Innovation Bureaucracy: Does the organization of government matter when promoting innovation?

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The high administration of society embraces the invention, examination, and execution of projects useful to the people. The high administrative capacity thus involves three capacities: the capacity of the artists, the capacity of the scientists, and the capacity of the industrialists, whose collaboration fulfills all the conditions necessary for the satisfaction of society’s moral and physical needs.

Henri Saint-Simon

Abstract

Current research on how to organize the role of government in innovation – both how governments support innovation in markets and how governments achieve innovations within public organizations – converges around a rather simplified single-organization explanations: innovations are driven by either (Weberian) elite expert organizations or (Schumpeterian) fluid peripheral organizations. We show that looking at history of innovation bureaucracy, a more complex picture emerges: historically we find a rich organizational variety for implementing diverse innovation policy goals. We show that historically the organizational variety is, first, driven by highly diverse public-private relationships; and second, the variety itself is an important factor in success and failure of innovation policies. Combining analytical lenses created by Weber and Mintzberg we build analytical framework based on routines and capacities to analyze organizational variety in innovation bureaucracy. We show how different kinds of public organizations are successful at delivering different kinds of innovation policy goals. Particularly important is the distinction between organizations capable of innovations in policies vs organizations supporting innovations in private sector. We finish with discussing the importance of organizational variety for the concept of entrepreneurial state.

Introduction

Gustav von Schmoller complained more than hundred years ago that Smithian economists assume that well functioning public bureaucracy and orderly finances are a given and that this assumption leads them to numerous mistakes. (1900, 292) Similarly, Richard Nelson and Sidney Winter reminded us more than 30 years ago: “If one views policy making as a continuing process, the organizational and institutional structures involved become critical. Public policies and programs, like private activities, are embedded in and carried out by organizations. And, in a basic sense, it is the organizations that learn, and adapt. The design of a good policy is, to a considerable extent, the design of an organizational structure capable of learning and of adjusting behavior in response to what is learned.” (1982, 384-385) Yet, most

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current innovation policy\textsuperscript{2} debates have one thing in common: implementation of policies is often assumed to be exogenous to policies; what matters is the policy choice (e.g., what kind of R&D tax breaks work? should we have a public venture capital fund?), and not how this choice is designed and implemented, and by whom. Thus, there’s an inherent \textit{policy bias} when we typically talk about innovation and the state.\textsuperscript{3} This is in quite a stark contrast to private sector innovation discourse where innovation is often related to implementation (e.g., how to keep creativity in an organization? how should we engage with clients, partners?). (See Lam 2006 for an overview) Such asymmetry is also reflected in research: while studying public sector organization of innovation is even among Schumpeterian/evolutionary economists relatively rare, then studying private sector organization of innovation is a venerable field of research and teaching. This essay sets out to show that public sector organization of innovation – implementation of various innovation policies – greatly matters to society’s successes and failures in trying to promote innovation and technological advance. We call these organizations innovation bureaucracy: public sector organizations tasked to enhance innovation and technology (via funding, regulating, procuring).

In a recent paper, Breznitz and Ornston (2013) analyze the evolution of the Israeli and Finnish innovation policies and argue that peripheral Schumpeterian agencies may be the sources of \textit{policy innovations} necessary for promoting \textit{rapid innovation-based competition}, given that these agencies have sufficient \textit{managerial capacities} (or slack).\textsuperscript{4} Arguably, the peripheral status (and little prestige and resources) is important to reduce the likelihood of political interference and allow space and create organizational need for \textit{policy experimentation} (and innovation), but also for new forms of public-private interactions (while avoiding capture by special interests) as these agencies are unable to tap into existing political, financial and institutional resources.\textsuperscript{5} Importantly, they claim that these findings contradict the earlier development and innovation policy research (from Johnson 1982; Wade 1990 to O’Riain 2004; Block 2008) that argued in favor of key nodal or central pilot agencies (also referred to as \textit{Weberian agencies}) as the source of developmental/innovation policy success or impact.\textsuperscript{6} Particularly East Asian \textit{developmental state} scholars –

\textsuperscript{2} Here and below we use innovation policy in the widest possible sense: in our view it includes all public policies that consciously aim to promote innovations and technological change. On why such usage might be justified, see Lundvall 2013.

\textsuperscript{3} In all of the recent larger evaluations of innovation policies, implementation issues have not received any attention. Such evaluations discuss in detail the effectiveness of various policies and policy mixes, but not whether design and implementation of these policies and policy mixes plays any role in the effectiveness. See European Commission 2013 and Manchester Institute of Innovation Research 2012. OECD country studies of innovation policy typically describe implementing agencies but rarely go into analytical details (e.g., whether a success of a measure has anything to do with the agency implementing it or not).

\textsuperscript{4} This tallies also somewhat with findings in public administration research that autonomous agencies with large managerial autonomy combined with strict performance controls – in another words, new public management style agencies emerging in 1990s – are rather innovation-oriented culture. (Wynen at al 2013) However, this is based on self-reported (by organizations) innovativeness and thus has to be taken with some caution.

\textsuperscript{5} They also recognize that the success of the peripheral agencies may lead them to become (politically) more central and reduce their capacity for policy innovation.

