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IFN Working Paper No. 1406, 2021

Collaborative Innovation Blocs and Mission-Oriented Innovation Policy: An Ecosystem Perspective

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Collaborative Innovation Blocs and Mission-Oriented Innovation Policy: An Ecosystem Perspective

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Abstract: Among contemporary economists, Mariana Mazzucato stands out for her emphasis on the importance of innovation to solve pressing challenges and achieve a greater quality of life. However, the type of mission-oriented innovation policies she promotes usually rely on an overly mechanical view of innovation and economic growth. We employ an ecosystem perspective to demonstrate that innovative entrepreneurship takes place in a *collaborative innovation bloc* consisting of a myriad of nodes. Entrepreneurs, inventors, early- and later-stage financiers, key personnel, and customers are all actors whose skills and abilities are necessary to realize an entrepreneurial project. When mission-oriented policies play a large role in an industry's production or financing, connections between actors in the innovation bloc risk being severed, severely curtailing the scope for actors to play their requisite roles. Thus, there is a risk that such policies do more harm than good for innovation and economic growth.

Keywords: Entrepreneurial ecosystems; Collaboration; Entrepreneurship policy; Institutions; Innovation policy.

JEL Codes: D20; G32; L23; L26; O33; O38.

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1. Introduction

Mariana Mazzucato stands out among contemporary economists for her emphasis on the importance of innovation to achieve prosperity and a greater quality of life. The relevance of this focus cannot be in doubt; estimated to account for more than nine tenths of the increase in GDP per capita since 1870 (Baumol, 2010), innovations are depicted as “the only way for the most developed countries to secure sustainable long-run productivity growth” (Bloom et al., 2019, p. 163). Equally laudable is Mazzucato’s insight that innovation requires focus on “high growth, high risk areas,” and her ecosystem emphasis. Where we differ from her is in the view of (i) how innovation comes about, and (ii), as an immediate consequence, what the state’s role should be in promoting innovation. This is not to say that there is not such a role.

Scholars (in this volume and elsewhere, see, e.g., McCloskey and Mingardi, 2020) have scrutinized and criticized the historical account of U.S. Industrial Policy that Mazzucato touts when making her case for why governments should “lead the process of industrial development, by developing strategies for technological advance in priority areas.” (Mazzucato, 2013, p. 40). It is certainly legitimate to object against state involvement and the very notion of a Ministry of Innovation (McCloskey and Mingardi, 2020, p. 169), but the fact is that many industrialized nations already have such a ministry, Sweden among them. This situation is unlikely to change.

A more fruitful approach, we believe, is to take “public–private entanglement” (Wagner, 2016) as a given. Governmental agencies will want a seat at the innovation table – whether for purely altruistic public interest reasons or for public choice reasons of power. Treating governmental involvement in innovation as unavoidable allows us to think about what governmental entities currently do, and what they *should* do to maximize innovation – a laudable goal we share with Mazzucato – while simultaneously minimizing errors and distortions. Although Mazzucato pays lip service to the latter goal, she makes no secret of her wish to tilt the playing field when necessary, a point to which we will soon return. We hope to convince the reader that realism is a key virtue of our approach.

The state does have roles to play when it comes to innovation, and while some of them are quite proactive, we consider them to be of a different nature than Mazzucato, though our perspectives do intersect. In her (2013) view, governments should strive to achieve “mission-oriented innovation” or (2018) “mission-oriented programs for innovation policy – and indeed policies aimed at investment-led growth.” To achieve these goals,

“(w)hat is needed is a ‘systems’ perspective, but one that is more realistic on the actual – rather than the mythological – role of the individual actors, and the linkages between actors” (Mazzucato, 2013, p. 196). Moreover (p. 198): “acknowledging the different roles played in the ecosystem – over time and along the bumpy risk landscape – will make it more difficult for overhyped economic actors that have captured the public imagination to argue for handouts and subsidies.”

We fully agree with the emphasis revealed in these quotes, but the devil is in the details, of which there are precious few in Mazzucato’s 2013 book *The Entrepreneurial State*. It seems possible to interpret her level of ambition as both an immense expansion of governments’ powers (e.g., McCloskey and Mingardi, 2020) and as a fairly modest correction of market failures (e.g., Karlson et al., 2021). Therefore, we will focus on the six lessons she draws in her 2018 article “Mission-oriented innovation policies: challenges and opportunities,” precisely because they are sufficiently detailed to merit a fruitful critique that steers clear of unwarranted assumptions and strawmen.

Discussing these six lessons from an ecosystem perspective will, we believe, offer food for thought for Mazzucato’s critics and advocates alike. That said, we do differ from Mazzucato in our view of what an entrepreneurial ecosystem entails; all our writings on the subject see innovations as shrouded in uncertainty in Knight’s (1921) sense, meaning it is impossible for private *and* public actors to know where the next generation of high-growth firms and radical innovations will emerge (e.g., Elert et al., 2019). A key goal for policy should, therefore, be to level the playing field, to make sure that no paths are closed unnecessarily, leaving the final selection to the entrepreneurial society rather than the entrepreneurial state (e.g., Elert et al., 2019). Mazzucato would likely call such a view “old-fashioned”; after all, she (2018, p. 804) specifically highlights that mission-oriented agencies do (and one assumes, should) tilt the playing field:

the relevant organizations made choices on what to fund, going against the more classic position that the point of policy making is simply to level the playing field. Indeed, these agencies, and the wider programs around them, “tilted” the playing field through missions aimed at a public objective, with other policies needing to be introduced to make it more profitable to move in that direction.

