for firms to locate their innovative activities and tax bases in the national territory. Domestic base erosion and profit shifting (BEPS) stemming from the exploitation of gaps and mismatches between different countries' tax systems affects all countries. BEPS requires additional international co-ordination to prevent, among other things, harmful practices such as incentivising business reallocation of intellectual property to more convenient jurisdictions without substantive activity requirements.

Improving the policy mix for support to business innovation

Understanding how support instruments work

The proliferation of R&D tax incentives raises important policy questions about the effectiveness of different policy tools in stimulating R&D, the heterogeneity of effects across different types of firms and the interaction of different policies. However, knowledge of "what works" in public support is somewhat limited by lack of critical data, the challenge of identifying valid counterfactuals, the multiplicity of policy objectives, and the complex chain of policies and contextual factors that determine the overall effectiveness of support policies in specific settings. The OECD microBeRD project investigates the structure, distribution and concentration of business R&D and R&D funding, modelling the incidence and impact of public support for business R&D while accounting for many such factors (Box 4.3).

The OECD recommends that governments carefully design their support for business innovation to consider the heterogeneity of potential beneficiaries (OECD, 2016^[16]). This includes looking at the position of “standalone” firms without cross-border tax-planning opportunities, as well as young, innovative firms without the profit-generating capacity to benefit from allowances or credits when the instruments are tax concessions.

Box 4.3. Findings from the OECD microBeRD project on the impact of R&D tax incentives

The OECD microBeRD project investigates whether R&D tax incentives and direct funding are effective at stimulating additional R&D investment (“R&D input additionality”) by business using a novel internationally distributed method of microdata-based impact analysis. Its analytical strategy combines the benefits of studies conducted at the macro level (e.g. on generalisability) and the micro level (e.g. on the ability to explore heterogeneous effects across firms). Results for 20 OECD countries show that the effects of such measures vary across different types of firms and R&D expenditures, shedding light on the mechanisms driving these effects (OECD, 2020^[17]). Key policy findings from the microBeRD project include the following:

- Both R&D tax incentives and direct funding are successful in incentivising R&D investment by business. One monetary unit (euro) of either translates into around 1.4 units of business R&D.
- R&D tax incentives help increase R&D activity, principally through changes to R&D personnel and other inputs. They do not appear to affect R&D unit-labour costs, suggesting that the effects of tax incentives are not absorbed into higher wages.
- R&D tax incentives encourage additional business R&D, both because existing R&D performers increase their R&D expenditure (intensive margin) and because additional firms start to perform R&D (extensive margin).
- The input additionality of R&D tax incentives is larger for firms that perform less R&D. As smaller firms tend to perform less R&D than larger firms, SMEs show larger input additionality.
- The effect of R&D tax incentives on experimental development is about twice as large as the effect on basic and applied research, while the effect of direct funding on experimental development is half the size of the combined effect on basic and applied research. Tax incentives and direct funding, therefore, complement each other.
- Firm-level analysis within microBeRD-participating countries highlights substantial variation in the R&D input additionality of R&D tax incentives and direct funding across countries. This underscores the need for more in-depth analysis of the link between business innovation policy uptake, policy design and innovation activity and outcomes, including R&D inputs and outputs.
- Changes in R&D tax incentives targeting smaller firms or involving ceilings or thresholds tend to have stronger effects on business R&D investment, as small R&D performers appear more responsive than larger firms to the availability of R&D tax subsidies.

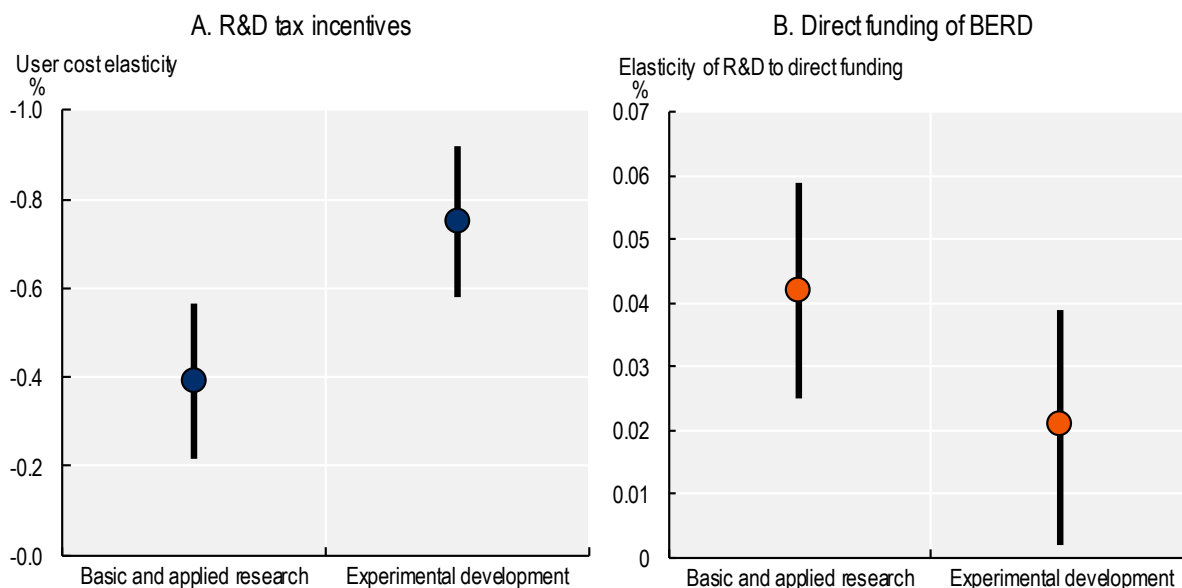
Source: OECD (2020^[18]), “How effective are R&D tax incentives? New evidence from the OECD microBeRD project”, *STI Policy Note*, OECD, Paris, <http://www.oecd.org/sti/microberd-rd-tax-incentives-policy-note.pdf>.