\textsuperscript{6} This is best captured by Chalmers Johnson and his concept of \textit{developmental state}: a country with predominant policy \textit{orientation towards development} supported by small and inexpensive \textit{elite bureaucracy} centered around a \textit{pilot organization}, such as MITI, with \textit{sufficient autonomy} (limited intervention by the legislative and judiciary) to identify and choose best industries to be developed and
Amsden (1989), Evans (1995; Evans and Rauch 1999), Haggard (1990; 2004), Wade (1990) – turned the concept of *highly capable bureaucracy* (together with a specific notion of embedded autonomy) into a crucial variable explaining the strong state-led development performance of East Asian economies and beyond. This line of research has *assumed* that whatever the policy and institutional variety between specific economies, bureaucratic capacities can be best developed and best talent recruited and motivated via *Weberian means* of *meritocratic recruitment* and *career management* to make working for government either financially competitive to, or culturally even more rewarding/prestigious than working in the private sector. Evans and Rauch (1999) cemented these ideas through a more quantitative analysis that only tested the importance of some of the Weberian elements (merit-based recruitment and Weberian career systems) on a much broader sample of countries as a whole without explicitly looking at innovation/development agencies/bureaucracies as explicit cases (see also Rauch and Evans 2000).

Paradoxically, it is almost never explicitly defined in any of the abovementioned research what is actually an innovation or developmental agency. Johnson (1982) looked at a *ministry*, later analysis of South Korea and Taiwan have emphasized *planning and policy coordination boards* (Cheng et al. 1998), often set-up on purpose *outside* usual career-system and examinations. Evans and Rauch’s (1999) empirical study of 126 countries does not differentiate systematically between ministries, development boards and other government organizations. Neo-developmental state research has looked at a *research-funding agency* (DARPA in the US – Block 2008), *industrial development agency* (IDA in Ireland – O’Riain 2004; Breznitz and Ornston 2013 argue that peripheral agencies in Ireland have been IDA’s sub-divisions, i.e. subunits within an organization). Breznitz and Ornston (2013) look at a *ministerial department*, or *office* (Office of Chief Scientist in Israel) and a *foundation* supervised by a central bank and later by parliament (Sitra in Finland). These organizations have highly diverse tasks and positions within broader public management and innovation systems; they differ in structure, size, skill-sets etc. In sum, it seems that their selection as cases to be analyzed is determined by their importance as *change agents* within specific innovation systems that have specific bottlenecks and failures that these agents have helped to overcome. In other words, their definition and selection as innovation agencies is determined by their *performance* on the system/policy level.

In the context of public sector innovations we see a somewhat similar trend where organizations tasked with innovating within public organizations or services (innovation or design labs, ilabs in short), tend to be established as at arms length to choose the best-fitting policy instruments (from administrative guidance to control over finance and regulation of competition) while still maintaining *market-conforming methods of state intervention*, and *public-private cooperation* in state-business relations (Johnson 1982, 305-320).

1 Johnson (1999) has argued that his original goal was to highlight the uniqueness of the Japanese development, limits to its emulation, and not to present Japan as a model. Only since the late 1990s have some studies tried to replicate the original claims of Johnson (see Cheng et al. 1998; Kang 2002; 2002b). See also Evans 1998.

8 Their original questionnaire (available here: [http://econweb.ucsd.edu/~jrauch/codebook.html](http://econweb.ucsd.edu/~jrauch/codebook.html)) does not in fact contain any questions about institutional or organizational structures, or about their politico-administrative position in policy systems, or about capacities. This is all the more striking as the period they cover – 1970-1990 – saw in many countries arguably the deepest administrative reforms of past 100 years, namely the rise of new public management type of managerialism and copying of private sector practices. On the latter, see Drechsler 2005.

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institutions, with low budgets and political profiles but with highly charismatic leaders, broad independence in agenda setting and with high level of experimentation (e.g., Nesta in the UK, Mindlab in Denmark; see Puttick et al. 2014, Tõnurist et al. 2015).

In what follows we aim to show that both analytically and historically the diversity of innovation bureaucracy is richer (both in function – what these organizations do –, and in organizational variety, i.e. how they work as organizations) than previous research has shown, and that it matters a great deal for the success and failure of policies how they are organized. In this paper we seek to contribute to this debate both theoretically and empirically. On the theoretical level, we show that the arguments in favor of central vs peripheral agencies are in fact not mutually exclusive, but highlight the complexity of how government organizations need to be structured and organized to support innovations both in policies and also through policies in firms and industries.

We first build briefly a policy implementation framework; then look at the history of innovation bureaucracies and diverse functions fulfilled by such organizations; with the help of Weber and Mintzberg we then build a analytical framework for organizational variety of innovation bureaucracy; and lastly, we discuss what does the functional and organizational diversity of innovation bureaucracy mean for current debates around the entrepreneurial state.

I Policy implementation: how can we conceptualize it for the innovation policy discussion?