This is an issue where we disagree fundamentally with Mazzucato. However, mission-driven innovation and government interventions more broadly necessarily entail directing resources in a particular direction, and away from another. This *is* something governments do, and while there are ample grounds for criticism of this fact, a more important concern

is *how* governments do this. Treating mission-driven innovation policy (i.e., a considerable level of government involvement) as a given, how should this involvement take the existence of entrepreneurial ecosystems into account?

To answer this question, we will adopt a collaborative innovation bloc (CIB) perspective, which focuses on the actors and competencies that are necessary for an idea or invention to become an innovation that eventually becomes an efficiently produced and widely disseminated high-quality good or service (e.g., Elert and Henrekson, 2019a, 2020, 2021; Elert et al., 2019). The CIB perspective shows how successful innovation, especially in “high-growth, high-risk areas”, depends on an entrepreneurial ecosystem that evolves spontaneously. As the name suggests, the ecosystem is inherently collaborative, and the perspective stands out in the ecosystem literature for its clear distinction between actors and institutions. A CIB consists of six pools of economic skills from which people are drawn or recruited to form part of a collaborative team. The six pools include entrepreneurs, inventors, early- and later-stage financiers, key personnel, and customers. The value of a successful innovation materializes when entrepreneurs’ talents, insights, and efforts are combined with the labor effort, human capital, and financial capital of other input providers drawn from the other pools to form a collaborative team. As such, entrepreneurial venturing and innovation are matters of collaborative effort, though each collaborative team competes against other collaborative teams, causing competitive pressures that create favorable macrolevel outcomes.

CIBs emerge spontaneously in modern economies, provided that the right policy and institutional conditions are at hand but will not emerge if those conditions are missing. For example, the system of CIBs known as Silicon Valley only emerged when (largely unrelated) reforms had created the right conditions, especially surrounding venture capital (see section 4.6). While the ecosystem may be surprisingly resilient along some margins, it can be fragile enough along others that one single institutional bottleneck or one single flawed policy impede an entire high-growth, high-risk area. In fact, given the complexities involved, one may wonder how successful collaboration can come about at all. This also emphasizes the need for a CIB-grounded analysis of government interventions and “mission-driven innovation” – and what they potentially entail for CIB actors and their collaborations. Specifically, we tie the perspective to the lessons Mazzucato draws in her 2018 article. Briefly, our lessons, drawn from her lessons, are as follows:

- 1) Mazzucato argues against picking winners, in favor of *picking the willing*, i.e., to promote and embolden those firms and organizations that are ready to do what is necessary to achieve a certain mission-oriented policy goal. In our reading, this is just another way to say picking winners. While it may limit the risk of unwarranted failures in the CIB, it will also increase the risk that unsound economic ideas survive for too long, which will be detrimental to the CIB's selection processes and its long-term survival.
- 2) Mazzucato argues in favor of the *state actively co-shaping markets*, even creating new markets, rather than merely trying to fix them. As alluded to earlier, this is something most governments do. It is sometimes warranted, e.g., with respect to health care and education, but will result in CIB problems. This is especially the case if governments curtail private citizens in their role as consumers, since they are usually the final arbiters of an innovation's success in the CIB.
- 3) Mazzucato argues that *governments should welcome experimentation* (instead of fearing failure). We agree that this is a laudable goal, not least in the policy arena. Yet, market selection (through entry and exit) offers a way for private actors to learn from such experimentation (and incentives to care) in a way that is unavailable to public actors, meaning the more learning occurs through bottom-up process in CIBs, the better.
- 4) Mazzucato argues that governments should *focus on the quality of finance* (rather than the quantity), a point which, if we read her correctly, mainly seems to concern the way R&D is financed. We disagree; in fact, the CIB perspective reveals that a focus on government investments in R&D as a driver of innovation reveals a far too narrow and mechanical view of how innovation comes about.
- 5) Mazzucato argues for *engagement*, i.e., democratization and including more stakeholders in mission-oriented projects. This is important for government activity writ large. Returning to point 2 above, however, we wonder if citizens *qua* consumers are not better placed to decide what they want than is a government agency.
- 6) Finally, Mazzucato argues that governments should *share both risks and rewards* if they engage in VC activity. This is reasonable, but the "if" does much of the heavy lifting. Government involvement in VC rests, in our view, on a flawed idea regarding what early- and late-stage financiers should do in CIBs, wrongfully labeling sound investment behavior as shortsightedness.

The list should make clear that while we often disagree with Mazzucato’s perspective, there is common ground. Few of her points can be disregarded out of hand. Hopefully, a fair reading of this article by advocates of Mazzucato’s view will inspire hope, humility, and afterthought.