Setting aside differences in design and implementation that can blur the dividing line between tax support and grants, there appears to be a broad consensus that tax incentives are more suited in principle to encouraging R&D activities aiming to develop applications with the potential to be brought to the market within a reasonable timeframe. By contrast, direct grants are more suitable for supporting longer-term,

high-risk research, as well as for targeting specific areas that either generate public goods (e.g. health and defence) or have particularly high potential for spillovers (Figure 4.6). The optimal mix of direct and indirect support will depend on both the specific circumstances and policy preferences.

Figure 4.6. Responsiveness of business R&D decisions by type of policy instrument

Elasticity of R&D to the user cost of R&D and direct



Note: This figure displays the percentage change in R&D in response to a one percentage reduction in the user cost of R&D through R&D tax incentives (user cost elasticity) and a one percentage increase in direct funding (elasticity to direct funding) respectively. Vertical lines mark the 90% confidence interval, which covers the “true” elasticity with a probability of 90%.

Source: (OECD, 2020^[17]) “The effects of R&D tax incentives and their role in the innovation policy mix: Findings from the OECD microBeRD project, 2016-19”, <https://doi.org/10.1787/65234003-en>.

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It has been advocated that public sponsorship of innovation should primarily target research by public-purpose organisations such as universities and research institutes, with residual support for business innovation assigned through non-discretionary incentives. Showing a growing division of innovation labour whereby public-purpose scientific institutions increasingly focus on research and corporations focus on developing products and processes, Arora, Belenzon, Pataconi, and Suh (2020^[19]) argue that universities produce knowledge that is rarely in a form that can be readily digested and turned into new goods and services through the input of technology transfer offices. In their view, the research specialisation process might “have slowed [...] the transformation of that knowledge into novel products and processes”. The authors opine that a widespread return to active business engagement in research (both basic and applied) is not particularly likely, except for situations in which companies, “due to complements such as specialized equipment or proprietary data, have strong incentives to invest, especially if they can appropriate enough of the benefits by restricting spillovers to rivals”. Targeted government support can only partly overcome the hollowing out of application-oriented research. Thus, policy makers have had to reconsider how to address this gap, by considering direct and indirect forms of support that match research and technology infrastructures with medium and long-term business needs, and by helping businesses boost their scientific capabilities to engage in such partnerships.

In this context, several countries have experimented with adapting to their local context programmes that are perceived to have successfully linked knowledge supply and demand in different countries. Examples include widespread policy interest in supporting proof-of-concept and commercialisation of technologies with public-sector applications through national adaptations of the Small Business Innovation Research (SBIR) programme in the United States. Howell (2017^[20]) argues that the SBIR awards owe their impact (particularly in terms of attracting additional private VC funding) to their facilitation of technology prototyping and demonstration of a technology serving the US federal government and the potentially wider need. The pathway from pre-commercial procurement of R&D to actual procurement of effective solutions is quite different across countries for companies receiving SBIR-equivalent grants, depending on the possibility of governments favouring awarded SMEs during this transition to the commercial phase. Korea has implemented a recommended set-aside for contracting with SMEs for technology development purposes, in combination with a mandatory “new excellent product” purchase quota. Despite their huge potential, the implementation of demand-side innovation support policies is still hampered by a lack of policy clarity, instrument co-ordination and evidence to support the widespread use of targets (Appelt and Galindo-Rueda, 2016^[21]).

Government intervention aimed at addressing failures in the market for finance for business innovation has also been the subject of increasing attention. Innovators often count intangibles as their main assets. These are difficult to deploy independently from their own ventures and personal engagement, resulting in a lack of collateral for investment and business growth in areas where the markets do not perceive a high likelihood of success. For instance, repayable government loans have played a key role in shaping technology development in the civil aerospace sector in recent decades, and VC interventions such as those implemented in Israel have attracted considerable interest worldwide. State-owned or guaranteed development banks play an important role in facilitating the flow of finance to innovative firms in many countries, including those where available statistics indicate they provide limited support. However, they expose governments to considerable liabilities, as loans may not be repaid, investments may fail, or guarantees may be called by private lenders. (Lach, Neeman and Schankerman, forthcoming^[22]) describe how the design of innovation loans should correspond to project features and policy objectives, avoiding both projects with a high probability of success that will be funded by the private market regardless and those that do not justify public financing because their expected net impacts are negative. The authors also draw attention to the evidence that the role of VC firms is to provide not only finance, but also “advice” and a network of connections that enhance the probability of success of the supported start-up projects.

Implementation matters

The design of policy instruments also needs to keep up with practical considerations regarding their implementation. For example, policy design should simplify the business support landscape and reduce uncertainty, so that support requests and claims procedures give potential beneficiaries legal certainty when embarking on sponsored activities, while also protecting the public interest. This also involves operationalising RDI definitions regarding software development and other service-based activities of increasing importance for innovation. For example, the United Kingdom’s tax authority released specific guidelines on the eligibility of software for R&D tax relief (HMRC, 2018^[23]). The new guidelines recognise the continuous evolution of information technologies (e.g. artificial intelligence, cloud and mobile computing), as well as the ongoing development of new applications (e.g. software robots, augmented reality and internet of things). Interagency collaboration is essential to prevent double or even triple-dipping into public resources, but especially to ensure the highest possible coherence in policy delivery and fully exploit synergies in terms of expertise. Public support information systems are not always fit for purpose and are not particularly suited to conducting reliable assessments of the potential impacts of domestic reforms, as is common in other policy areas.