Typically implementation comes into innovation and technology discussions as a question about capacity, e.g. whether a country, a ministry or an agency has the capacity to create new policies, learn from past mistakes, take new partners onboard, etc. Such discussions tend to be binary in their nature: the capacity is either there or it is not. Accordingly, our first task is to unpack the idea of capacity and show that capacity of an organization is in fact a highly dynamic concept rather than a binary on-off feature. Thus, we propose to understand capacities of an organization as results of day-to-day routines within the organization and within its context (other organizations, institutional rules). Organizational routines in turn are evolutionary phenomena formed via organizational setup or configuration (how organization is structured within, its finances, external relations, etc; see Mintzberg 1989) and

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9 We will not discuss here research around public sector innovations, see however Kattel et al 2014.
10 We follow here a classic definition of policy capacity: “the ability to marshal the necessary resources to make intelligent collective choices and set strategic directions for the allocation of scarce resource to public ends” (Painter and Pierre, 2005, 2) Policy capacity can be differentiated from state and administrative capacities, but here we mean policy capacity to encompass also state and administrative capacities. (See also Karo and Kattel 2014 for more detailed discussion)
11 We differentiate between the concepts of organizational routines and capacities. While in the firm and industry level research, economists tend to look at organizational routines, i.e. specific patterns of behavior that different organizations follow (as in Nelson and Winter 1982; also Chandler 1977), in the case of public sector organizations the focus tends to be on capacities, i.e. outcomes/impact of specific routines on some performance criteria. The closest concept to routines in public management research is that of organizational trajectories (Pollitt and Bouckaert 2011).
positive feedback mechanisms or interaction channels the organization is engaged with.\textsuperscript{12}

Feedback mechanisms enforce specific types of behavior (routines) and discourage others, and thus form capacities of organizations – what tasks and with what kind of impact organizations can deliver. These feedback mechanisms are highly contextual: an innovation policy organization lives and breathes among legal, political, administrative, financial, technological and economical feedback mechanisms.\textsuperscript{13} Feedback mechanisms, in other words, help us understand that organizational routines and subsequent capacities of public sector organizations are not only internally selected and designed (and determined by their rationales), but are also relational, or dynamic (see also Jayasuria 2005).

For the sake of brevity we can summarize these feedback mechanisms in the innovation arena under politico-administrative and business-administrative feedbacks.

First, \textit{politico-administrative interactions, or feedback mechanisms}. We can think of such interactions in terms of the forms and extent of political delegation and autonomy of specific organizations. This autonomy can be either consciously granted by national strategies and political elite for specific goals (i.e. innovation), or organizationally gained though political infighting, lack of political importance of the field, etc. In terms of routines, we can list here following routines: organizational routines (e.g., how is organization set up, does it have divisions, departments), strategic management routines (e.g., who sets key targets and how, are strategies and evaluations formalized), personnel routines (e.g., what are hiring and promotion practices), financial management routines (e.g., how is budgeting formalized, what are the sources of funding) and coordination routines (e.g., with whom does the organization have to coordinate its activities). All these routines are formed in daily politico-administrative interactions and result in specific kind of politico-administrative capacities.

Second, \textit{business-administrative interactions, or feedback mechanisms}. We can think of these in terms of the forms and extent of public-private cooperation in policy design and implementation; or, whether and to what extent there is interest capture of bureaucracy, which business groups have access to bureaucracy and how is this access formalized. More specifically, we can list here the following interactions that matter in innovation arena: technological interactions (e.g., how typical it is for specific organizations to communicate with technology intensive companies, and how does it happen), production interactions (e.g., how do industrial companies gain access to policy making processes, are there sectoral or ownership differences) and financial interactions (e.g., how close are linkages with financial sector regulations and innovation policy, how are these linkages organized). All these interactions form

\textsuperscript{12} Pierson 2004 offers to date perhaps the most detailed discussion of positive feedback mechanisms within public sector and politics. Positive feedback is closely linked to the idea of path dependence: once certain organizational routines become dominant it also becomes costly to change to alternative ones (as it would typically mean changing organizational stucture, hiring new people, etc) and thus exiting routines are solidified over time.

\textsuperscript{13} It is important to note that the precise definition of all relevant routines is close to impossible, especially given that the definition and scope of innovation policy and related activities is not definite, is constantly changing, and differs between contexts (see Edquist 2011).
business-administrative routines and engender in specific kind of business-
administrative capacities.

In sum, capacities are not on-off phenomena, but continuously formed in through
daily interaction and follow from routines established in these interactions.
Organizational configuration initiates the diverse interactions. These routines tell us
what an organization can and what it cannot deliver.

In addition, there are two somewhat countervailing dynamics surrounding feedback
mechanisms in the public sector: isomorphism and competition. On the one hand, we
can assume that forces of isomorphism are quite strong within one country, for
instance because of common legal background (e.g., civil service law), universalistic
regulations and rules (e.g., procurement rules) and common principles of funding
(e.g., annual budgets, fiscal rules). Accordingly path dependencies in organizational
configurations and capacities tend to be relatively strong. On the other hand, often
within the same policy arena organizations compete for the same limited resources
(e.g., basic vs applied research agencies) and different policy arenas can easily have
conflicting goals (e.g., research agency funding renewable energy research and energy
agency subsidizing carbon based energy production). Accordingly, conflicts within
public sector are normal occurrence. Such competitive and conflictual dynamics create
needs for organizations to differentiate (e.g., via different hiring practices) in order to
‘succeed’, that is to legitimaze what they do, to defend their budgets, etc. Thus, both
of the dynamics together – isomorphism and competition – create what can be called
punctuated positive feedback mechanisms in public sector: tendencies towards
isomorphism and similar capacities are counteracted by competitive needs to
differentiate. This means that even within common rules and context, there is bound
to be organizational variety and different capacities to deliver innovation policy goals.
In short, we can expect that within innovation policy arena there exists organizational
variety of configurations, that is various types of organizations with different
feedback mechanisms and capacities working towards rather similar wider policy
goals.