2. How does innovation come about in the CIB?

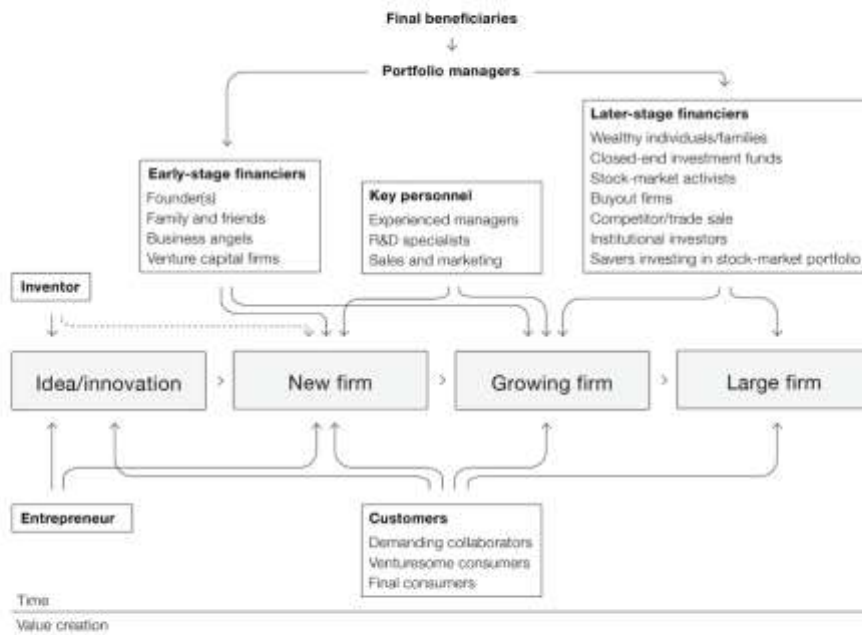
Human collaborations are often superadditive, meaning that they have an “explosive upside, what is mathematically called a superadditive function” (Taleb, 2012, p. 238). Baumol (2005, p. 3) notes much the same thing when discussing the revolutionary innovations of small and new firms and the incremental innovation of large firms, stating that “the contribution of the two together is superadditive, that is, the combined result is greater than the sum of their individual contributions.” This collaborative effect characterizes many economic interactions, and likely explain both why many ventures are founded by teams (Schjoedt and Kraus, 2009) and why innovation and entrepreneurship are often localized phenomena (Zucker et al., 1998). A critical mass of firms in dense, knowledge intensive areas seems to be required for a dynamic innovation environment to emerge (Feldman and Audretsch, 1999), with strong clusters enhancing growth opportunities in adjacent industries and clusters (Delgado et al., 2014).

The CIB perspective promises a greater understanding of such clusters and the conditions enabling collaborations within them. Its roots can be traced to the works of earlier Swedish economists (Erixon, 2011), but the perspective also shares features with the more recent literature on entrepreneurial ecosystems (Stam, 2013) and the national system of entrepreneurship approach (Acs et al., 2014).¹ These related perspectives offer valuable insights, yet seldom make a clear distinction between actors and institutions, and “the institutional variables that are used, such as technology absorption, gender equality, R&D spending, and depth of capital markets, are not institutional variables; they are outcomes resulting from the evolution of the economic system in a given institutional setup” (Braunerhjelm and Henrekson, 2016, p. 101). Our reintroduction and reformulation of the CIB perspective (Elert and Henrekson, 2019a) resulted in a fruitful debate involving several entrepreneurship scholars (Lucas, 2019; Foss et al., 2019; Bylund, 2019; Elert and

¹ Christopher Freeman, B.-Å. Lundvall and Richard Nelson jointly pioneered the national system of innovation approach in the 1980s, which was developed into the systems of innovation approach in an extensive effort by a group of scholars in the 1990s (see Edquist, 1997). Many of them had close ties to the Science Policy Research Unit (SPRU) at the University of Sussex and its founder Christopher Freeman. This is also true for Mazzucato, who was the RM Phillips Professor in Economics of Innovation at SPRU in 2011–2017.

Henrekson, 2019b). We have applied the perspective to analyze what the European Union should do to become an entrepreneurial society (Elert et al., 2019), to better understand Sweden’s transformation into an entrepreneurial economy (Elert and Henrekson, 2020), and recently took stock of what the perspective has taught us (2021).

Figure 1. The collaborative innovation bloc—an overview.



Source: Elert and Henrekson (2021).

Figure 1 provides an overview of the structure of skills that, according to the CIB perspective, are required to take an idea from inception to commercial use (e.g., Fenn et al., 1995; Gompers and Lerner, 2001). The skills and resources must be mobilized by drawing upon skill pools with six distinct, stylized skills: entrepreneurs, inventors, key personnel, early-stage financiers, later-stage financiers, and customers (Elert and Henrekson, 2019a). One person can embody more than one skill, but it is useful to consider them as distinct functions embodied by separate actors. For example, entrepreneurs generally have an overall understanding of how to exploit an opportunity but may lack specific knowledge regarding relevant technologies. Conversely, there is no reason to assume that inventors have a comparative advantage in bringing new ideas to

the market as a good or service. In fact, Schumpeter (1934) distinguished between inventors and entrepreneurs, but the nuance was lost when modern growth models (e.g., Romer, 1990) collapsed invention, innovation, and commercialization into one decision (Acs and Sanders, 2013).

Entrepreneurs are regularly the prime movers: most ideas and inventions originate with them or with inventors (Baumol, 2005). To commercialize the ideas, an entrepreneur or a group of entrepreneurs decides to create new collaborative teams, searching for and attracting the skills they perceive to be necessary to realize their projects. In this role, entrepreneurs benefit from the skill pools in existing CIBs but also create new blocs and help existing CIBs evolve. If their innovations are sufficiently disruptive, they can also cause the demise of existing CIBs (Beltagui et al., 2020). The process frequently begins when an entrepreneur identifies and attempts to develop a potential opportunity into a successfully commercialized innovation together with an *inventor* and a small number of *key personnel*. Financing is critical in this uncertain, experimental stage. *Early-stage financiers* like VC firms usually propel the project into a scale-up phase, during which the conjectured entrepreneurial profits can be realized (assuming the project reaches this point). While VC firms can substantially reduce uncertainty by concurrently investing in many young firms, entrepreneurs typically invest all their human capital and most of their financial assets in their venture, thus being unable to mitigate any uncertainty through diversification (Knight, 1921). A varied and competent VC industry is, therefore, a crucial aspect of the early-stage selection machinery of the CIB.

To scale up the business to a full-grown firm, entrepreneurs also require more *key personnel*, permitted and able to act upon the knowledge only they possess to promote intra-firm discoveries (Foss, 1997). When these conditions are met, the firm should react quickly to change and encourage innovation by way of intrapreneurship. Eventually, *later-stage financiers* assume responsibility for financing, which may be substantial. At this point, the innovation may have resulted in the emergence of new firms as perceptive competitors begin imitation efforts. The market grows through the operational scaling-up of activities resulting from differential growth and selection (Metcalf, 1998), ultimately resulting in the emergence of a new industry.