Regardless of the type of instrument considered, implementing business support is a complex undertaking, which requires building internal capabilities within public agencies and enhancing innovation planning

among beneficiaries. This can be underpinned by a professional network of specialised intermediaries acting in the best interest of companies, while complying with the letter and spirit of the rules on public innovation support. This is particularly important for non-discretionary schemes in order to prevent an unmanageable number of potentially bogus claims that may ultimately undermine trust in the system.

Overall, governments wishing to introduce new measures in support of innovation have had to contend with multiple regulatory and budgetary restrictions that limit their margin of operation. This is evidenced by innovation support measures where the government acts as a financial investor intent on leveraging additional financial resources into long-term investments. Compliance with international subsidy control rules, and pressures to ensure that financial assets and liabilities (including those of a contingent nature) are absent from the government or the broader public sector's balance sheet (e.g. to avoid exceeding public-debt limits) shape the room for manoeuvre. In the United Kingdom, the Industry Panel Response to the UK Treasury's review of patient capital recommended that the UK government not have control over the board of the proposed new investment vehicle, or any direct or indirect influence on decisions regarding its individual investments, stating reasons of compliance rather than other arguments (HM Treasury, 2017^[24]). The potential downside of forgoing control and influence stems from difficulties in ensuring value for money and maintaining directionality.

A shift towards greater directionality of business support for innovation

In contrast to the trend towards reduced directionality in innovation support, some argue that governments have erred too much in renouncing some of their discretionary powers, failing to recognise the implications of their choices in terms of guiding the markets. Such views have become more prominent in recent years. This is apparent in the Aho Group Report (Aho et al., 2006^[25]), which calls for EU governments to adopt an innovation lead-user perspective, and in the growing popularity of the concept of smart specialisation (OECD, 2013^[26]). This trend was further fuelled by the global financial crisis (GFC) and its aftermath. The GFC exposed a number of ways in which markets incentivise innovation towards outcomes that do not necessarily match public interests, e.g. through financial innovations that socialise risks and privatise gain, or through suspect methods to overcome regulatory controls on vehicle emissions. Greater awareness of corporate tax strategies, and concerns about growing concentration, have helped cast doubts on policies offering unconditional support to business innovation. Furthermore, a number of studies pointing to concrete examples where government interventions have played an important role in supporting the growth of new businesses and the emergence of new industries have also challenged narratives about industrial policies necessarily resulting in failures (Mazzucato, 2013^[27]). In the public discourse, the attribution of merit underpinning innovation has become a hotly contested issue, highlighting the complexity of the innovation enterprise and how value is captured from the generation of ideas to their commercialisation.

The growing realisation and sense of urgency around key societal challenges has resulted in calls for outcome or mission-oriented approaches, raising questions about the adequacy of current support instruments and portfolios (Mazzucato, 2018^[28]). Among the growing trends in the run-up to the current COVID-19 crisis, OECD member countries have continued to witness a progressive rehabilitation of industrial policy from the perspective of innovation, with arguments that governments should actively engage in making explicit innovation policy choices on where to focus their limited resources (e.g. (HM Government, 2009^[29]; HM Government, 2017^[30]), for the United Kingdom; (Ministry of Economic Affairs, 2011^[31]), for the Netherlands).

Support for business innovation in times of crisis: The COVID-19 shock

The disruption to normal financing conditions and economic activity is a major existential challenge for businesses, for which preserving innovation capabilities may shift from representing an unaffordable luxury to an imperative for survival. The COVID-19 crisis is not only a key threat to innovation systems' ability to

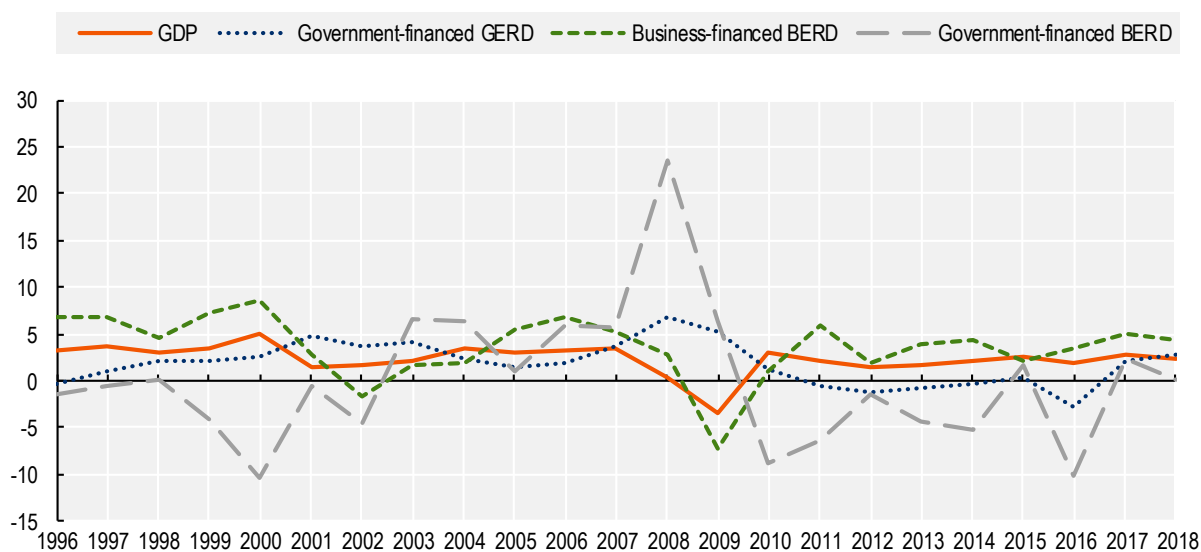
fulfil their normal functions, but also a call for mobilising these systems to provide new solutions to the immediate health, societal and economic challenges posed by the pandemic. Against this backdrop, investments in R&D and broader innovation are essential. The COVID-19 emergency, and the measures adopted across the world to overcome its pernicious health impacts, pose major challenges for innovation systems, questioning major assumptions – about the definition of collective priorities; the bearing of risks and rewards; and the role of the market, civil society and governments – while also irreversibly endangering the survival of key productive and innovation capabilities, especially within sectors hit the hardest. The innovative potential of businesses and the broader private sector has been called upon to deliver a wide range of solutions to help cope with the health emergency and emerge from it as robustly as possible. In this context, innovation support policies can make a major difference.

