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Working Paper

Grand Challenges, Industrial Policy, and Public Value

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29/2020 September



This project has received funding from the European Union Horizon 2020 Research and Innovation action under grant agreement No 822781

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Abstract

Policymakers are increasingly embracing the idea of using industrial and innovation policy to tackle societal ‘grand challenges’ such as climate emergency. In this article we argue that challenge-led policies require a new conceptual and analytical framework that has at its core the idea of confronting the direction of growth—growth that is, for example, more inclusive and sustainable. Such framework should focus on public value creation through market co-shaping rather than simply fixing market failures. This is both a question of theory as well as of policy practice. In theory, challenge-driven industrial and innovation policy questions both established neoclassical as well evolutionary concepts. In policy practice, directed policies require rethinking what is meant by vertical industrial policies. In this article we argue that through well-defined goals, or more specifically ‘missions’, that are focused on solving important societal challenges, policymakers have the opportunity to determine the direction of growth by making strategic investments and coordination actions across many different sectors and nurturing new industrial landscapes.

Keywords

grand challenges, mission-oriented innovation policy, public value, inclusive growth, sustainable growth

1. INTRODUCTION

Twenty-first-century policymaking is increasingly defined by the need to respond to major social, environmental, and economic challenges. Sometimes referred to as ‘grand challenges’, these include threats like climate change, demographic, health, and well-being concerns, as well as the difficulties of generating sustainable and inclusive growth. Against this background, policymakers are increasingly embracing the idea of using industrial and innovation policy to tackle these ‘grand challenges’. Examples of challenge-led policy frameworks include the United Nation’s Sustainable Development Goals (SDGs; [Borras](#),

2019), the European Union's Horizon Europe research and development programme (Mazzucato, 2018a), and the UK's 2017 Industrial Strategy White Paper (HM Government, 2018).

Challenge-driven policy frameworks are emerging in parallel to well-established modernization¹ and competitiveness² frameworks. While modernization, and in particular competitiveness frameworks, rely on the idea that government should first and foremost fix market failures,³ a challenge-driven agenda does not have such clearly defined theoretical origins and analytical lenses. As Richard Nelson argued in 1977 in his seminal book *The Moon and the Ghetto*, getting man to the moon and back is not the same as solving the problem of ghettos in American cities. Put differently, the nature of our knowledge about socio-economic challenges differs from our perception of strictly technical challenges. We can discover answers to technical puzzles; socio-economic issues do not have a single correct discoverable solution. Such issues require continuous discussion, experimentation, and learning.

We believe challenge-led growth requires a new conceptual and analytical framework that has at its core the idea of confronting the direction of growth with growth that is, for example, more inclusive and sustainable. Such a framework should focus on market shaping and market co-creating (Mazzucato, 2016). This is a question of both theory and policy practice. In theory, challenge-driven innovation policy questions both established neoclassical and evolutionary concepts (Schot and Steinmueller, 2018). In policy practice, directed policies require rethinking what is meant by 'vertical policies'.

Industrial policies have always been composed of both a horizontal and a vertical element. Horizontal policies have historically been focused on skills, infrastructure, and education, while vertical policies have focused on sectors like transport, health, energy, or technologies. These two traditional approaches roughly embody differing schools of economics: neoclassical economics-inspired horizontal policies focusing on supply-side factors and inputs; and evolutionary economics-inspired policies putting emphasis on demand-side factors and systemic interactions (Nelson and Winter, 1974; Hausmann and Rodrik, 2006 for a synthesis). Although certain sectors might be more suited to sector-specific vertical strategies, the 'grand challenges' expressed in SDGs are cross-sectoral by nature and hence we cannot simply apply a vertical approach to them. Both neoclassical and evolutionary approaches to industrial policy have relied on the idea that the best policy outcome is economy-wide development, without specifying its nature. In policy this has led to managing economies according to GDP growth rates, competitiveness indices and

¹ See, for instance, the Blair government's 'Modernising Government' White Paper from 1999, https://www.civilservant.org.uk/library/1999_modernising_government.pdf; for further discussion, see Margetts, 6 and Hood (2010).

² EU's Lisbon Strategy from 2000 is perhaps the best-known example of this, see <https://portal.cor.europa.eu/europe2020/Profiles/Pages/TheLisbonStrategyinshort.aspx>.

³ On competitiveness, see Reinert (1995).

rankings, or other macro indicators (e.g. exports, patents) (Drechsler, 2019). Yet, many SDGs are only indirectly related to the economy and hence many of the key issues around SDGs have not been theorized in the context of innovation and industrial policy (see, e.g., Zehavi and Brenzitz, 2017).

In this chapter we argue that through well-defined goals, or more specifically ‘missions’, that are focused on solving important societal challenges, policymakers have the opportunity to determine the *direction* of growth by making strategic investments, coordinating actions across many different sectors, and nurturing new industrial landscapes that the private sector can develop further (Mazzucato, 2017; Mazzucato and Penna, 2016). The result would be an increase in cross-sectoral learning and macroeconomic stability. This ‘mission-oriented’ approach to industrial policy is not about top-down planning by an overbearing state; it is about providing a direction for growth, increasing business expectations about future growth areas, and catalysing activity—self-discovery by firms (Hausmann and Rodrik, 2003)—that otherwise would not happen (Mazzucato and Perez, 2015). It is not about de-risking and levelling the playing field, nor about supporting more competitive sectors over less (Aghion et al., 2015), since the market does not always know best, but about tilting the playing field in the direction of the desired societal goals, such as the SDGs. However, we argue, to achieve this requires a new analytical framework based on the idea of public value and a policy-making framework aimed at shaping markets in addition to fixing various existing failures. Indeed, we argue that if we want to take grand challenges such as the SDGs seriously as policy goals, market shaping should become the overarching approach followed in various policy fields.

2. FROM MARKET FAILURE TO MARKET SHAPING

The dominant approach to public policy is derived from neoclassical economic theory, in particular microeconomic theory and welfare economics.⁴ This approach emphasizes the idea that, given certain assumptions, individuals pursuing their own self-interest in competitive markets gives rise to the most efficient outcomes (Samuelson, 1947; Mas-Colell et al., 1995: 539–40). Efficiency is understood in a utilitarian sense, whereby an activity is efficient if it enhances someone’s welfare without making anyone else worse off (so-called Pareto efficiency). Under these conditions, the role of government intervention is in practice often limited to addressing instances where the market is unable to deliver Pareto-efficient outcomes.