Most ideas do not get this far—most business ideas and businesses fail (Hall and Woodward, 2010). Moreover, the ideas that are eventually commercialized may differ substantially from the idea that provided the igniting spark. Especially in the early stages,

customers acting as demanding collaborators may be essential sources of information and offer critical inputs and feedback that shape emerging innovations (Bhidé, 2008; von Hippel et al., 2011). Errors are ubiquitous in this process, but so are plan and error corrections, as actors find ways to cross technological, economic, social, and institutional hurdles through trial and error and learning by doing, guided throughout this search by markets and prices.

3 How do “modest” interventions affect CIBs?

Before turning to the issue of how government interventions, especially mission-oriented innovation policy, affects CIBs, we should note that most CIBs are subject to an entanglement between the economic and political realms. First, politically instituted rules and regulations fundamentally affect the strength of interactions between the different actor categories, their incentives to acquire and use skills, and ultimately the quality of the collaborations that come about (as discussed in all our previous articles on the subject, most recently Elert and Henrekson, 2021). Moreover, political appointees and state-owned firms can be big players in a CIB (though they exert influence rather than control (Wagner, 2016), e.g., as important customers or financiers. This is the realm of direct government involvement, the scope of which can differ widely. Before discussing mission-oriented innovation policy, we will devote a few words to more limited interventions.

No specific agent inside or outside of the innovation bloc is in charge in the CIB – in fact, no one understands more than a fraction of the ecosystem’s inner workings (cf. Autio, 2016). In fact, the uncertainty shrouding all innovative efforts is a central reason why top-down “command-and-control” approaches should be undertaken with great humility. Because we are effectively dealing with a complex system, misguided policy interventions need not only be ineffective; rather, effects can be cascading, spelling doom for the entire CIB. And while the inverse – that good policy interventions may have beneficial spillovers for all actors in the bloc – may also be correct, the likelihood of being wrong in the context of a CIB is arguably at least as large as the likelihood of being right. After all, most business ideas do not survive, hence the strategy of spreading “attempts in as large a number of trials as possible” characterizing much of venture capitalism (Taleb, 2012, p. 235). Those ideas that do survive will usually do so not because they were perfect from the start but because their creators/caretakers responded to

everchanging conditions, adapting their ideas until they became marketable. Adding more (public or private) money does not change these fundamental facts.

Analyzing (fairly) limited state interventions and how they affect CIBs is attractive because they are more tractable, at least on paper, though there is no shortage of such instruments. In a survey, Bloom et al. (2019) argue that the top five policies for boosting (technological) innovation is as follows: i) offering tax incentives for R&D, ii) promoting free trade, iii) supporting skilled migration, iv) training workers in STEM fields, and v) providing direct grants for R&D. Among other strategies that *may* boost innovation, meaning the evidence is not yet in, they list i) providing incentives for university researchers, ii) engaging in intellectual property reform, and, interestingly iii) embarking on mission-oriented projects. While it is encouraging that policy levers (tax incentives and grants) aimed at increasing R&D seem to work, it is noteworthy that Bloom et al. (2019) essentially offer no real definition of innovations. Instead, they (subconsciously) seem to subscribe to a Schumpeter Mark II view of the world (Malerba and Orsenigo, 1995), effectively equating innovation with R&D except in a few instances. To us, this is obviously a far too narrow and mechanistic view of what innovations are and how they come about. In fact, a key point of the CIB perspective is that R&D is – at best – just an igniting spark to create an innovation that benefits consumers.

4 How does mission-driven innovation policy affect CIBs?

Mazzucato (2018) argues that mission-oriented innovation policies (should) tackle grand challenges such as climate change, demographic, health and well-being concerns, and the difficulties of generating sustainable and inclusive growth. Her article presents six lessons that policymakers should draw on to make such missions a reality, based on evidence from previous mission-driven innovative projects. It is an informative read, though as Bloom et al. (2019, p. 179) put it when discussing mission-oriented policies under the label moonshots, “it is difficult to bring credible econometric evidence to bear on the efficacy and efficiency of moonshots. [They] are, by nature, highly selected episodes with no obvious counterfactuals.”

This seems to us the nature of many economic puzzles of real significance. Absent natural experiments offering reliable identification, what researchers can do is effectively to observe patterns, and judge these patterns according to what essentially amounts to an aesthetical standard (Klein, 2012). When it comes to mission-oriented innovation policy,

our view is that reasonable people can disagree on this standard. Mazzucato (2018, p. 805) argues that missions

should be feasible, draw on existing public and private resources, be amenable to existing policy instruments, and command broad and continuous political support. Missions should create a long-term public agenda for innovation policies, address a societal demand or need, and draw on the high potential of the country's science and technology system to develop innovations.

Her subsequent list of key lessons (section 3 of her article, pp. 805–809) are summarized as a new approach to policy making (p. 809) and contrasts her approach with an older approach to missions-oriented projects (based on the so-called Maastricht Memorandum). We use her lessons as titles for the following six subsections, addressing each of them in turn. The purpose is not to refute them (though sometimes we will), but to see what insights can be yielded by seeing them through the CIB perspective.

4.1 From picking winners to picking the willing

Deciding on a mission is about deciding that a transformation of society must be made, implying that choices must be made. This, in Mazzucato's view, is not about picking winners, but rather about "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 societally relevant mission" (Mazzucato, 2018, p. 806). Can this be considered as anything other than semantics, substituting one word for another in order to make corporate handouts sound more palatable? We struggle to see how.