Lessons from previous crises

COVID-19, like the 2008 GFC and previous economic crises, is having major negative repercussions on business RDI through multiple yet interconnected channels. The evidence shows that uncertainty is a principal driver of business decisions during crises (OECD, 2009^[32]). Historically, business R&D expenditure and patent filings have moved in parallel with measures of economic activity such as GDP, slowing markedly during the economic downturns of the early 1990s and early 2000s. On an aggregate basis, investments in RDI are pro-cyclical, and thus prone to contraction in times of crisis (OECD, 2009^[32]). While R&D projects already under way are expensive to interrupt, the GFC experience indicates that the business sector was the first to cut its R&D investments as conditions deteriorated (Figure 4.7).

Figure 4.7. The impact of the business cycle on business R&D and government support

OECD area, annual growth rate



Note: The estimate of government-financed business enterprise expenditure on R&D (BERD) for 2008 reflects to some extent a break in the series for federally funded support to business in the United States. This also applies to a less visible extent to the estimate of government-financed gross domestic expenditure on R&D (GERD).

Source: OECD *Main Science and Technology Indicators* (database), <http://oe.cd/msti> (accessed October 2020).

StatLink  <https://doi.org/10.1787/888934223460>

Cuts to plans to subcontract R&D and other knowledge services tend to be faster to implement than adjustments to the R&D workforce, which tend to be avoided for as long as possible. Business are aware that policy makers are very sensitive to R&D workforce-adjustment decisions, bidding for support for projects that enable them to retain such a hard-to-replace workforce. During crises, as risk portfolios are revised, some R&D and technology-based operations can sometimes be sold to collaborators in the supply chain, triggering concern about potential losses of strategic capabilities, or left to spin off. In past crises, sales functions tended to be privileged over knowledge-creation activities, to boost liquidity and near-term solvency. By depressing demand, financial crises appear to be associated with overall declines in rates of product innovation as new product launches become less likely to succeed and product innovation may be more oriented towards frugal consumer behaviours. Such crises may encourage resource-saving process innovations, but only to the extent that business appreciate a tangible short-term return on the investment and are in a position to raise the necessary finance.

The policy response *during* the GFC recognised the need to mitigate the crisis's impact on productive and innovative capacities as many countries introduced stimulus and recovery packages with substantial measures to support innovation (OECD, 2009^[32]; OECD, 2012^[33]; Izsak et al., 2013^[34]). Most countries did not substantially alter the structure of their innovation policies as an immediate response to the GFC (Pellens et al., 2018^[35]). Instead, they opted to enhance existing support measures and introduce additional short-term measures to address liquidity constraints (e.g. loans, loan guarantees) and maintain business innovation activity (e.g. innovation vouchers, structural funds). Additional financial support for businesses – i.e. a sharp temporary increase in direct funding (e.g. R&D grants), coupled with a higher use of R&D tax incentives – helped attenuate the decline in business R&D investment during the GFC.

Although countries greatly differed in their reaction to the GFC and its aftermath, the crisis accentuated national innovation systems' pre-existing weaknesses. Not all economies were equally able to support business innovation. In the European Union, for example, special rules allowed countries to use the Temporary Framework for state aid. As business R&D and innovation investments recovered and resumed growth (Figure 4.7), government R&D budgets, which had proved resilient until 2010, came under increased budgetary pressure, owing to the phasing out of emergency measures and political requirements for fiscal consolidation. While this shift greatly restricted the scope for innovation policy directionality, abundant examples point to the crisis driving renewed interest in tools allowing greater innovation targeting and prioritisation. For instance, the GFC prompted a re-examination of policy attitudes towards innovation financing institutions such as national development banks, e.g. the KfW banking group in Germany, with the capacity to direct resources to businesses with innovation financing needs. KfW is one of the members of the D20 Long-Term Investors Club, which was created in 2009 and has since expanded to include, among others, the China Development Bank, the Russian state development corporation VEB.RF and the Brazilian Development Bank.² Based on the experiences gathered through OECD studies (OECD, 2012^[33]), Box 4.4 outlines a number of lessons learned from previous economic crises as a basis for further reflection.