These ‘market failures’ arise when there are information asymmetries, transaction costs and frictions to smooth exchange, non-competitive markets (e.g. monopolies) or externalities whereby an activity harms another agent not directly connected with the market transaction (e.g. pollution), or coordination and information failures hamper investment (Rodrik, 1996).

⁴ This section builds on Mazzucato and Ryan-Collins (2019).

In the 1960s, public-choice theory considered how the actions of agents (voters, bureaucrats, politicians) involved in policy could be considered from an economic efficiency perspective, as those agents, including government agents, were assumed to be self-interested (Buchanan and Tullock, 1964). While in markets the existence of competition and the profit motive tends to enforce efficient decision-making, in collective decision-making processes (i.e. politics and public administration) the same disciplining framework does not exist. Policymaking is thus subject to capture by certain interest groups, in particular those most able to influence policymakers for reasons of power or money. In public administration, the lack of competitive pressures leads to ‘bureau-maximizing’ behaviour, whereby departments and agencies look after their own survival rather than the ‘common good’.

Public-choice theory argues that even where there are clear examples of market failure, it is not always the case that government intervention would result in a more efficient outcome. Rather, there could also be ‘government failure’, whereby decisions aimed at improving welfare make things even worse than they would have been under conditions of market failure (Le Grand, 1991). For policymaking processes such an approach creates a bias towards inaction. If the default assumption is that the market will find the best outcome, even if it doesn’t the overriding concern is that government intervention may worsen existing outcomes; the default prescription for government policy is to maintain the status quo. There is a danger that analytical frameworks become focused more on justifying and measuring the non-failure of public policies than on the attainment of wider policy goals.

In development theory and practice, the market-failure-based approaches coalesced in the 1990s around the so-called Washington Consensus policies focused on deregulation, opening up domestic markets, and relying on foreign direct investments and exports to drive economic transition and growth (Williamson, 2002). The Washington Consensus main assumption was that as all development problems are of the same nature, the solutions are bound to be the same as well. This removes the question of directionality of growth away from domestic policymaking and leaves global markets in charge (Kattel et al., 2016).

The market failure perspective also creates a particular orientation towards innovation, industrial policy, and structural economic change.⁵ While certain elements of innovation policy, in particular early-stage R&D, can be considered to be public goods and thus a case for public policy provision can be justified, in the main it is assumed that the private sector is the more efficient innovator, possessing greater entrepreneurial capacity and better able to take risks given the pressure created by competition. In contrast, the state is viewed as risk averse and in danger of creating government failure if it becomes too involved in industrial policy by ‘picking winners’. Its role is to level the playing field for commercial actors—

⁵ Some eminent economists have rejected the market failure justification for policy intervention since the concept that markets by themselves lead to efficient outcomes is dependent on conditions—perfect information, completeness, no transaction costs or frictions—that have never been empirically demonstrated (Coase, 1960; Stiglitz, 2010). Rather, markets are *always* incomplete and imperfect, and hence not ‘constrained Pareto-efficient’, i.e. they are never in a situation where a government (a central planner) may not be able to improve upon a decentralized market outcome, even if that outcome is inefficient (Greenwald and Stiglitz, 1986).

mostly through supply-side inputs such as better skills or the removal of market frictions—and then get out of the way. This has led to rather diverse debates and the development of policy practices aimed at finding ever more precise *policy targets* through better measurement of failures and of the impact of policies trying to fix those failures. Instead, policy discussions in particular should focus on ‘heterodox’ policy approaches that recognize both market and government imperfections and failures—as well as the fact that it is impossible or even undesirable to attempt to remove all of them at once—and the need for policies that support scale economies, dynamic learning effects, and cross-sectoral spillovers (Rodrik, 2009).

In order to expand such heterodox notions to grand challenges, we need a positive theory of public value that begins with a notion of the public good not as a correction to a failure, but as an objective in itself—an objective that can only come about if linked to a process through which value is created. In this sense a new building block is needed to guide and legitimize public policy. As indicated by Kenneth Arrow (1962), while a market failure approach can be utilized to understand why, for example, private firms underinvest in R&D, it is not so useful for guiding public investment in R&D, because of the inherent uncertainty involved in the outcomes of such investment. Indeed, Arrow called for alternative approaches to analysing public investment and policies for innovation.

Critically, the market-failure justification implies that pure private markets/private goods can exist independently of public or collective action. While the role of institutions is admitted (North, 1991), the role of different voices coming together to form the notion of the public itself is left mainly to sociology, not economics. Nelson notes that ‘there is no satisfactory normative theory regarding the appropriate roles of government in a mixed economy’ (1987: 556) and no theory that captures the complex variety of institutional arrangements that people have developed to solve collective problems. Just as pure public goods are rare, so too are pure private goods. Babysitters or sharing everyday appliances such as lawnmowers involves no government intervention or regulations, but does involve collective or ‘public’ negotiation. Hence the ‘market failure’ dichotomy is not particularly useful.

We propose an alternative approach, which begins with the notion of public value as collectively generated by a range of stakeholders including the market, the state, and civil society. Key here is the emphasis on value creation at the core: not ‘public’ value but value itself—with a clear delineation of the role of the different actors that are central to its formation. While in economics value is, in essence, created inside businesses and only facilitated by the public sector, in this view value is co-created and requires a stakeholder understanding of capitalism itself. This view draws on the work of Elinor Ostrom (2005), who shows that a radical state/private division is, to use her word, barren. In developed economies there are many types of organizations. Non-partisan government regulators, state-funded universities, and state-run research projects, for example, are quite different. Besides, the crude binary state/private division fails to capture the many ways in which all institutions create and destroy value. In addition, Ostrom’s (1990) emphasis on pooled common

resources and her interest in shaping systems so that they take into account collective behaviour, can help shape new policy tools.

This more collective view also benefits from a different understanding of the market itself, with the market as an outcome of the interactions of individuals, firms, and the state, as discussed in the work of Karl Polanyi (1957), and ‘embedded economies’, as discussed by Granovetter (1985). If value is created collectively, a first question becomes: what capabilities, resources, and capacities are needed for this value to be created inside all the different organizations, including those in the public sector, private sector, and civil society? In the same way that a theory of private value creation benefits from a resource-based theory of the firm (Penrose, 1959), so does a public-value notion. Indeed, it is by sidelining the notion of value as only created in business and facilitated or redistributed by the public sector that the question of capabilities is missed. The work by Teece (1990) on the dynamic capabilities of the firm becomes equally necessary for the public sector, as we have argued elsewhere (Kattel and Mazzucato, 2018).