Here, the CIB's spotlight on actors' interactions is helpful for understanding how and why entrepreneurial plans are reformulated, revised, or even abandoned over time. These are necessary steps if an idea is to achieve success as an innovation benefiting consumers. It is important to understand which steps were missed when such a success failed to materialize and whether this "failure" was a good or a bad thing, but the government is seldom better placed to do so than private actors. To appreciate these points, one should recognize that a well-functioning CIB facilitates the joint mitigation of two error types (Eliasson, 2000).

The first error type is that of rejecting winners. Such missed opportunities often result from excessive pessimism on the part of entrepreneurs or other actors, and it is, we contend, from the fear of this type of error that the mission-oriented innovation argument draws much of its appeal. The other error type is perhaps more subtle, relating as it does to spurious discoveries that occur when an individual has partially or completely misread

the data, thereby allowing failed projects to survive for too long. Market forces tend to systematically eliminate such errors as “market experience reveals the unfeasibility of some (hitherto sought after) courses of action and the (hitherto unnoticed) profitability of other courses of action” (Kirzner, 1997, p. 71).

The two error types are linked and omnipresent. For example, if “picking the willing” entails accepting a project that one “should” reject, it becomes impossible to put the resources that go into that project to alternative use. Collaborations in CIBs are essential for identifying and correcting such errors early and at the lowest cost possible. Having the government pick the willing/winners hampers this crucial function, and because CIB actors are interconnected, the consequences will be cascading. Thus, even the selection of a relatively small number of winners may create an imbalance throughout the CIB (or system of CIBs), with unfortunate consequences for the long-term ability to select those innovations that benefit consumers the most. This can be appreciated by considering governmental grants intended to stimulate innovation and growth. Swedish evidence suggests that “highly productive entrepreneurs abstain from seeking grants, moderately productive firms allocate a share of their effort to grant seeking, and low-productivity firms allocate most resources to seeking grants,” but that receiving a grant negatively affects firm productivity and that several grants do so even more (Gustafsson et al., 2020).

Still, mission-driven projects often have an end-goal that cannot be directly measured in terms of profit and loss (or productivity), meaning the market selection mechanism for having the winners emerge bottom up through the CIB may be a poor (or at least inadequate) guide. An urgent mission may require selecting winners through some other mechanism. Mazzucato (2018, p. 806) states that “[a] mission-oriented approach uses specific challenges to stimulate innovation across sectors.” Possibly, she here refers to innovation prizes of the kind that were common in the 18th and 19th centuries, yielding substantial progress in such varied fields as navigation, air voyage, and food preservation (Abramowicz, 2003). Currently, they are used by private organizations like the XPrize Foundation and, incidentally, by DARPA. The competitions stipulate a clear goal to be achieved – say the development of a climate-neutral technology for transportation – but can be formulated in an open-ended way technology-wise. Furthermore, innovation prizes are exempt from the welfare loss that comes from the monopoly rents associated with patents (Adler, 2011) and do not require an extensive bureaucracy that assesses and evaluates proposals and credentials *ex ante*. The use of such prizes to select winners

would combine a minimal risk to taxpayers with innovation encouragement that does not commit to specific firms or a particular technology, hence decreasing the risk of cascading errors in the CIB (Elert et al., 2019).

4.2 From fixing markets to actively co-shaping them

“Missions do not fix existing markets but create new markets,” Mazzucato (2018, p. 806) states, offering examples from the “three classic mission-oriented agencies” NASA, DARPA, and NIH to exemplify the point that the “organizations are not about fixing existing markets but creating new landscapes.” This argument (developed further in Mazzucato, 2016) is indeed ambitious. At the same time, CIB activity rarely if ever takes place in a free market devoid of political influence. In fact, central segments of many advanced economies are heavily regulated or even monopolized by the public sector, especially the provision of private good social services such as health care, care of children and the elderly, and education (Andersen, 2008; Henrekson and Johansson, 2009). Some of these markets may be thought of as both created and maintained by the government.

Considering how this involvement affects CIBs is useful. For example, a government monopolizing both production and financing (or only production) will severely curtail the role of CIB actors meaning a sufficient variety of actors with requisite skills and skin in the game will fail to emerge. In practice, it is only under free private provision of goods and services and private financing that incentives for all CIB actors can be harmonized. Moreover, even when private production is allowed but the government remains the sole buyer of goods and services, CIB development will suffer because the government *qua* monopsonist hampers the crucial function of consumers in the CIB. They are, after all, the ultimate arbiters of an innovation’s success – those whose preferences (rather than those of the entrepreneurs) essentially govern all CIB activity.

Supplanting this broad and diverse category by the state will likely have profound effects. After all, the consumer role is far from passive; rather, a nation’s wealth rests crucially on its “venturesome consumption” – the willingness and ability of intermediate producers and individual consumers to take a chance on and effectively use new know-how and products (Bhidé, 2008). In addition, a sophisticated, active demand is a *sine qua non* for industrial success (Porter, 1990), which likely explains why modern markets for industrial goods and services are typified by open-ended relational contracts and long-term demand–supply relationships between business partners who know each other (Kasper et

al., 2014). Thus, small and large consumers matter, and their opportunities to act competently are severely curtailed when a certain service or good can only be offered by a government-commissioned provider who typically has a limited scope for acting entrepreneurially by offering and charging for additional services on top of what is granted through the tax-financed system, impeding the back-and-forth bargaining that characterizes evolving market relationships.