Box 4.4. Lessons from past crises for business innovation support

- use public support as a tool to manage and combat uncertainty as a priority
- adopt measures that help stabilise the economy and initiate recovery, ensuring it is durable and oriented towards sustainable growth, as crises expose structural weaknesses
- identify key R&D and broader innovation capabilities most exposed to the impact of the crisis and with the highest long term potential
- enhance and draw on available evidence to make the case for innovation to finance and economic ministries

- understand the scope for temporary asset-purchasing programmes conducted by monetary authorities and consider under what conditions non-financial sector assets might be eligible
- explore mechanisms to facilitate the use of knowledge-based assets as collateral for raising private finance and securing public support
- prioritise addressing rigidities and bottlenecks in implementing support
- assess the relative merits of different instruments with respect to objectives and trade-offs; consider implications for the policy support mix and balance
- have efficient appraisal systems in place, drawing on all relevant expertise within government and its delivery agencies, while engaging intermediaries that contribute to implementation
- evaluate adaptability to the local context of measures introduced elsewhere
- embed reasonable information and evaluation requirements to facilitate policy learning
- limit measures that only benefit incumbents and monitor implications of potential concentration
- engage proactively with other countries and multilateral organisations to address cross-boundary implications within the available governance frameworks, which may evolve and adapt to circumstances.

This time is different

As all crises differ, it is hard to extrapolate from past episodes, both in terms of the potential impacts of the current crisis and the lessons to be drawn regarding the appropriate policy response. In contrast to the previous financial crisis, the current phase of the COVID-19 crisis is forcing businesses to enter uncharted waters. Businesses today are constrained by a unique and probably unprecedented combination of marked supply and demand constraints, coupled with very substantive uncertainty about whether and how the crisis will be resolved. This uncertainty also makes it more complicated to identify the appropriate policy response. Chapter 1 lays out some key features of the current crisis, as well as its implications for business innovation and the general policy response. Mandated and voluntary lockdowns, combined with physical distancing measures, contribute to reduced levels of production and consumption activities – especially those requiring personal proximity and mobility. Restrictions have complex impacts across supply and demand chains.

OECD analysis of the published financial reports of large publicly listed R&D investors covering the second and third quarters of 2020 shows significant differences across and within sectors in terms of how these companies are adapting their R&D investment portfolios (see Chapter 1). Among non-traded companies, evidence is scarcer, but points (e.g. in Canada) to a threefold increase in the number of companies reporting a decline in R&D (e.g. 22% more companies reporting lower rates of manufacturing R&D vs. 6% reporting higher rates) (Statistics Canada, 2020^[36]). Large businesses' quarterly reports highlight uncertainty as a major factor driving business responses and the immediate outlook. The sentiment clearly differs by sector, from potential concerns about advertising revenue, through uncertainty about the success of ongoing trials in pharmaceutical companies, to uncertainty about the future of transportation and personal services, especially if business travel and tourism continue to contract significantly even after the pandemic has been contained. Company reports highlight concerns over liquidity management, adaptation to supply chain disruption, and protecting workers and customers. In the United Kingdom, a sample of Innovate UK support beneficiaries reported that two-third of firms suggested future R&D plans remained unchanged, with the remainder slowing or cutting back on their projects (Roper and Vorley, 2020^[37]).

While the underlying pandemic persists, business practices need to be constantly revised as new information becomes available and new policies are adopted. Adaptive innovation seems rather prevalent, spurred by necessity. According to Statistics Canada, over two-fifths (45.4%) of Canadian businesses

reported they had added new ways to interact with or sell to customers; nearly two-fifths (38.1%) reported they had increased their internal use of virtual connections; and 2.8% of businesses indicated they had begun manufacturing new products in response to government requests to help cope with the crisis.

A distinctive feature of the COVID-19 crisis, compared to previous ones, is the realisation that innovation has a clear and explicit role to play in its containment resolution, over and above its role in the ensuing economic recovery. This is particularly obvious in the development and deployment of diagnostics, vaccines and treatments for COVID-19, but is not exclusive to the sectors that are directly preoccupied with such issues: designing new products and processes that enable greater resilience to the current and related future disruptions is important to society as a whole. A significant portion of the required innovation potential rests within the business sector. In the United States, for example, (Azoulay and Fishman, 2020^[38]) point out that clinical trials have increasingly been conducted in private practices and dedicated, for-profit study sites since the 1990s. The continuity and upgrade of network services also rests on the capacity of (private or state-owned) business to adapt to the situation and provide new responses.

Business innovation support as part of the government response

As highlighted by (Gans, 2020^[39]), efforts to incentivise private, market-based innovations addressing an urgent global challenge such as the pandemic face a fundamental paradox. Profit-driven innovators will ultimately wish to price their solutions at rates that will make access prohibitive to many people, which is a socially unacceptable outcome. The anticipation of “expropriation”, in turn, deters private investment, an innovation incentive paradox that highlights the limitations of the market mechanism and the need to identify appropriate instruments to serve the public interest.

Most governments have steered clear of utilising market-replacing interventions within their statutory powers, such as those allowed by the Defense Production Act in the United States, which allows issuing loans to expand a vendor’s capacity, controlling the distribution of a company’s products and compelling companies to prioritise government orders over those of other clients. Instead, governments have mostly opted for moral persuasion and appeals to corporate responsibility, along with significant financial support, as allowed by emergency funding bills. Table 4.1 lists selected examples of recently adopted business innovation measures, split between R&D tax incentives and other initiatives. It shows that some measures focus on promoting innovation in the fight against the disease, while others seek to support the overall business innovation ecosystem at a time of distress.