A collective theory of value creation requires understanding by all actors of investment and production capacity. Indeed, as discussed by Mazzucato and Sekera (2019), a theory of public value needs to also understand the productive capacity and capabilities of the state. And if the state loses that capacity it will lose its absorptive capacity—and hence be unable to understand technological and market opportunities (Cohen and Levinthal, 1990).

Similarly, instruments like taxation are no longer about correcting externalities, but about creation itself. Adam Smith’s notion of the free market was free from rent and this distinction between rent and profits requires tools to incentivize creation, not extraction, of value (Mazzucato, 2018a). Thinkers such as Ricardo, Mill, and even Adam Smith recognized that unfettered markets were often inefficient and prone to capture by special interests, and could have negative distributional outcomes without ongoing intervention by the state. In particular, there was a recognition between productive profits and economic rents that represented unearned income deriving from arbitrary control over resources. These authors argued that the primary role of taxation, for example, rather than internalizing externalities caused by identified market failures, should be to tax away rents accruing from the monopolistic ownership of factors of production, in particular land (Mazzucato, 2017: 39–45; Ryan-Collins, 2018: 37–64). In the classical view, rents did not accrue from market ‘imperfections’ as in market failure theory, but from the inherent imbalances in economic and political power that characterized dynamic capitalist economies.

Thus, the focus is on the economic and political processes, institutions, and conditions that enable (public) value creation—and equally on how to counter (public) value extraction — across sectors and economies (Mazzucato, 2018a). The role of the state is key here, since it is the only institution with the power to shape markets and direct economic activity in socially desirable directions—or ‘missions’—to achieve publicly accepted outcomes (Mazzucato, 2013, 2016). Similarly, many government interventions enable markets to function, such as legal codes, public policies, antitrust policies, university scientists, and physical infrastructure (Nelson, 1987: 550).

Public value should thus be as much concerned with the direction of growth (and the macroeconomic implications) as with the microeconomic structure of government agencies. The question should be how to shape and co-create markets, not just how to correct them. Industrial and innovation policy should be focused both on fixing existing market failures and, equally importantly, on shaping future markets to deliver public value.

3. LEARNING FROM HISTORY: THE EVOLUTION OF MISSION-ORIENTED POLICIES

While economists have had difficulties with the normative theory of the role of government in the mixed economy, as noted by Nelson above, governments have at various points in history attempted to implement challenge-driven, mission-oriented policies. This section gives a brief overview of these policies and draws some key lessons for public value-based market-shaping theory and policies.⁶

The idea of mission-oriented policies has its root in the idea of modernization, which of course is not a ‘modern’ idea at all. Even if we are today accustomed to equating modernization with Westernization, what we call the modern state and bureaucracy have arguably Asian and specifically Chinese origins (Fukuyama, 2011). What matters for our context is the religious-cultural idea of the ‘mandate of heaven’ (particularly applicable in late Imperial China) under which rulers must govern well and provide for the people; non-fulfilment of this ‘mandate’ was a legitimate reason to overthrow the ruler (Drechsler, 2018). The counterpart to mandate of heaven in Western culture is the idea of ‘reason of state’, originating with Giovanni Botero’s eponymously titled book from 1591, *Della Ragion di Stato*—number five on the bestseller list of economics books published before 1850 (E. Reinert et al., 2017; E. Reinert, 2007; S. Reinert, 2011)—and justifying policies (Botero explicitly includes economic policies) on the grounds of what today is called ‘national interests’.

These two ideas coalesce around developmental states of the late eighteenth and early nineteenth centuries with (proto-)missions of catching up, finding their practical toolbox in Alexander Hamilton’s *Report on the Subject of Manufactures* in 1791 and their theoretical embodiment in Friedrich List’s *Das Nationale System der politischen Oekonomie* (1841). Mandate of heaven and national interest offer ideational backdrops to what can be called a ‘duty to catch up’ as an overarching policy challenge that subsumed under it a variety of policy missions, from building up knowledge base (e.g. reforming universities) to creating trade relations and social policy (the latter is particularly crucial for Bismarck’s Germany, including for the evolution of economics as a science through the debates around the ‘social question’ of the 1870s; see Drechsler, 2016). The German catching-up story is especially noteworthy, not only for the country’s significant investments in development resulting in impressive actual catching up and, in many instances, forging ahead of England and other

⁶ This section builds on Kattel and Mazzucato (2018).

industry leaders of the time, but also for a wealth of institutional innovations such as central banks as underwriters of private investment in industry and multiple welfare-state insurance schemes.

The first generation of mission-oriented policies, the ‘developmental state’, relied on expert meritocracy in public organizations accompanied, however, by constant renewal and rejuvenation of organizational configurations (Karo and Kattel, 2015). As *exemplar institutions* we can look at what is called System Althoff in German higher education and research policy (named after Friedrich Althoff, a top civil servant in the Prussian Ministry of Culture responsible for hugely successful university reforms; vom Brocke, 1991), and at MITI (Ministry of International Trade and Industry) in Japan as quintessential development agencies with ‘embedded autonomy’ (Evans, 1995). While both institutions are often seen as representing Weberian bureaucracy at its finest (with merit-based recruitment and promotion systems and rule-based organization of work), both enjoyed high-level political support but also relied on what can be called wide-ranging charismatic networks, built and nurtured by top civil servants (Karo, 2018).

These policies were wide-ranging, demanding endurance and sacrifice in the name of national catching up and pride, which served as the key sources for normative framing of public value and as the backdrop for mission/priority selection. A version of these policies is also to be found in the Soviet Union and other planning-based policies of the post-Second World War era (Freeman, 1987; Chandrashekar, 2016; Chibber, 2003). Indeed, the latter can be considered an intermediate form between the first and second generations of mission-oriented policies, particularly in their more successful forms such as Commissariat du Plan in France, with its origins in mixed enterprises of the 1920s and its heyday in the 1960s. Schonfield argues that the success of French planning was also pivotal for Kennedy’s ‘un-American’ fervour for setting targets for long-term economic growth (1966: 72–3). The French planning culture, with its focus on achieving a ‘more complete view of man’ (quoted in Schonfield, 1966: 227), makes it clear that the point of ‘planning is thus in part an ethical one: it imposes choices about the use of resources other than those which the market would produce’ (Schonfield, 1966: 227). The planning exercises were thus driven by an idea of public value and socio-economic challenges.