Paradoxically, such countervailing dynamics also mean that in public sector
organizational configurations and capacities can prevail that are not necessarily
viewed as somehow successful or creative by outsiders. If a public organization does
not look and behave like Apple it does not mean it cannot be as important for
innovation and technological change.

II History: how have governments organized innovation efforts in the past?

Historically, modern public organizations consciously aiming to support innovation
and technological advancement emerge in late 18th and mostly in early to mid-19th
centuries.\textsuperscript{14} It is probably not a coincidence that such organizations coalesce
concomitantly with industrial revolution and its diffusion. There are two key trends
that help to explain the birth of modern innovation bureaucracy:

\textsuperscript{14} Evolution of such organizations has obviously a longer history, reaching back at least to Renaissance
Italian city states, to German cameralists states and to industrial policy practices by Colbert in France,
but these and other such occurrences will not be discussed here due to space limitations.
The emergence of polytechnics and engineering education (related to both military and civilian needs) in Europe and the US (mostly military engineering at West Point) that created supply of engineers and technicians for both public and private sectors.\textsuperscript{15}

The emergence of professional managerial class both in private companies (e.g., in railroads, armories, and others) and in public sector (e.g., military procurement practices of Quartermaster department during the US civil war).\textsuperscript{16}

Both of these trends can be seen as evolutionary reactions to increasing technological complexity of societies in the aftermath of the industrial revolution. From these two springs, as it were, come forth almost all forms of modern innovation bureaucracies: it is difficult to think of any such organization without engineers (and similar technical skills) working in them as it is equally difficult to imagine them without professional level of managers (or middle managers, according to Chandler 1977, 7). This would indicate that historically innovation bureaucracies resemble quite strongly the Weberian thesis proposed in 1980s and 1990s by developmental state studies: hierarchical rational (elite) expert organizations supporting mostly private sector in innovations and technological change. However, the story is not as straightforward. In fact, while most innovation bureaucracies use technical experts/engineers and professional managers as key ingredients of their organizational DNA, the way these become fused with various technological, financial, political and administrative contexts (feedback mechanisms described above) opens up a much larger and colorful canvas for organizational configurations to emerge. Indeed, as we will show, it is the relationship between private and public initiative, and how these partnerships are organized and structured, that is one of the key determinants for how types of innovation bureaucracy emerge and operate – and what capacities they contain.

However, for looking at history and current practices of public sector organizations promoting innovations, it is useful to first differentiate diverse functions such organizations exercise (what policy goals they pursue) and only then we can look at what kind of organizations (with what kind of feedback linkages, capacities) there have been and are. Table 1 attempts to give a birds-eye view of these functions, describing what policy goals are typically pursued and how these goals relate to innovations and technological advance; the table also brings historical and current examples of organizational configurations carrying out these functions / policy goals. It goes without saying that there can be considerable over-lap between functions and organizational forms; here they are depicted in an idealypical taxonomy.

<table>
<thead>
<tr>
<th>Function</th>
<th>Socio-economic policy goals, relation to innovation</th>
<th>Examples of organizational configurations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management of strategic resources</td>
<td>Ensure wider returns from key assets; up/downstream skill and technology development</td>
<td>Trading companies, state owned companies</td>
</tr>
<tr>
<td>Long-term investment</td>
<td>Ensure financing of future</td>
<td>Central banks steering private</td>
</tr>
</tbody>
</table>

\textsuperscript{15} Engineers play also a crucial role in some countries in professionalizing civil service in early 19th century and helped to by-pass ‘old’ patrimonial structures; see comparative study by Lundgreen 1990.

\textsuperscript{16} For our purposes is not important whether the professional managers were born in private or public sectors (for a discussion, see Chandler 1977, Hoskin and Macve 1988 and 1994); it is, however, important that in both sectors it happens around the same time. On the role of Quartermaster department in the evolution of US administrative system, see Wilson 2006.
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Organizations/Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furthering knowledge frontier</td>
<td>Ensure research into basic scientific questions, enable next generation of technologies</td>
<td>Research funding agencies; public universities</td>
</tr>
<tr>
<td>Deepening technology base</td>
<td>Ensure widening of applied R&amp;D, lowering risks of diversification, upgrading</td>
<td>Developmental and innovation agencies; IPR offices; experimental technology and policy/public service labs</td>
</tr>
<tr>
<td>Generating demand for new products and services</td>
<td>Generate market power for new technologies, innovations deemed socio-politically important</td>
<td>Procurement of innovations, public R&amp;D laboratories; regulatory bodies (in health, environment, energy)</td>
</tr>
<tr>
<td>Diffusion of new skills, technology</td>
<td>Ensure wider benefits from technological advances and innovations</td>
<td>Industry associations, competition authorities</td>
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</table>

As we see, in many ways these are functions around creating and/or enhancing markets for new skills and technologies. We will refrain from further discussion of the functions but will try to get somewhat better understanding of the corresponding organizational configurations, specifically their emergence and evolutionary trajectories.\(^\text{17}\)

**Management of strategic resources**

Emergence of organizations: Trading companies emerge from 16\(^{th}\) century onwards first as various East India companies, later covering wide trade and military purposes. These companies were often first private companies with high-level political support, later state-owned. (Carlos and Nicholas 1988; also Bowen 2006) Such strongly private configurations with overt political support were in some instances spectacularly successful in trade and military conquests, but less important for innovations and technology development.