Table 4.1. Selected examples of emergency government measures supporting business innovation

R&D tax incentives	
<i>Instrument re-design</i>	
Increase of R&D tax credit/allowance rates	<ul style="list-style-type: none"> Australia (SME rates and rates for R&D-intensive large firms (R&D intensity >2%) for income years starting on or after July 1, 2021), Denmark (subject to ceiling), Iceland, Italy (Southern regions), Spain (technological innovation)
Adjustments in ceilings on qualifying R&D expenditure or R&D tax benefits	<ul style="list-style-type: none"> Australia (increase in R&D expenditure ceiling for income years starting on or after July 1, 2021), Germany (increase), Iceland (increase), New Zealand (partial removal and simplification)
<i>Administration and monitoring</i>	
Extension of time limit for filing applications	<ul style="list-style-type: none"> Australia, Canada (Quebec and British Columbia SR&ED tax credits), Mexico, Portugal
Accelerated or earlier processing of R&D tax relief claims	<ul style="list-style-type: none"> Canada (refundable claims under federal SR&ED tax credit), Poland
Advanced and/or expedited cash payments (refunds)	<ul style="list-style-type: none"> Denmark, France, Ireland
Other business RDI support measures	
Improved access to funding for innovative companies	<ul style="list-style-type: none"> China (R&D subsidies for SMEs), France (Investments for the Future Programme innovation grants), Germany (VC financing for start-ups), United Kingdom (investment fund for high-

	growth companies, grants and loans for SMEs focusing on R&D), Hungary (subsidies of wage costs for R&D staff), New Zealand (Callaghan Innovation's R&D Loan Scheme), Spain (partially reimbursable grants for SMEs), United Kingdom (continuity loans, grants and loans for SMEs focusing on R&D)
Postponement of application deadlines, increased flexibility for existing beneficiaries and/or assistance for new applicants	<ul style="list-style-type: none"> • EU28 (Horizon 2020), Austria, Germany, Norway, Spain
Funding for innovation on COVID-19 solutions	<ul style="list-style-type: none"> • Austria (KLIPHA-COVID19), Belgium (regional grants), Canada (Challenge programme), Czech Republic (grants), EU28 (European Innovation Council accelerator and Innovative Medicines Initiative, ERAvsCorona Action Plan), Germany (Bundesregelung Forschungs-, Entwicklungs- und Investitionsbeihilfen), Ireland (rapid response funding, direct grants and repayable advances), Italy (Innova), Korea (R&D project to foster medical device industry), Luxembourg, Malta (grants), Poland, Portugal (grants), Slovak Republic, Spain (soft loans for innovative companies with COVID-19 projects), United Kingdom (sustainable innovation fund), United States (NIH/FNIH public-private partnership for COVID-19 vaccine and treatments)

Note: This table does not attempt to provide a comprehensive representation of all measures supporting business innovation introduced by governments in response to COVID-19; such a list would be too large to present here and would require constant updating.

Source: OECD elaboration, based on the OECD STIP COVID-watch (<https://stip.oecd.org/covid>), OECD survey of R&D tax incentives, and other sources (OECD, 2020_[40]).

Public procurement of innovations, or more generally of solutions that may require an innovation on the part of firms or other actors, is a salient form of policy response to address the innovation paradox posed by this crisis and other similar grand challenges. The transformation potential of government procurement action in response to COVID-19 is probably an order of magnitude above other forms of innovation support. In the United States, COVID-19-related federal procurement amounted to close to USD 28 billion from March to September 2020.³ This amount is by no means entirely dedicated to new products or new applications of existing products. The information collected by the OECD ; (OECD, 2020_[41]) suggests that governments are placing innovation agencies in key procurement support roles during this crisis. Authorities have tended to commit to products that are closer to the market, where the risks are mostly located downstream of the innovation chain. In many cases, however, public procurement as a form of innovation policy can contribute to societal missions through the careful design of advance market commitments and the building of public-private partnerships (Edquist and Zabala-Iturriagagoitia, 2012_[42]).

In addition to the measures outlined above, countries have increasingly updated the legislative and regulatory frameworks covering support for business innovation. In April 2020, the European Commission announced the adoption of an amendment to the Temporary Framework initially adopted in March. Among other actions, the amendment extended the framework to include support for coronavirus-related R&D (European Commission, 2020_[43]). The framework has since been further amended to better accommodate the position of otherwise viable start-ups which incurred losses before the COVID-19 crisis and hence would not have been considered eligible for support.⁴ The United Kingdom is currently reviewing its approach to state aid, an issue that is intertwined with trade-agreement negotiations following Brexit. Bilateral trade deals, such as the agreement UK-Japan Comprehensive Economic Partnership Agreement of September 2020, contain commitments to transparency regarding the subsidies awarded and consultations over concerns about subsidies that may affect the other party, highlighting the interconnectedness between industry support and access to markets in a globalised world.

The medium to long-term outlook for business innovation support

Possible scenarios and implications

As highlighted in Chapter 1, a range of generic factors will shape the outlook for science, technology and innovation policies. These have marked implications for the future design, implementation and impact of public policies supporting business innovation.

At the time of writing, the COVID-19 pandemic is a principal driver of public policy. As long as the crisis persists, governments will be compelled to sustain and drive business participation in identifying and implementing solutions to the health crisis. Governments have been providing multiple forms of support for firms' innovative activity, recognising the need to engage the business sector in fighting the pandemic as part of the ongoing broader public health intervention.