The second generation of mission-oriented policies are the well-known policies and public agencies of the 1940s–1960s concerning military and space technologies in the United States and major Western European economies (Ergas, 1986; Soete and Arundel, 1993). As Alvin Weinberg, for eighteen years the director at Oak Ridge National Laboratory, which was part of the Manhattan Project, argues, these mission-oriented policies were about ‘big science’ deployed in the ‘national interests’ (Weinberg, 1967: 132). Thus on the one hand, the national interest of the first generation of mission-oriented policies became much more clearly defined through defence and military aims; on the other hand, as we shall see, the translation of these public-value framings into civilian policy areas failed.

Organizationally, these policies were often implemented by single national/public laboratories with a concrete mission to solve particular technological problems, not to engage

in basic science, which also meant that their facilities were built up more hierarchically than universities (Weinberg, 1967). Weinberg argues that partly due to accomplishing missions, partly due to pressure from researchers, many of these organizations lost focus on the original missions and moved towards basic research (Weinberg, 1967: 136; see also Nelson et al., 1967: 169). Similar problems emerged in the Western European countries where the basic policy assumption was that ‘research results constitute an undirected potential’ (Krupp, 1985: 51) and that it was up to the private sector to ‘find’ the direction of innovation. The basic research policies were in reality supplemented by multiple civilian mission-oriented policies in the form of large-scale funding for, e.g. nuclear energy and transportation (magnetic trains, supersonic aviation) (see Gummett, 1991). This was perhaps the key challenge for the second generation of mission-oriented policies, and specifically, implementing agencies: how to redeploy former military resources around new, civilian missions (Weinberg, 1967: 134–5; Nelson et al., 1967: 3). While first-generation mission-oriented policies—catching-up policies—relied on a wide range of constantly renewed organizations that hired expert civil servants and had strong political support, the second generation of mission-oriented policies had a much more heroic vision of dynamic change. Missions were built around single agencies with high-profile managers in charge of them (Weinberg 1967: 134; also Lambright et al., 1985). This ambition—in terms of both the problems these organizations took on and the scale of investment—brought both massive successes and spillovers (Block and Keller, 2011; Mazzucato, 2013), but also played a crucial role in the demise of this generation of mission-oriented policies.

As suspected by Weinberg and later documented by Ergas (1987), many mission-driven research laboratories could not create sensitivity and flexibility around their purpose, particularly when it came to taking up new emerging, less technological and more social, challenges such as pollution and the decay of inner cities (Nelson, 1977). The seeming lack of success in translating the successes of military R&D and its procurement into the civilian realm also played a significant role in changing policy attitudes (Pavitt and Walker, 1976). Similarly, planning exercises, the siblings of mission-oriented policies, often did not lead to successful outcomes. As documented by Schonfield (1966), economic and industrial policy failures in the United Kingdom and elsewhere in the 1960s, particularly in contrast to their successes in France, were due both to low political commitment to long-term planning (not just business-cycle management) and to lack of proper capabilities within planning organizations. The idea was to pick the willing: ‘deliberately selecting a few promising firms who seem willing and able to move ahead fast, and then giving them every encouragement in the form of large contracts, financial help, and other favours’ (Schonfield, 1966: 111) and with handpicked membership in modernization commissions (Schonfield, 1966: 98).

Furthermore, one of the key factors in the demise of mission-oriented policies and industrial planning in Europe was the emergence of the European Economic Community, in which each country had rather different planning styles and capabilities (Schonfield, 1966). In the late 1960s and 1970s, instead of a common European style of industrial planning and mission-oriented policies emerging, rather a gridlock of plans and missions, and policy cultures remained in place (Schonfield, 1966: 141; also 133). The results of this could be seen

in the fate of the European electronics and semiconductor industries: they could not compete individually with the US companies but neither could a European industry emerge as national policy cultures remained dominant (Schonfield, 1966: 374–5; Dosi, 1981).

The end of this era saw the emergence of (general-purpose) technology foresight exercises and a search for visions which, particularly in East Asian economies, was accompanied by the idea of leapfrogging international competitors rather than just catching up with them. In essence, mission-oriented policies were slowly replaced by the search for future technologies and preparing economies for their diffusion (Rothwell and Zegveld, 1985). At the same time, however, the end of the era denotes the emergence of the market-failure-based approach to (innovation) policy that came to dominate the policy arena, along with New Public Management reforms, in the late 1980s, resulting in privatization of public laboratories, the emergence of new arms-length funding agencies (such as research councils), a focus on commercializing and marketizing research (for example, with competitive grant systems), and cost-efficiency practices in policy evaluation (Gummett, 1991; Boden et al., 1998). This contributed to the demise of the directionality of innovation as a policy agenda, and to the dominance of market-failure-based value framings in innovation and industrial policies.

The third generation of mission-oriented policies and organizations, which today is in the ascendant, has multiple drivers and a somewhat heterogeneous set of actors:

- a) Multilateral organizations such as the European Union have been prominent in urging the development of ‘new’ missions around sustainability and other decidedly socio-economic (as opposed to solely technological) issues (Soete and Arundel, 1993).
- b) Large private philanthropies such as the Gates Foundation and others have sought out specific problems (e.g. diseases) to solve and have focused not only their funding but also important networks on those problems as missions.
- c) Bottom-up social movements have been able to focus the directionality of research, e.g. ACT UP’s impact on HIV research and its increased funding (Leadbeater, 2018). Similarly, Germany’s *Energiewende* would have never happened without the green movement (Fagerberg, 2018).

In contrast to previous generations of mission-oriented policies, the current manifestation does not have a ‘dominant design’ regarding its public-value framing or its governance system. There is, however, a distinct focus on increasing the social responsiveness of science and innovation. Rather than focusing on a specific sector (such as energy) or technology (such as nuclear), as was often the case in the previous generation, current attempts are characterized by cross-sectoral focus ‘by design’ (Mazzucato, 2018a). Alongside social responsiveness, citizens and social engagement have moved into the arena of mission-oriented policies. Finally, experimentalism is seen as a key feature of mission-driven policies and organizations, which is reflected in randomized control trials being embraced by philanthropists and social enterprises at the one extreme, and by service design principles of prototyping within various public agencies at the other.