Evolution of organizations: Evolve from trading (and military) organizations towards supporting industry development (e.g., Society for Establishing Useful Manufactures, founded in 1791 in US; it was meant as a new industrial town with textile production at its core; with private funding but public leadership under Alexander Hamilton and Trench Coxe; see Cooke 1975)\(^\text{18}\) and then towards utilities and natural resource management in the second half of 20\(^{th}\) century. Many private sector management practices remain important features of such configurations up to late 20\(^{th}\) century (e.g., Development Bank of Singapore is established under private law although publicly owned, in 1968); autonomy from politics and market-like discipline (e.g., through governing boards, floating shares on stock exchanges, performance management practices) become key issues for these configurations. There are success

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\(^{17}\) The following descriptions are necessarily extremely simplified as we do not intend to provide here history of such organizations but rather tiny snapshots of their evolution; we refer readers to the references for more details. It needs to be further mentioned that organizational aspects are rarely discussed in detail in historical works, thus we have gleamed together organizational facts from various sources.

\(^{18}\) The failure of SEUM has been attributed to managers of the company who had almost no industry background: most of them were financiers looking for short-term returns. (Nelson Jr. 1979)
stories such as China’s use of state-owned companies in industrialization. As policy goals, public revenue creation and management (e.g., today as holding companies in Singapore) has since inception dominated over innovation and technology. (See Tönurist and Karo 2016 for detailed discussion)

Long-term investment

Emergence of organizations: Sraffa famously attributes in his 1930 lectures on continental banking emergence of this type of public organization that attempts to steer private finance into industrial development to late 19th century German central bank and its role as lender of last resorts. (Sraffa 1930) For its organizational configuration, the Reichsbank was directly under the guidance of the German Chancellor, but initially it was privately owned and followed corresponding management practices. (Rieser 1911) In US we see at the same time a rather different type of financial system emerging where states created their own public banks that undertook investment functions. (Kregel 1997)

Evolution of organizations: Evolution of public organizations dealing in one way or another with steering investments towards innovations and technological change can be seen in three layers: First, evolution of central banks from essentially departments within ministries of finance into autonomous institutions devolved from fiscal policy during the second half of the 20th century, and de-segmentation of banking sector (e.g., diminishing role of sectoral industrial banks in Europe) during the same time through financial deregulation (that results in increasing financialization); effectively central banks change from quite strongly hierarchical industrial policy organizations into highly autonomous professional organizations tasked with financial stability. Second, emergence of development banks – in the US case state level development companies – first in Asia (in 1902 in Japan; Yasuda 1993) and in post-WWII era in many other countries with notable success and with direct focus on industrial development and with autonomous professional organizations configuration (Mazzucato and Penna 2015). Third, emergence of venture capital, private and public, in the aftermath of WWII, initially in the US, later elsewhere as well. Particularly in the US, the symbiotic co-evolution between private venture capital, new technology companies and public defense spending is well documented. (Weiss 2014)

Particularly in its public form, organizational configurations that emerge use mid-level managerial autonomy and close linkages to private venture capital and technology companies. Importantly, within this function we can see strong division of labour emerging over time as central banks move away from industrial financing; financial authority over private banks is divided into multiple (auditing) organizations and venture capital looks for high risk-high return undertakings. This division of

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19 Recently Rothstein (2014) has hypothesized that the exceptional development of China – despite the lack of rational and transparent bureaucracies – may have been based on the ‘cadre’ or ‘missionary’ type bureaucracies. These bureaucracies share some institutional similarities with Weberian organizational model (formal hierarchies and career models), but follow rather different policy doctrines (or missions) that frame and coordinate (through socialization, charismatic leadership etc) the activities of bureaucrats and organizations and explain China’s development success (for a discussion of non-Western governance paradigms, see Drechsler 2015). In recent years we have also witnessed a re-emergence of Western discourse on mission-oriented innovation policies (see Foray et al. 2012; Weber and Rohracher 2012; Mazzucato 2013).

20 Emulation and learning from (failed) Crédit Mobilier experiences in France were important as well. See also Gerschenkron 1962; Cameron 1953, 1961, 1967.
labour is reflected also in different organizational configurations and by varying impact in innovation and technological change.