Thus, while mission-oriented innovation projects can be justified because problems are urgent, it is important to be aware of the potentially adverse implications for the long-term generation of innovations in such markets caused by the hampering of a crucial (and far from passive) actor. Something similar occurs when the state offers government grants to stimulate entrepreneurship (as discussed in section 4.1), stripping consumers of their role as final arbiters, giving it to a bureaucrat or government agency who may or may not have preferences reflecting those of consumers. From a strict efficiency perspective, this seems unsound – but from other perspectives? The whole of a mission-oriented project may be that the bureaucrat *should* have different preferences, promoting things that cannot survive on a private market but are deemed valuable in some other sense (say, solar energy to combat climate change). Again, many real-world puzzles can only be judged according to some aesthetical standard (Klein, 2012), on which reasonable people can disagree.

In summary, a mix of public financing and private provision does not preclude CIBs, but they are likely to be insufficiently coalesced to generate innovations in the long run. Still, permitting private provision is better than not doing so. Indeed, it has been shown that opening previously monopolized markets to private providers has led to impressive performance of high-growth firms suggesting that there is a large untapped potential for this in sectors such as health care, education and care of children and the elderly (Andersson et al., 2019). Sweden offers several illustrative examples in this respect, e.g., the voucher system for school choice introduced in the early 1990s, which paved the way for several high-growth firms in the area. At about the same time, local governments began to outsource health care, spawning several high-growth firms, some of which have become multinational (Blix and Jordahl, 2021).

4.3 From fearing failure to welcoming experimentation

Here, Mazzucato (2018, p. 807) embraces what in, e.g., Harford's (2011) view (and ours), should guide private and public initiatives of all kinds. "Because innovation is extremely

uncertain, the ability to experiment and explore is key for a successful entrepreneurial state”, she writes. “Therefore, a crucial element in organizing the state for its entrepreneurial role is absorptive capacity or institutional learning ... Governmental agencies learn in a process of investment, discovery, and experimentation that is part of mission-oriented initiatives.” Yet, it is one thing to say that actors should experiment and learn, and another to appreciate how this is done; and how learning differs between private actors staking their own money and public actors staking tax-payer money.

CIBs are experimental at their core, with frequent failure being inevitable and sometimes even desirable. Unsuccessful projects are not necessarily a waste of resources; failures provide actors with valuable information on a business model’s viability. This “process of learning by trial and error ... must involve a constant disappointment of some expectations” (Hayek, 1976, p. 124). The process will be quicker and less costly if entry and expansion, as well as contraction and exit are easy. Indeed, empirical research shows that a higher turnover of companies leads to a more competitive economy both nationally and regionally, boosting the number of high-growth firms (Brown et al., 2008; Heyman et al., 2019). Conversely, business failures can stimulate firm founding by opening new opportunities, enabling knowledge spillovers, and making additional resources available (Hoetker and Agarwal, 2007). Indeed, more lenient bankruptcy laws are associated with higher rates of venture formation (Peng et al., 2009), to the point where “lowering barriers to failure via lenient bankruptcy laws encourages more capable – and not just more – entrepreneurs to start firms” (Eberhart et al., 2017, p. 93).

How, absent turbulence driven by markets and ultimately by what citizens *qua* consumers want, do mission-driven innovation agencies determine what is a failure and what is success? Innovation prizes (section 4.1) may be one way to do so. Other hints may be found in what Azoulay et al. (2019) label the “ARPA model” of mission-oriented research to generate breakthrough innovations. These authors argue that successful examples of such ambitious initiatives are characterized by decentralization, active project selection, tolerance for failure, and organizational flexibility. Essentially by mimicking the way markets work, we should add. While it is difficult to see how actors are to have the incentives to alter plans when they lack market actors’ skin in the game, government agencies are likely to be more successful in doing so when embracing and maintaining an experimentally oriented political and bureaucratic culture lauding experimentation.

But how? To us, at least, the current democratic and media-driven system appears highly intolerant against public sector failure, though we disagree with Mazzucato that this entirely inhibits politicians from taking risks (with someone else's money). Politicians do take risks; however, while they are usually ready to take credit for risky projects when they succeed, they are also ready to blame a scapegoat, usually a bureaucrat, an agency, or "the market," when projects fail. Mazzucato would likely counter with her juxtaposition between Solyndra – seen as a government failure – and Tesla – seen as a private success, even though both firms got government money.² While that narrative exists, so do narratives blaming private actors for virtually every financial crisis that has ever happened.

4.4 From a focus on quantity of finance to a focus on the quality

Whereas Mazzucato (2013, p. 40) argues against subsidies to R&D, this seems to be a matter of how. According to Mazzucato (2018, p. 808), several mission-driven institutions "have been critical to basic research", and continue to be so today, with the rise in R&D expenditure, e.g., by NIH being "a deliberate and targeted choice on where to direct public R&D funding." She is certainly not alone in seeing R&D as key to innovation; indeed, this is a core assumption in much of the mainstream entrepreneurship and economics literature considering innovative activities as the result of systematic and purposeful efforts to create new knowledge by investing in R&D, followed by commercialization (Audretsch et al., 2006; Chandler, 1990). From the CIB perspective, the ancillary idea that more R&D spending is the tool that will promote innovation reveals an overly mechanical view of how the economic system works, neglecting other means of innovation, such as learning-by-doing, networking, and combinatorial insights (Braunerhjelm, 2011). Bhidé (2008) even argues that turning a high-level idea (available to anyone once produced) into a commercially viable product seldom involves much high-level R&D.

Although high R&D spending can be a necessary component of a thriving economy, it is far from sufficient, and a policy of increased government R&D spending or subsidies will not necessarily result in more economically valuable knowledge (Da Rin et al., 2006). Spillovers, after all, do not need to be positive. Public R&D can crowd out private R&D,

² Solyndra was a California-based manufacturer of thin film solar cells. The company was once touted for its unusual technology, but declining silicon prices made the company unable to compete with conventional solar panels. Solyndra filed for bankruptcy in 2011 and the U.S. government lost more than USD 500 million based on a loan guarantee (Groom, 2014).

as attested by the fact that the share of R&D in the business sector that is directly or indirectly funded by the government is lower in countries with high R&D spending by business enterprises and higher in countries with low business spending (Elert et al., 2019). Furthermore, R&D is an *input* in the production process; the desired output from the CIB perspective is higher value creation, which depends on many more steps along the way.