To sum up, we can draw the following lessons from the history of mission-oriented policies. First, there is a taxonomy of missions, from the socio-economic missions of the first generation to the technological missions of the second and socio-technological missions of the current (third) generation. Each type of mission-oriented policies implies different public-value framings and capabilities to design, implement, and evaluate missions. The directionality of the innovation systems is engendered by different ideational contexts: first-generation policies were driven by catching up as a national and often also nationalistic mission; second-generation policies were driven by national security needs and the technological arms race; and third-generation policies gain their urgency and purpose from ‘intractable’ socio-economic challenges and social movements connected to these challenges (e.g. various green movements).

Second, among factors determining the success or failure of previous generations of mission-oriented innovation policies were investments both in R&D capabilities (e.g. research laboratories) and in market-shaping capabilities (e.g. procurement practices of military organizations). This complementarity within and between mission-oriented policies and other economic policies plays an important role in the success of missions.

Third, missions are about setting concrete directions, which of course must be picked, that is, chosen strategically. The choice is not whether or not to pick but how to do so: picking directions is not the same thing as ‘picking winners’, in the sense of picking individual firms or sectors. It is about deciding that a transformation must occur in society—and making it happen. The direction will require different missions, which in itself provides a focus for the different actors and sectors to collaborate. Thus, missions require ‘picking the willing’: those organizations across the economy (in different sectors, including both the public and private sphere) that are willing to engage with a mission relevant to society.

Fourth, with the focus on the market-making, rather than the market-fixing, role of missions, it also becomes clear why public investment by mission-oriented institutions has been required along the entire innovation chain, and not just upstream basic research. Better understanding of the distribution of public agencies, their positioning across the innovation chain, and the balance between directive and bottom-up interactions is a key area for future study.

4. INSTRUMENTALIZING MISSIONS AS INDUSTRIAL POLICY

In order to instrumentalize public-value-based policy frameworks as industrial and innovation policy tackling grand challenges such as the SDGs, we need, first, to be able to justify the kind of market creation and mission-oriented directionality that was required for innovations such as the Internet and nanotechnology and is now required to address today’s societal challenges ([Mazzucato, 2016](#)). Second, without the state as a lead investor and market creator, failure-based approaches do not provide insights into the type and structure of

public-sector organizations needed to provide the depth and breadth of high-risk investments. Third, as long as policy is seen merely as an ‘intervention’, rather than a key part of the market creation and shaping process, the criteria used to assess public investments will inevitably be problematic. Finally, by not describing the state as a lead risk-taker and investor in this process, failure-based approaches have avoided the key issue of the distribution of risks and rewards between the state and the private sector.

Thus, a policy framework for market-shaping activities by the public sector should offer answers to the following questions, for which we have devised the acronym ROAR:⁷

- (1) How can public policy be understood in terms of setting the direction and route of change; that is, shaping and creating markets rather than just fixing them (Routes of directionality)?
- (2) How should public organizations be structured so they accommodate the risk-taking, explorative capacity, and capabilities needed to envision and manage contemporary challenges (Organizations)?
- (3) How can this alternative conceptualization be translated into new dynamic indicators and evaluation tools for public policies, beyond the static microeconomic cost–benefit analysis and macroeconomic appraisal of crowding in/crowding out that stem directly from the market failure perspective (Assessment)?
- (4) How can public investments along the innovation chain result in the socialization not only of risks, but also of rewards, enabling smart growth to also be inclusive growth (Risks and rewards)?

While the questions may seem broad, it is their potential connections and internal coherence that can help build a market-creation policy framework—and a practical toolkit. Policies that aim to actively create and shape markets require indicators that assess and measure the performance of a policy along that particular transformational objective. The state’s ability and willingness to take risks, embodied in transformational changes, requires an organizational culture and dynamic capabilities that welcome the possibility of failure and experimentation and are rewarded for successes so that failures (which are learning opportunities) can be covered and the next round financed.

5. R: ROUTES AND DIRECTIONALITY—A MISSION-ORIENTED APPROACH

A key success of past market-shaping innovation policies, such as the mission-oriented policies of the Moonshot era, has been setting a clear direction for problems to be solved (e.g. going to the moon and back in one generation), which then required cross-sectoral

⁷ This section builds on [Mazzucato \(2016\)](#).

investments and multiple bottom-up solutions, some of which inevitably fail. Too much top-down can stifle innovation and too much bottom-up can make it dispersive with little impact.

A crucial difference between classical mission-oriented policies of the Cold War era and modern missions is that the latter are focusing on areas such as managing the impact of technological advance and artificial intelligence on the labour market; adapting to changing demographics and an ageing population; or making the transition to a low-carbon economy (European Commission, 2011; Kattel and Mazzucato, 2018). Taking up the challenge posed by Richard Nelson in his seminal *Moon and the Ghetto* (1977), modern-day mission-oriented policies focus not on technological challenges alone but rather on areas traditionally the responsibility of public services, such as education or the welfare state, and entail changes across various economic and policy sectors. Germany's *Energiewende* policy, for instance, aims to combat climate change, phase out nuclear power, improve energy security by substituting renewable sources for imported fossil fuel, and increase energy efficiency. By providing a direction to technical change and growth across different sectors, *Energiewende* is tilting the playing field in the direction of a desired socio-economic goal. Importantly, it is not just about growing 'green sectors'—it has required many sectors, including traditional ones such as steel, to transform themselves, and is leading to changes in patterns of production, services, and consumption of energy. In other words, its spillovers are as much technological as social and behavioural (see Fagerberg, 2018, for a discussion).

Policies tackling grand challenges should thus be broad enough to engage the public, enable concrete missions, and attract cross-sectoral investment, and remain focused enough to involve industry and achieve measurable success. By setting the direction for a solution, missions do not specify how to achieve success, but rather stimulate the development of a range of different solutions to achieve the objective. In other words, missions guide entrepreneurial self-discovery (Foray, 2018). As such, a mission can make a significant and concrete contribution to meeting a Sustainable Development Goal (SDG) or grand challenge.