Furthering knowledge frontier

Emergence of organizations: Emergence of modern research university is attributed to late 19th century German Althoff system in which direct ministerial guidance of Friedrich Althoff universities were reorganized and new ones founded, chairs remodeled and also modern libraries and other research infrastructure created. (vom Brocke 1991; also vom Brocke 1996) In some way to countervail this development (to emphasis more research and to involve private funding in research), early 20th century saw creation of pure research institutions according to so-called Harnack Prinzip that gave huge (scientific, financial and managerial) power to leaders of such institutions (first called Kaiser-Wilhelm-Gesellschaft, later Max-Planck-Gesellschaft). These institutions were highly personality-oriented configurations and were initially publicly owned with significant industry funding that later diminished. (vom Brocke 1996) Post-WW1 era saw also emergence of (applied) public research organizations in UK within government departments. (Gummitt 1980)

Evolution of organizations: Research funding organizations within public sector have become one of the mainstays of modern innovation bureaucracies from national research councils in charge of grant funding to (sectoral) applied research agencies within ministries and outside.21 While typically these organizations are relatively autonomous and operate under the principles of scientific excellence and peer-review,22 then particularly since 1980s there has been noticeable impact of neo-liberal management ideas (new public management) (Boden et al 1998). This has led to privatizations of public research organizations, to increasing the share of competitive funding in total research funding and to influx of other market-friendly managerial principles. But also we can detect rise in more fluid configurations, especially in terms of staff exchanges with industry and rise of short-term contracts (such as in Fraunhofer in Germany; Basedow 2013).

Deepening technology base

Emergence of organizations: While evolutionary economists would view Japan’s MITI as somewhat archetypical public organization aimed at dealing with technological upgrading of private companies (with strong role played by technical experts), it can also be argued that the aforementioned Society for Establishing Useful Manufactures (SEUM) from 1791 that attempted to found a new town based on new industries could be seen as a forerunner of such organizations. In both cases the perhaps key ingredient of such configurations is strong public leadership and political support combined with close relationships with private investors and with private

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21 The impressive ICT development of Taiwan (see Breznitz 2007) is often linked most notably with Industrial Technology Research Institute (ITRI, created in 1973 as a merger of existing government labs). ITRIs task has been to concentrate on R&D and technological development (as state technology-creating agent acquiring and developing foreign technologies, diffusing them to industry and supporting private R&D and development activities) to the extent of providing prototypes that can be transferred to the private sector.

22 However, in US such agencies as NIH and NSF combine centralized expert skills with in-sourced field-specific skills in the form of medical- and academic self-steering through mechanism such as peer-review (see, e.g., Sampat 2012).
companies potentially benefiting from such activities. However, organizations' configurations could not have been more different: while in the case of SEUM the organizational configuration meant management by private investors; in the case of MITI, on the hand, it meant management of private initiative by administrative guidance of industries.

Evolution of organizations: Particularly East Asian success countries used multiple iterations of such developmental agencies and councils during their rise. Such agencies with high level political support and key role played by technical experts have evolved in the second half of 20th century into innovation agencies with either narrower policy goals (such as SBIR, DARPA in US) or with rather wide brief to invest into wider set of technologies and innovations (such as TEKES in Finland).23 In particular DARPA’s unusual organizational configurations has garnered lot of attention.24 National innovation agencies are similarly to a national research agency most visible element of modern innovation systems. Another similar feature of such agencies is the impact of new public management ideas (e.g., increasing share of competitive funding, funding projects that ‘fix’ market failures) that increasingly guide funding decisions and evaluation practices at such organizations. In general, organizational configurations include fluid organizations such as DARPA but also relatively stable and standardized organizations (for instance such as in charge of EU’s structural funds in Central and Eastern European Countries; see Suurna and Kattel 2010; Karo 2011).

Generating demand for new products and services

Emergence of organizations: Procuring innovative – or often simply products with higher quality and new specifications – has a history in military procurement both in

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23 In Finland two key government agencies, Sitra and TEKES, created in 1980s a division of labour emerged with Sitra providing loans to companies in early stages risk-capital markets (establishing the Finnish VC market and the Finnish Venture Capital Association in 1990) and TEKES (who had considerably larger budget) concentrating on R&D funding and incentivizing the local R&D networks. These agencies worked in complementary manner as almost all companies receiving Sitra’s financing received also TEKES grants for technological innovation (Ornston 2012).

24 DARPA (ARPA 1958-1972) was from the outset allowed to collaborate with the commercial industry in developing both military and dual-use technologies. Over the years, DARPA’s programs and funding choices (it does no internal R&D) have contributed considerably (together with other agencies and programs) into most defensive and civilian innovations (see Mazzucato 2013) and the organizational model has become a blueprint for systemic changes and innovations in other fields, from homeland security (HSARPA in 2003), intelligence (I-ARPA 2007) and energy (ARPA-E in 2009).