This is not to neglect the role of the state, but to nuance what the state does: A broad policy program conducive to innovative entrepreneurial venturing will likely spontaneously increase R&D spending and allocate it efficiently as a side effect. In contrast, if a healthy system of CIBs is not already in place, a government R&D push becomes a waste of resources, directing focus and resources towards factors that would have found better use elsewhere. It should be clear by now that the CIB perspective judges it virtually impossible for a bureaucracy to “pick the winners,” which is why spontaneous, demand-driven increases in R&D expenditures should be preferred to any top-down designed alternatives. Thus, policies and reforms should aim to mobilize and incentivize the available resources, including R&D, to flow to their most productive use. This implies that R&D – and ultimately, scientific knowledge and innovation – is most effectively promoted through the pull of demand rather than the push of supply.

So, what happens to the CIB when the government nevertheless opts to stimulate R&D? Both tax incentives and subsidies appear to promote this, as well as policy measures increasing the supply of skilled labor (whether through freer migration or STEM-education policies) (Bloom et al., 2019). CIB effects from such efforts primarily accrue to two actor categories: inventors and key employees. Ideally, these skill pools should see an increase both in their breadth and their depth, to the benefit of the entire CIB. However, this consequence rests on the assumption that the skill pools did not already have sufficient breadth and depth, a debatable empirical fact, to say the least. As pointed out by Lucas (2019) in an article arguing that the CIB perspective needs public choice, actors thus supported are likely to become a politically relevant interest, using its power to suck up resources when they could be put to better use elsewhere.

Making a particular type of key personnel less scarce than it should be could fundamentally alter entrepreneurs’ calculus when putting together a collaborative team, skewing things away from what would be “desirable” in the non-subsidized case. As Bhidé (2008, pp. 150–151) puts it, “the commercial success of innovations turns not just

on the attributes of the product or know-how, but on the effectiveness and efficiency of the innovator's sales and marketing process." The result may be too much knowledge generation at the expense of knowledge exploitation or diffusion, too great a reliance on technological innovations relative to process innovations, or too much focus on product development with too little effort put into marketing and sales. Or, maybe the intervention achieves the optimum level of the that skill pool in order to achieve as a great an innovation output as possible. The counterfactual is muddy, which is precisely the point. In complex, interconnected systems, even relatively targeted, relatively limited interventions can have far-reaching, unforeseen repercussions.

4.5 Engagement

Next, Mazzucato (2018, p. 808f) argues against an older view of missions where stakeholders are fewer in number and things are, generally, less democratic: "Understanding how the definition of missions can be opened up to a wider group of stakeholders, ... is a key area of interest," she states, and this "is tied to rethinking the notion of public value" as opposed to pure economic notions of "public good." We willingly acknowledge this point. Democratically elected public officials and their bureaucrats *should* take the will of its citizenry into account, meaning mission-oriented innovation policy should reflect principles of democracy and inclusion rather than autocracy and exclusion.

However (returning to our point in section 4.2), the state taking on the role of buyer in a mission-oriented project puts under scrutiny the question of precisely who the innovation generating system is for. A normative underpinning of the CIB perspective is that innovations should increase prosperity and the quality of life of a country's citizens, with buying and selling and foregoing other options being an obvious way for those citizens, in their role as consumers, to express what they value at a specific point in time. Introducing the state as a middleman interpreting the will of citizens seems a roundabout way of achieving this goal, even when democratic checks and balances are present. Again, this may be an issue of aesthetics, on which reasonable people can agree. Still, as we have stressed, sometimes the whole point, from the perspective of a mission-oriented project, may be that the bureaucrat *should* have different preferences than citizens *qua* consumers, promoting the next generation of solar energy or other things that cannot (yet) survive on a private market but are deemed valuable in some other sense. Does this mean that

mission-oriented innovation projects derive some of their value from not taking their citizens (short-term? irrational?) preferences into account?

We are unsure. Saying that values other than those that can be expressed in monetary terms “matter” can be an easy way out for people wishing to promote *their* pet project – or reveal thoughtful criticism of the present day’s “post-modern” sclerosis where the only acceptable criterion to gauge success, paradoxically, has become the corporate bottom-line. Failing to consider economic realities – market forces, CIB collaborations, etc. – when planning a project is, in our view, tantamount to ignoring gravity when building a bridge, but it is not the only thing that should be considered. It is an entirely different matter to distill what the public wants (or what it does not want but needs!), i.e., weigh these “other things” and aggregate them in a manner that leaves everyone better off. Possibly, Mazzucato’s reaching out to a wider group of stakeholders is a way to do this, but who can be sure they do not end up as rent-seekers striving to get as big a part of the mission-oriented pie as possible? Sometimes, a thin line separates public interest from public choice.

4.6 From de-risking to sharing both risks and rewards

Mazzucato (2018, p. 809) argues that “(m)issions require a vision about the direction in which to drive an economy, focusing investment in particular areas, not just creating the horizontal (framework) conditions for change.” Moreover, “these types of investments are often those that private venture capitalists are not willing to make due to their exit driven model that seeks short-term returns (usually 3–5-year cycles) ... some have argued that it is precisely this short-termism that has caused problems in sectors like biotechnology.” Therefore, the government should act as venture capitalist as regards mission-oriented projects, sharing the risks *and* the rewards of its investments (cf. Mazzucato and Penna, 2016).