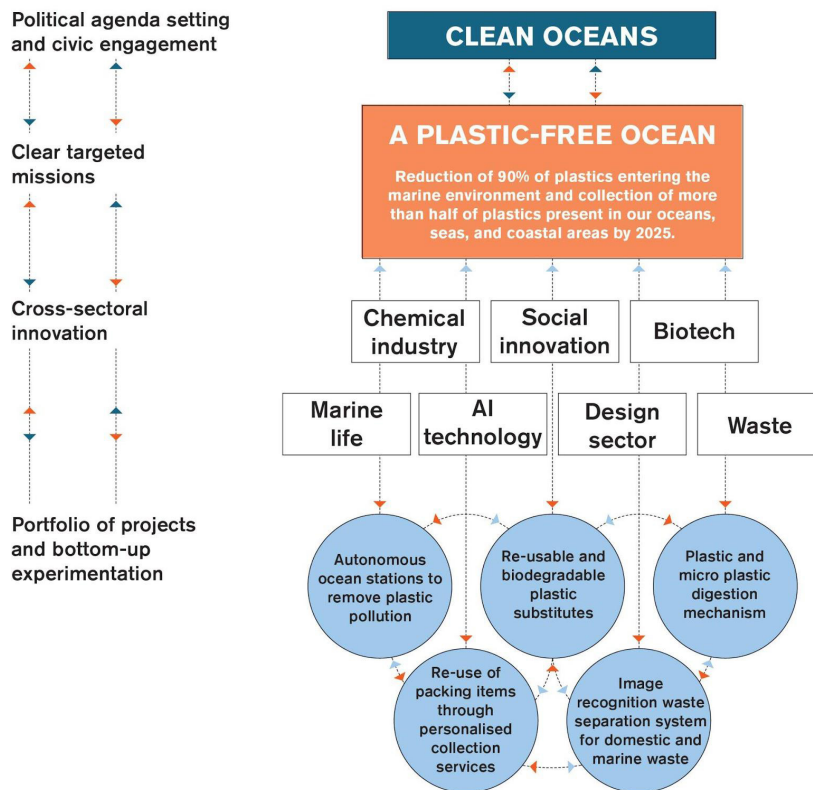
The criteria for selecting missions adopted by the European Commission, after widespread stakeholder consultation based on the 'Missions Report' (Mazzucato, 2018a), are that they should:

- be bold and address societal value;
- have concrete targets: you know when you get there!
- involve research and innovation: technological readiness over limited time frame;
- be cross-sectoral, cross-actor, and cross-disciplinary;
- involve multiple competing solutions and bottom-up experimentation.

To illustrate, take SDG 14: 'Conserve and sustainably use the oceans, seas and marine resources for sustainable development.' This could be broken down into various missions, for example, 'A plastic-free ocean' (Figure 12.1). This could stimulate research and innovation in methods of clearing plastic waste from oceans or in reducing the use of plastics, innovation in new materials, research on health impacts from micro-plastics, behavioural research and

innovation to improve recycling or drive public engagement in cleaning up beaches. Each of these areas can be broken down into particular ‘projects’.

Figure 12.1 A mission-oriented approach to cleaning the oceans.



6. O: ORGANIZATIONAL CAPABILITIES IN THE PUBLIC SECTOR

A key concern should be to establish skills/resources, capabilities, and structures that can increase the chances that a public organization will be effective, both at learning and at establishing symbiotic partnerships with the private sector, and will ultimately succeed in implementing mission-oriented and transformative policies. Public and private organizations must re- rethink their roles when working together. Public–private partnerships have often limited the public part to de-risking the private part. This ignores the capabilities and challenges involved in public-sector risk-taking. De-risking assumes a conservative strategy that minimizes the risks of picking losing projects, but does not necessarily maximize the probability of picking winners, which requires the adoption of a portfolio approach to public investments (Rodrik, 2014). In such an approach, the success of a few projects can cover the losses from many projects, and the public organization in question also learns from its loss-making investments (Mazzucato, 2013). Here, matching failures with fixes is less important

than having an institutional structure that ensures that winning policies provide enough rewards to cover the losses, and that losses are used as lessons to improve and renew future policies.

One can argue that the community of Schumpeterian scholars never followed up the call by [Nelson and Winter \(1982\)](#) for public policy to be matched by bold new organizational structures in the public sector: ‘The design of a good policy is, to a considerable extent, the design of an organizational structure capable of learning and of adjusting behaviour in response to what is learned’ (384). Indeed, there is no equivalent in the literature to ‘dynamic capabilities of the firm’ for the public sector. Developmental state research looking at the success of the East Asian Tigers argued that public-sector capacities and capabilities can be best developed by talent, recruited and motivated by Weberian meritocratic recruitment and career management that makes working for government either financially competitive and/or culturally even more rewarding/prestigious than working in the private sector. [Evans and Rauch \(1999\)](#) cemented these ideas through a quantitative analysis that tested the importance of some of the ‘Weberian’ elements (merit-based recruitment and career systems) in a much broader sample of countries as a whole (see also [Rauch and Evans, 2000](#); [Evans, 1998](#)). This is best captured by Chalmers Johnson and his concept of the developmental state: a country with a predominant policy orientation towards development, supported by a small and inexpensive elite bureaucracy centred around a pilot organization, such as the Ministry of International Trade and Industry (MITI) in Japan, and with sufficient autonomy (limited intervention by the legislature and judiciary) ([Johnson, 1982](#): 305–20).

What is missing, however, in the Weberian framework of capacities are the evolutionary dynamics: why do specific constellations of capacities become more successful than others?

Teece and Pisano define dynamic capabilities of the firm by their evolutionary nature.

The term ‘dynamic’ refers to the shifting character of the environment; certain strategic responses are required when time-to-market and timing is critical, the pace of innovation accelerating, and the nature of future competition and markets difficult to determine. The term ‘capabilities’ emphasizes the key role of strategic management in appropriately adapting, integrating, and re-configuring internal and external organizational skills, resources, and functional competencies towards a changing environment. (Teece and Pisano, 1994: 1)

We argue that challenge-driven public policies need to be based on a similarly evolutionary understanding of capabilities in the public sector.

We propose that twenty-first-century missions require the following set of dynamic capabilities in the public sector in order to engender mission-oriented policies ([Kattel and Mazzucato, 2018](#)).

First, key to our premise is that grand challenges can only be solved through dynamic public–private partnerships, but these have been constrained by the notion of public actors as at best fixing markets. A market-co-creating role requires the state to have capabilities for

leadership and engagement: missions can all too quickly become either just fashionable labels on ‘business-as-usual’ practices or too rigid top-down planning exercises. Thus, capabilities to engage with a wide set of social actors and to show leadership through bold vision are vital at a time of high ‘democratic deficit’ in many developed countries (see also [ESIR, 2017](#)). Some of the grand challenges contest ‘the way of life’ as we know it (e.g. suburbanization accompanied by congested transportation systems). Capabilities to encourage bottom-up engagement mean a capacity to set mission but also to leave enough space for contestation and adaptability.