DARPA has followed a rather specific mix of organizational routines to achieve its missions: 1) entrepreneurial managerial approach with short-term (3-5 years) appointment of highly capable program managers (with proven technology-related track-record in military, academia, or industry) who act like experts-on-loan to the bureaucracy (mid-level people whether from the government, industry or academia who are temporarily on a leave from their permanent position – Fuchs 2009: 67) with budgetary autonomy to steer the direction of the funded R&D projects (indeed, it has worked as a project-based organization with some missions, or technological priorities); 2) These program managers are assessed internally through personal feedback and peer pressure as opposed to formal performance management and incentive systems. The Office Directors and the Director of DARPA approve the programs while following The Heilmeyer Catechism, review the progress and make sure that the programs are scrutinized (Jordan and Koinis 2013). This system seems to also allow for failures and closure or changes of non-working projects and initiatives; 3) Internally, it has used rather streamlined organizational and managerial processes as project approvals that rely on in-house expertise as opposed to peer-review.
Europe and in US, with the Quartermaster Department in the latter being perhaps one of the forerunners of modern US bureaucracy with its activity during the Civil War and of venture capital industry with its activities during WWII. (Wilson 2006; Weiss 2014) However, military procurement has often had close linkages to civilian inventors (e.g., Eli Whitney); another important strand of procurement is public works. In general procuring innovative products emerges in strongly hierarchical administrative (military) configurations. This is, however, quite different to regulatory and standardization efforts where the evidence is much more mixed. For instance, while railroads where initially developed by private initiatives, later standardization was led by Verein Deutscher Eisenbahnverwaltungen in Germany that became dominant force for technical standards in Europe’s railway system – but it was initially also a private association (Kaiser and Schot 2014). Similarly, in many emerging industries in the US in the middle of 19th century, private networks were creating and maintaining standards, with armory industry being the key exception. (Thomson 2009)

Evolution of organizations: Post-WWII era up to 1980s is the golden age of procurement of innovations with various US agencies leading the way and being spectacularly successful. To lesser degrees, similar success stories can be observed also in Europe and in emerging Asian Tigers as well. (See Lember et al 2014 country studies) Since 1980s and later with the emergence of WTO’s regulations procurement agencies focus increasingly on efficiency and creating level playing fields. (Kattel and Lember 2010) This tendency has started to change since 2000s. One of the key obstacles in wider use of procurement of innovations are the organizational routines of many procurement agencies that are oriented efficiency of markets. (Lember et al 2015) Regulatory agencies (such as FDA in US), but also large public service providers (in health, environment, energy grids, infrastructure) have become also important in generating demand for new products and services via regulatory efforts; here configuration are rarely oriented towards innovations directly, but it is often a secondary policy goal.

**Diffusion of new skills, technology**

Emergence of organizations: Private sector business interest associations and cartels have origins in medieval guilds and later in town management of markets (limiting competition). (Schmoller 1900, 313-315) However, perhaps the most prominent case of publicly supported private cartels is the late 19th and early 20th century German industrialization efforts, later emulated in UK and many other countries. Typically organizational configurations are very loose in the sense that public sector’s role is that of coordinating various public policy fields and organizations (from competition and intellectual property to forging linkages with research institutions and applied education institutions).

Evolution of organizations: While private cartels have become effectively outlawed in modern economies, in post-WWII era management of competition was a crucial function of developmental agencies in East Asia. Anti-trust agencies of today deal mostly with investigating price collusion and fixing, rarely dipping into innovation

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25 For instance, see Murmann 2003 on chemical industry in German and UK. See also Fear 2008 on the importance of cartels in early 20th century, and Lanzalaco 2008 on business interest associations and the role of governments in supporting such organizations.
arena (with some notable exception, e.g. the EU vs Microsoft court case). Today’s equivalents of cartels are variety of cluster organizations, technology parks, business incubators and accelerators, etc. In all of these organizations, their configurations public leadership and organizational resources are secondary and private funding, initiative and management practices dominate, although with highly varying degrees of success.

From these very brief descriptions of what kind of organizations have fulfilled various innovation policy functions, we can draw following preliminary discussion points:

- Both innovation policy functions (policy goals) and organizations fulfilling them change considerably over time; next to new technologies and related changes in economic structures that necessitate changes in policies and organizations, policy and management fashions and ideologies have strong influence both on organizations and functions.
- There is strong evidence that multiple organizational configurations co-exist in innovation systems, and that indeed such diversity itself might be part of the success.
- Complexity of innovation bureaucracy is increasing over time as new functions are added and organizations change, or new forms of organizations emerge, and not only with positive track record; old ones with positive track record (at least partially) in turn vanish (e.g. cartels for industrial competition management).
- Policy failures can be often connected with misguided choices for organizational configurations either for the reasons emerging from wider socio-economic context (e.g., many technology parks have little to do with innovations and technology often because there are not that many technology intensive firms around) or with sector specific challenges (many applied research agencies rely on industry-university cooperation funding schemes, yet without significant industry demand being codified into agencies routines, such schemes are bound to be relatively ineffectual).
- There seems to be relatively strong relationship between what functions (policy goals) an organization is tasked with and what kind of configuration it has and what kinds of feedback mechanisms influence this organization. That is, policy function (e.g., long term financing of technological change) drives feedback linkages (e.g., how financial regulations and nature of investments by private banks are taken into account) and this in turn influences initial organizational choices (e.g., creating public development bank using regulatory framework for private banks vs ministerial department).
- At the outset, policy functions are often created by private demand for them, that is innovation bureaucracy organizations seem to emerge because there are dynamic technological developments within private sector. Thus, these organizations are furthering what can be called Schumpeterian rents from innovations (e.g., creating a central bank as lender of last resort and enabling private banks to invest into long term projects, that is diversify their investments and at same time create for industrial companies option to raise capital for long term investments).
- However, in time, most innovation policy functions become socialized in one form or other (public sector role becomes more dominant than private initiative) and organizations fulfilling them more bureaucratic (in the sense of
feedback linkages from politico-administrative system become dominant over other feedbacks). This tendency can be, in turn, followed by push back of public initiative (such as privatizing organizations and/or functions). As new functions emerge, this leads to either creation of new organizations (e.g., current trend to create innovation labs in public organizations) or to reform attempts of the existing ones (e.g., merging organizations).