From a CIB perspective, the “short-termism” of VC is not to be lamented. It is merely an acknowledgment of specialization, and the fact that early-stage financiers (angels, VC firms) and later-stage financiers (buyout firms, etc.) add different things at different points of an innovation’s journey. Thus, if VC does not exit at an early stage, it can probably not be considered VC. Nor is their role easy to mimic: the process of evaluation in the private VC industry is highly complex and typically includes tacit judgments. VC firms also perform important screening functions and contribute management and market expertise. Such non-financial value appears to be a main driver of the superior performance of

firms backed by early-stage financiers (Croce et al., 2013; Landström and Mason, 2016). Sure, VC actors are at best moderately successful in picking the winners among high-risk projects (Gompers and Lerner, 2004; Svensson, 2008; Gompers et al., 2009), but that is the point of VC's many buckets strategy. Also, there is little empirical evidence to suggest that politically controlled organizations are better placed in this respect (Baumol et al., 2007, p. 220); governmental venture capital appear to promote less innovation than private or mixed venture capital (Bertoni and Tykova, 2015) and private-backed firms seem to have better exit performance (Cumming et al., 2017). One likely reason for the discrepancy is that governmental entities base their decisions on political rather than commercial criteria. As our discussion suggests, however, this may be considered a feature rather than a bug of a mission-oriented project.

Second, while it may certainly be possible that the state can pool risks in a way that venture capitalists cannot, the very essence of the VC business model is precisely to convert high-risk opportunities to a more acceptable risk level through portfolio diversification, thereby aligning the incentives of investors, VC firms, and entrepreneurial founders. To the extent that the state is “better” at risk pooling, this seems to be because it essentially spreads the costs of its failed VC investments over all taxpayers. Which is to say that Mazzucato's (2018) suggestion that the taxpayer should also reap the rewards of successful projects seems fair (*if* the state acts as a venture capitalist). Still, the problem remains that the cost/benefit to each taxpayer will be so small to be trivial, and the cost to the VC-bureaucrat non-existent since he/she gets a salary anyway. This lack of anyone with true skin in the game will substantially decrease the incentives to learn from failures, or even result in a “failure to fail,” to borrow Lucas's (2019) terminology.³

According to Bloom et al. (2019), “removing constraints on the development of an active early-stage finance market (like angel finance or venture capital) might be a reasonable policy focus” to promote innovations. These sectors have been impeded historically in many countries. This was also true for the United States until a set of reforms around 1980 paved the way for the modern VC sector, without which there likely would not be any Silicon Valley to talk about (Henrekson and Rosenberg, 2001; Fenn et al., 1995).

³ As an example, Swedish governmental venture capital often seems to result in “exits by share buybacks to the original entrepreneur[, which] indicates that many investments in practice were used as long-term loans by the entrepreneurs” (Wennberg and Mason, 2018, p. 85). For a treatment on why a large part of returns need to be in private VCs' hands even in public-private VC collaborations, see Jääskeläinen et al. (2007).

These policy prescriptions essentially entail capital gains taxes, the effective tax treatment of stock options in young entrepreneurial firms, and the right for pension funds to invest in high-risk securities including VC funds. The recipe seems to work to unleash VC as a driver of creativity and innovation where it has been tried.

In addition, a reasonable “compromise” (between those in favor of and against the state acting as a venture capitalist) can perhaps be found when pondering the current trend of a progressively larger share of savings going into pension funds, which is unlikely to reverse anytime soon (OECD, 2018). Elsewhere, we have argued that at least part of these assets should be allowed to be invested in equity in general and venture capital specifically, thus reaching not only real estate, public stocks, and high-rated bonds but also entrepreneurial firms. This seems to us like a no-regret policy lever, as it achieves greater risk-pooling while utilizing people’s specific knowledge of the circumstances of time and place, unleashing the creative power of a myriad of people. We should add that such a move does not bias the flow of capital toward a particular sector; rather, it makes sure that doors are opened for entrepreneurial firms that were previously only open for large incumbent firms (Elert et al., 2019).

5. Conclusion

Mazzucato paints with broad strokes, both in her books and in the article under discussion. When discussing her six lessons, we occasionally did the same. That said, we hope our comments and criticisms have embodied some level of concreteness. We conclude by briefly summarizing our view of her lessons:

- 1) *Picking the willing* is just another way to say picking winners. While it may limit the risk of unwarranted failures in the CIB, it will inevitably increase the risk of unsound economic ideas surviving for too long.
- 2) *Actively co-shaping markets*, even creating new markets, is something most governments do. It is sometimes warranted but will result in problems. This is especially the case if government policies curtail consumers, who are the final arbiters of an innovation’s success in the CIB.
- 3) *Welcoming experimentation* (instead of fearing failure) is a laudable goal. Yet, the evidence strongly suggests that market selection (through entry, exit, contraction, and expansion) offers a way for private actors to learn from such experimentation (and incentives to care) in a way that is unavailable to public actors.

- 4) *Focusing on the quality of finance* (rather than the quantity) may entail government investments in R&D, but too much emphasis on R&D rests on a far too narrow and mechanical view of how innovation comes about. R&D is an input in a production process whose desired output – higher value creation – depends on many more steps along the way.
- 5) *Engagement*, i.e., democratization and including more stakeholders, is of course laudable for government projects. Yet one may wonder if the citizen *qua* consumer is not better placed to decide what he/she wants than the government agency.
- 6) Finally, the idea that governments should *share both risks and rewards* if they engage in VC activity is reasonable. Yet, the argument that they should do so rests, in our view, on a flawed idea regarding what early- and later-stage financiers should do, wrongfully labeling sound investment behavior as shortsightedness.

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