Over the medium to longer run, evidence and perceptions of future pandemic vulnerabilities or infectious disease issues will determine whether authorities maintain and possibly expand the innovation support mechanisms developed during the current crisis to mitigate future successive pandemic shocks. A "recovery" scenario in which viral and other infectious disease outbreaks are recurrent and difficult to contain will heighten demand for a greater focus of public support on health-related R&D and innovation. This will likely diminish interest in horizontal forms of public support and will have uncertain implications on support towards other domains that may not appear to be as directly relevant to building pandemic preparedness. Under an alternative scenario in which recurrence or alternative outbreaks are perceived as less likely, there will be reduced willingness to sustain incentive mechanisms towards business driven health R&D and innovation. Resources dedicated to innovation in pandemic prevention will eventually be re-allocated to other uses, but policy makers will need to beware of the risk that core capabilities in this area might be irreversibly lost, eventually exposing societies to future risks. Indeed, the current crisis has brought into question the way innovation priorities are determined.

Paraphrasing John Maynard Keynes (Keynes, 1919^[44]), future scenarios for policy will be shaped by the social and economic consequences of the COVID-19 peace and the terms on which it is ultimately achieved. A key dimension in the scenarios for socio-economic damage and the shape of a future recovery is the extent to which structural change becomes a consequence of a "new normal", where the pre-COVID baseline was a protracted period of lacklustre productivity growth compared to recent history (Andrews, Criscuolo and Gal, 2016^[45]; OECD, 2019^[46]). The range of possible scenarios is too broad to detail here; it relates to how people can and prefer to work, interact with each other and enjoy their leisure. Plausible scenarios have entire industries and locations transforming their models to remain viable settings of economic activity. In such cases, transformation and disruption will become regular features; governments will be called upon to support and manage such processes, beyond designing strictly people-based policies.

As happened during previous crises, tensions will likely arise between the idea of government sustaining industries and firms or re-allocating resources towards new opportunities. The cloud of uncertainty will often not allow predicting which changes will be temporary and which will be permanent. As a result, identifying the optimal response will be challenging, and the results often controversial. A key consideration for national innovation policy makers will be to identify and prioritise business innovation capabilities that should be preserved for the long run. Considerable uncertainty is likely to hold back investment for an extended period, particularly by companies with high debt (OECD, 2020c).

The room for manoeuvre for policies supporting business will be shaped by the future state of government finances and the macroeconomic policy response. The experience of the GFC highlights the plausibility of a scenario in which governments seek to reduce the currently heightened public-debt levels at a fast clip, initiating a period of rapid budgetary adjustment. Aside from the important direct impacts the timing of such a process may have on the economy, the budgetary envelope for government financial support for R&D

and innovation as a discretionary area of spend stands to fall if it is not deemed a national priority. This may trigger a search for complementary funding mechanisms, including a greater role for private, non-corporate R&D funding. Differences in budgetary responses across countries may also shift the global landscape and accentuate national differences in businesses' innovation capabilities. Firms will tend to move innovation activities to locations where the business environment, including the availability of public support, appears to be more favourable. In this context, the focus and actual implementation of short and medium-term *recovery packages* will be critical. They will straddle competing priorities, from resolving short-term business liquidity and solvency concerns, to addressing the challenges and opportunities presented by the pace and direction of digitalisation and automation, as well as the pursuit of the ecological transition. The *OECD Economic Outlook* (OECD, 2020^[47]) also notes that government support for companies through wage subsidies, tax deferrals and guarantees will need to be phased out gradually in phase with the recovery, to ensure that unviable firms are not supported for an extended period.

The global crisis accentuates pressures on the international governance mechanisms that have defined the terms allowing governments to support the business sector. Such systems have demonstrated some flexibility in times of crisis as emergency frameworks have been put in place, but the yet unknown severity and duration of the current crisis casts some doubts about their future. The opportunities associated with the “next production revolution” (which is occurring through the confluence of a range of technologies, including artificial intelligence, 5G, new materials, 3D printing, nanotechnology and industrial biotechnology) have set the scene for support and regulation of business innovation to become one additional driver of the push towards greater productive technological autonomy. President Xi Jinping of the People's Republic of China, for example, points to the need to drive original innovation capabilities and achieve more “zero-to-one” breakthroughs (Xi, 2020^[48]). The agreement between Germany and France in 2019 to support funding for the R&D and innovation activities of two companies in the area of next-generation lithium-ion batteries, as well as their initial industrial deployment, could be a sign of further initiatives to come. The rather fuzzy idea of technological sovereignty as a policy objective to be served by government innovation support has been exacerbated by the crisis effect on perceived dependence from supply chains controlled by a few countries. The underlying struggle for geopolitical technological hegemony, evident well before the crisis, may result in further trade tensions.

In this context, multilateral frameworks could eventually be reinforced as a result of a greater appreciation of risks and challenges that transcend national boundaries, requiring co-ordinated responses to bring new products and processes to markets. This would be especially true if transnational actors in the public and private sectors succeeded in fighting the pandemic. In such a scenario, international rules governing state aid and public procurement of innovation may ultimately result in arrangements that are more accommodating towards discretionary actions targeting priority challenges. On the other hand, the current crisis and pressures to decouple value chains may undermine trust in global governance solutions, exacerbating the existing pre-crisis discontent. This may ultimately entail a shift towards national approaches as countries – especially larger economies – seek to become more self-reliant and favour their domestic companies, instead of pursuing more distributed mechanisms to build resilience to shocks.