Second, on the level of policy, finding coherent policy mixes (instruments and funding) and coordination capabilities is fundamental to the success of today’s mission-oriented policies. As these missions are not just about technological solutions but also have strong socio-political aspects, experimentation capabilities matter perhaps more than before. Equally important are evaluation capabilities that do not simply rely on market-failure-based approaches (e.g. cost–benefit analysis) but can also integrate user research, social experiments, and system-level reflection ([Lindner et al., 2016](#); [Rip, 2006](#)).

Third, administrative capabilities need to rely on a diversity of expertise and skills from engineering to human-centric design: organizational forms that mix unrelated knowledge areas (e.g. in urban mobility and planning, lifestyles are just as important as new energy storage systems; see [Grillitsch et al., 2017](#)) and organizational fluidity (e.g. cross-departmental teams) seem to be fundamental for managing new missions ([OECD, 2017](#)).

7. A: ASSESSMENT AND EVALUATION

One of the key challenges of applying a public value-based framework to policymaking is the relationship between policy assessment, appraisal, and evaluation. Influenced by the market failure framework, today’s dominant evaluation practices are usually based on allocative efficiency and some form of *ex ante* cost–benefit analysis (CBA).⁸ Costs (including the costs of potential government failure) are usually defined by their opportunity cost, that is, the value that reflects the best alternative use a good or service could be put to (include a do-nothing/business-as-usual option), with all else (including all other prices) assumed equal, and with market prices usually the starting point for the analysis (see, e.g. [HM Treasury, 2018](#): 6). Post-intervention policy evaluation then seeks to verify whether the estimates were correct and whether the market failure was addressed.

To enable market-type price comparison of interventions whose return will vary in terms of time, CBAs typically make use of a ‘discount rate’ that reflects the time preference of users of the service for having money now rather than in the future. After adjusting for inflation and discounting, costs and benefits can be added together to calculate the net present value (NPV) of different policy options. In recognition of the problem of externalities, some attempt has been made in recent years to incorporate the wider costs to society of particular

⁸ This section builds on [Kattel et al. \(2018\)](#).

policy actions, e.g. through monetizing certain social or ecological externalities in a ‘social cost–benefit analysis’ (SCBA) or ‘social cost-effectiveness analysis’ (SCEA). However, the overall framework remains rooted in the idea that creating a ‘market price’ for interventions will enable the most accurate decision to maximize welfare and public value. CBA and NPV are mostly aimed at preventing costly government failures; by their very nature, they cannot tell us very much at all about proactive market creating and shaping.

This limitation is of crucial importance. Market-shaping policies, such as missions, aim to accelerate innovation, creating new technologies and radically changing the prices, availability, and existence of goods and services. Their central purpose is to transform underlying relationships, a wide range of prices and the broader environment (OECD, 2015). The ‘all else (including prices) being equal’ assumption underlying cost–benefit analysis becomes problematic in such circumstances.

By always comparing the policy intervention with the status quo and emphasizing short-term risks, CBA approaches encourage decision makers to prefer small-scale, marginal interventions (Allas, 2014: 89). Yet there is considerable evidence that innovation systems exhibit increasing returns or an S-curve-type effect, in which shifting incentives across multiple sectors may be more likely to achieve such increasing returns (Mazzucato, 2017). So, arguably, if there is to be any bias around innovation policy it should be in favour of large-scale interventions. Furthermore, the strong emphasis on risk assessment/optimism bias is likely to mitigate against the creation of a mission-oriented approach where failure is viewed as a learning process integral to the achievement of important technological breakthroughs (Mazzucato, 2013).

CBA-type analyses derived from market failure theory are concerned with allocative or distributive efficiency, which involves making the best use of (fixed) resources at a fixed point in time. Dynamic efficiency involves making the best use of resources to achieve changes over time and so is concerned with innovation, investment, improvement, and growth—including, perhaps most importantly, the creation of new resources (technologies) and shifting technology frontiers (Kattel et al., 2018). Missions are, by definition, concerned with dynamic efficiency, since they aim to accelerate innovation and transformational change.

When allocative efficiency frameworks are applied to dynamic efficiency problems, the analysis risks are either irrelevant or actively unhelpful.

Aside from considerations of efficiency, given the importance of dynamics over time for market-shaping policies, it is important to define a concrete target and objectives. In other words, it must be possible to say definitively whether the policy has been achieved or not. Technological missions such as putting a man on the moon had obvious end points which made evaluation easier. However, modern grand challenges are more long term and their end points less easy to define.

8. R: RISKS AND REWARDS

But this raises a more fundamental question: how to make sure that, like private venture capital funds, the state can reap some return from the successes (the upside), in order to cover the inevitable losses (the downside) and finance the next round of investments.⁹ This is especially important given the path-dependent and cumulative nature of innovation. Returns arise slowly; they are negative in the beginning and gradually build up, potentially generating huge rewards after decades of investment. Indeed, companies in areas like ICT, biotechnology, and nanotechnology had to accept many years of zero profits before any returns were in sight. If the collective process of innovation is not properly recognized, the result will be a narrow group of private corporations and investors reaping the full returns of projects which the state helped to initiate and finance.

So who gets the reward for innovation? Some economists argue that returns accrue to the public sector through knowledge spillovers (new knowledge that can benefit various areas of the economy), and via the taxation system due to new jobs being generated and taxes being paid by companies benefiting from the investments. But the evolution of the patenting system has made it easier to take out patents on upstream research, meaning that knowledge dissemination can effectively be blocked and spillovers cannot be assumed. The cumulative nature of innovation and the dynamic returns to scale (Nelson and Winter, 1982) mean that countries stand to gain significantly from being first in the development of new technologies.

At the same time the global movement of capital means that the particular country or region funding initial investments in innovation is by no means guaranteed to reap all the wider economic benefits, such as those relating to employment or taxation. Indeed, corporate taxation has been falling globally, and corporate tax avoidance and evasion rising. Some of the technology companies that have benefited the most from public support, such as Apple and Google, have also been among those accused of using their international operations to avoid paying tax (Johnston, 2014). Perhaps most importantly, while the spillovers that occur from upstream 'basic' investment, such as education and research, should not be thought of as needing to earn a direct return for the state, downstream investments targeted at specific companies and technologies are qualitatively different. Precisely because some investments in firms and technologies will fail, the state should treat these investments as a portfolio, and enable some of the upside success to cover the downside risk.

In particular, there is a strong argument to be made that, where technological breakthroughs have occurred as a result of targeted state interventions benefiting specific companies, the state should reap some of the financial rewards over time by retaining ownership of a small proportion of the intellectual property it had a hand in creating. This is not to say that the state should ever have exclusive licence or hold a large enough proportion of the value of an innovation to deter its diffusion (and this is almost never the case). The role of government is not to run commercial enterprises; it is to spark innovation elsewhere. But by owning some of the value it has created, which over time has the potential for significant

⁹ This section builds on Mazzucato (2016).

growth, government can generate funds for reinvestment into new potential innovations. With the adoption of a portfolio approach to public investment in innovation, success from some projects can help cover the losses from others. In this way, both risks and rewards are socialized ([Mazzucato, 2016](#)).

There are many examples of public organizations that have strategically considered the distribution of risks and rewards. At times, they have granted licences to private firms willing to invest in upgrading publicly owned technologies, offering the opportunity for public and private sectors to share both risks and rewards. For example, NASA has sometimes captured the returns to its inventions, while private partners gained on the value added in case of successful commercialization ([Kempf, 1995](#)). There are other examples of state-owned venture capital activity generating royalties from public investments (in Israel, see [Avnimelech, 2009](#)) or equity (in Finland via Sitra), and the more pervasive use of equity by state development banks (e.g. in Brazil, China, and Germany; see [Mazzucato and Penna, 2016](#)).

Policy instruments for tackling risk/reward issues combine supply- and demand-side mechanisms geared to enabling public value creation through symbiotic public–private partnerships (‘active’) ([Lazonick and Mazzucato, 2013](#)) and mechanisms blocking value extraction (‘defensive’).

Rewards can be distributed either directly through profit sharing (via equity, royalties) or indirectly through conditions attached that focus more on the market-shaping role. The latter may involve conditions on the reinvestment of profits, conditions on pricing, or conditions on the way that knowledge is governed.

This list is not meant to be exhaustive, but rather, to illustrate that there are multiple experiences in handling policy instruments that, implicit or explicitly, enable consideration of issues like value extraction and allowing government to capture a share of the value it helped to generate. The latter, in particular, have been adopted by different types of agencies, at different stages of the innovation chain but mainly downstream, involving different types of partners (e.g. firm size) and industries. However, they have not always been adjusted to the specificities of different economic, industrial, and legal settings. Absent a framework that more clearly informs these policies, decisions on these matters have sometimes been made unintentionally and haphazardly, inviting both government and systemic failures.

The prospect of the state owning a stake in a private corporation may be anathema to many parts of the capitalist world, but given that governments are already investing in the private sector, they may as well earn a return on those investments (something even fiscal conservatives might find attractive). The state need not hold a controlling stake, but it could hold equity in the form of preferred stocks that get priority in receiving dividends. The returns could be used to fund future innovation ([Rodrik, 2015](#)). Politicians and the media have been too quick to criticize public investments when things go wrong, and too slow to reward them when things go right.

Thus, more thought should be given, not so much to the problem of ‘picking winners’, as to how to reward the winning investments so they can both cover some of the eventual losses (inevitable in the innovation game) and raise funds for future investments. Going hand in hand with this consideration is the need to rethink how public investments are accounted for in national income accounting. Investments in innovation are different to current expenditure. The latter does not add to balance-sheet assets; the former does, and is potentially productive investment in the sense that it creates new value (Mazzucato and Shipman, 2014). When setting limits to fiscal deficits, it is therefore necessary to distinguish public debt contracted for investment in R&D and infrastructure (value-creating investments) from public debt contracted for (public or private) consumption. In this sense, financial and accounting reforms should be regarded as a prerequisite for any successful smart and inclusive growth plan.

Finally, regarding the government as lead risk-taker helps to debunk fundamental assumptions behind the theory of shareholder value that underpins the exorbitant rewards earned by senior executives in recent years. Share options as part of pay packages have been a key feature of modern capitalism, and especially, a key driver of the inequality between the top 1 per cent of income earners and the rest (Piketty, 2014). Share options are boosted when share prices rise, and prices often rise through ‘financialized’ practices such as share repurchase schemes by companies (Lazonick, 2014). Focusing on boosting share prices is justified on the grounds of the theory of shareholder value, which holds that shareholders are the biggest risk takers in a company because they have no guaranteed rate of return (while workers earn set salaries, banks earn set interest rates, etc.). That is, they are the residual claimants (Jensen, 1986).

But this assumes that other agents do have a guaranteed rate of return. As we have argued throughout this chapter, it is precisely because what the state does is not just facilitate and de-risk the private sector, but also take major risks, that there is no guarantee of success in its investments, which have historically also played a crucial role in enabling wealth creation. The fact that a key driver of inequality has been linked with a problematic understanding of which actors are the greatest risk takers implies that combatting short-termism and speculative forms of corporate governance requires not only reforming finance and corporate governance, but also rethinking the models of wealth creation upon which they are based (Lazonick and Mazzucato, 2012; Mazzucato, 2018b).

9. CONCLUSION

Market-shaping, mission-oriented approaches to policy allow us to reconsider how to justify ambitious policies that aim to transform landscapes rather than fix problems in existing ones. This approach to policy raises challenges in terms of how to nurture organizational structures that can manage such policies, and how to appraise and evaluate the market-shaping effect of the policies. This approach would help capture the potential for policy to create spillover

effects across many sectors of the economy and alter the level of investment and the broader trajectory of economic growth.

What are some of the possible concerns with this type of approach? One concern is around the setting of missions and the direction of the market shaping in the first place. Clearly governments can and do become captured by particular interest groups which limit their ability to both establish missions and follow through on them. The challenges of climate change and inequality are obvious examples. Government subsidies continue to favour vested interests (for example fossil-fuel energy firms), while taxation policy favours labour saving (increasing unemployment or underemployment) over resource saving (supporting decarbonization), despite governments signing up to treaties committing themselves to different policy directions. And, of course, democracy is no guarantee that societal missions such as climate change will be adopted globally, as the current administrations in the United States and Brazil clearly demonstrate.

However, arguably these are the outcomes of governments not doing enough to shape markets to support social and environmental policy goals in the first place. Hopefully the ideas in this chapter can help meet that challenge.

Acknowledgements

This chapter is based on our previous work: [Mazzucato \(2018a and 2018b\)](#), [Kattel and Mazzucato \(2018\)](#), [Mazzucato and Ryan-Collins \(2019\)](#), and [Mazzucato, Kattel, and Ryan-Collins \(2019\)](#). The research for the article has been partially funded by the Horizon2020 project GROWINPRO (GA 822781).

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