For instance, the COVID-19 pandemic has spurred many governments to enhance their foreign investment screening mechanisms or introduce new ones, in the midst of an already steep drop in global foreign direct investment (FDI) flows. This may bring about transformational change to policy practice on investment screening, and the way governments and societies view the benefits and risks associated with foreign investment (Novik, Pohl and Rosselot, 2020^[49]). The European Commission recently connected the adoption of defensive trade measures and screening of FDI flows to new proposals for assessing the role of foreign subsidies and their potential impact on the internal market, publishing a White Paper and a consultation on the subject (European Commission, 2020^[50]).

Mechanisms aiming to ensure a level playing field within and across countries may come under undue criticism at a time when they are more necessary than ever. While possibly welcoming greater flexibility, innovation policy makers also need to acknowledge the importance of the business environment and the

benefits of such arrangements in terms of market access. In this context, it may be necessary to reform current systems, developing a consistent approach towards public-sector engagement towards the broader aspects of innovation rather than its R&D component alone. Networks of bilateral agreements between countries are likely to shape the delicate balance of public support for innovation, but their complexity may be too difficult to navigate, even for medium-sized countries.

In the future, the effective possibilities for public support for business innovation will also be linked to governments' ability to use the opportunities of digital transformation and adopt innovative practices. Digitalisation may completely transform the way that governments assess the merits of business claims for support and monitor the projects they fund as a portfolio. Some multilateral collaboration scenarios could enable timely information sharing between governments, such as those developed for the automatic exchange of information for tax purposes. The G20/OECD Inclusive Framework on base erosion and profit shifting has been working on reform of the international tax system to address the tax challenges arising from the digitalisation of the economy, restore stability to the international tax framework and avoid the risk of further unco-ordinated, unilateral tax measures (OECD, 2020^[40]). The experience of this initiative will also shape how governments can use tax incentives as a means to attract innovation to their countries.

As implied by all of the above, political economy considerations will be critical. The outlook for the role of government in supporting and shaping innovation activity involving the business sector will depend on how society, through the prism of the current crisis and its immediate aftermath, perceives businesses as deserving beneficiaries of public assistance as they pursue innovations promoting social well-being, and views governments as capable facilitators of this process.

Conclusions

This chapter has provided innovation policy makers with an overview of the factors that have helped shape today's landscape for public support for innovation and the main questions open going forward. It has touched upon the lessons learned from recent OECD studies, particularly in relation to past crises and recent government responses to the COVID-19 crisis in the area of innovation.

The mobilisation of business innovation resources and capabilities is crucial for tackling the current crisis and addressing long-standing economic and societal challenges. As recent experience shows, how governments incentivise and influence research and innovation in firms has major implications for our future. The R&D and innovation business response to COVID-19 has been very heterogeneous. While for some the crisis represents an opportunity to expand such efforts, in many industries, innovation capabilities are under significant stress. Public support for innovation is not an exclusive concern of innovation policy makers. Its design and implementation has to take into account several implications and constraints that cut across several policy areas, thus calling for horizontal coordination and implementation approaches.

Public innovation support policies need to be able to guide private innovation efforts to where they are most needed, especially where market signals prove to be insufficient and coordination is most challenging. Recent OECD data and analysis shows that governments' policy mix is not entirely consistent with that ambition. R&D tax incentives, the undirected innovation support policy instrument that a majority of OECD governments have come to increasingly rely on in the last couple of decades, are effective in achieving their generic R&D-raising objectives as long as they are consistently designed and implemented. However, they are insufficient as a means to guide innovation to broader societal needs, and represent suboptimal instruments to encourage investment in knowledge at the interface between basic research and actual product or process development. Governments need to build balanced innovation support portfolios through mechanisms, instruments and capabilities that allow them to guide business innovation efforts, especially to areas where government is a primary user or customer of innovations.

Many of the assumptions underpinning the global policy consensus on the appropriate role of government in funding and promoting innovation are likely to be further challenged. International policy collaboration for business innovation support is critical. Business support today is possible within a delicate balance of international agreements that shape what national governments can do to help their businesses innovate without triggering retaliatory responses by other countries that restrict market access. Governments need to build a clear appreciation of the trade-offs facing them as they redesign their innovation support portfolios, in parallel with their partners and competitors in other countries. National self-interest, also when it comes to business support for innovation, will be most often best served by international collaboration.

Governments can learn from each other on how to improve the design and administration of innovation support during crises. Public support for innovation comes in many forms and is not always easy to measure, track over time or compare to facilitate mutual learning. Governments also need to continue to invest, alongside other capabilities, in evidence about their innovation support policies in order to improve them. This requires breaking down silos and developing capabilities to exploit this information. This is an ongoing priority of the OECD, both in terms of measurement and policy analysis.

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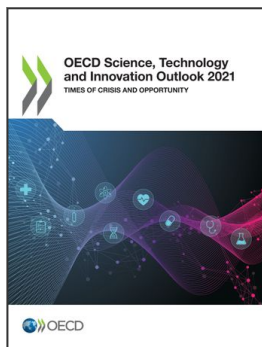
Notes

¹ According to WTO rules, a financial contribution by a government is not a subsidy unless it confers a “benefit”, to be determined by comparison with what the “market” would provide (WTO, n.d.a^[13]).

² <http://www.d20-ltic.org/>.

³ https://www.fpds.gov/fpdsng_cms/index.php/en/reports.html.

⁴ The amendment extended the Temporary Framework to enable Member States to provide public support under the framework to all micro and small companies, even if they were already in financial difficulty on 31 December 2019 (see https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1221). The ability of governments to support medium-sized companies in scaling up remains a contested issue.



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