- It is clear that further research is needed to understand better specific trajectories and how especially levels of economic development, technology/sectoral trajectories and techno-economic paradigms have influenced the evolution of organizational variety.  
- One of the issues not discussed above but that is important in the development context is the influence of foreign and international funders on domestic innovation bureaucracies.

III Innovation bureaucracy: analyzing organizational variety

Perhaps one of the key observations from history of innovation bureaucracies is the oscillation between new fluid (often with substantial input and leadership from private sector) and rational expert organizations; that is Schumpeterian vs Weberian organizations as we described in the introduction. We can make this juxtaposition more theoretical using Weber’s own work. Calling small fluid agencies Schumpeterian is evocative but hardly justifiable through Schumpeter’s own work. While Schumpeter argued that “new men” can bring forth innovations in all walks of life (from economy to arts), he did not discuss organizational underpinnings in detail. (Schumpeter 1912, 142-157) However, Weber’s taxonomy of domination or power (traditional, charismatic, rational) and corresponding organizational forms offers a way describe what Schumpeter attempted to show in a analytical way. That is, Weber offers theoretical reasons why different types of innovation bureaucracies can deliver different policy goals and how. In essence we can argue that in the history of innovation bureaucracy we can detect two ideal-typical Weberian organizations:

- **First**, historically most forms of innovation bureaucracy start as one type of Weberian organizations – what we can call Weber I: charismatic, dynamic organizations—innovating often in emerging policy areas proposing new

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26 Techno-economic paradigm theory developed by Perez assumes that paradigms have a strong influence on public sector organizational variety as they have on private sector (Perez 2002).

27 For instance, during the early post-WWII period, Taiwan created numerous *US aid based economic planning agencies* – Industrial Development Council (IDC, 1953–58), Economic Development Board (EDB, 1953–58), Council for US Aid (CUSA, 1959–63) and Council for International Economic Cooperation and Development (CIECD, 1963–73) – where the key policy institutions. These provided policy input for regular ministries of finance and industry. Cheng et al. (1998) show that these agencies were constructed outside the normal bureaucracy to have flexible coordinating roles and allow for less strict bureaucratic rules (higher salaries, flexible recruitment etc). Wu (2004) claims that their short life span (as they were mostly abolished by political choices of the ruling elite) is indicative of their dependence on the policy and person-based relations with the ruling elite; and the elite had much closer personal ties and trust in the financial as opposed to economic planning bureaucracy. Similarly, in Eastern Europe, European Union has played major role in creating and funding innovation agencies with mixed success, see for a discussion Suurna and Kattel 2010, Karo and Kattel 2014.

28 This form is succinctly summarized by Samier: “A charismatic organization is consistent with its own principles, that is a new organization with its own language, mores, myths, and roles derived from the personality and belief system of the charismatic founder, affecting staffing, working patterns, social behavior, and the material environment.” (2005, 71)
policies and regulations, standards, or cooperation forms, and reside often outside of typical government operations (but can have high level political support or enjoy societal prestige), and

- **Second**, with time move on to another type of Weberian organization – what we can call Weber II: professional, centrally governed organizations that are stable and predictable, manned with high level experts and are strong in delivering innovations in private sector during catching up or mission dominated periods, and

- **Third**, with new functions and/or ideologies emerging, can be pushed towards more charismatic form again (often under the pretense of market-friendly ideology).²⁹

We can see in Weber I and Weber II organizational archetypes of innovation bureaucracy from which formation of hybrid forms is possible. While the Weberian dichotomy – and inherent conflicts and dynamics it captures – seems to fit well with historical developments, diversity and fluidity of changes of innovation bureaucracy seems to be governed by a wider set of organizational variety than simply Weber I and Weber II. While this dichotomy seems to gives us an easy way to differentiate between organizations dealing with innovations in policy and with innovations through policy impact, it seems too linear to assume that organizations – or even policy arenas, let alone countries – move from Weber I to II and back. Indeed, as we aim to show, there is a more complex organizational variety of hybrids beneath Weberian dichotomy. We use Mintzberg to unlock this diversity.³⁰

We use the framework offered by Mintzberg (1989) that differentiates between five key organizational configurations or forms – entrepreneurial, machine bureaucracy, diversified, professional, innovative organizations – that can co-exist and exhibit – depending on the contextual factors – either cooperation (ideology and missions) or competition (politics) tendencies.

According to Mintzberg (1989), different organizational configurations embody different routines and capacities (i.e. forces towards specific behaviors), i.e.: “The entrepreneurial organization can certainly innovate, but in relatively simple ways. The machine and professional organizations are performance, not problem-solving types, designed to perfect standardized programs, not to invent new ones. And although the diversified organization resolves some problems of strategic inflexibility found in machine organizations, as noted earlier it too is not a true innovator.” (Mintzberg 1989, 198)

That is, organizations with different configurations are managed differently and are good at different things. In evolutionary economics (Nelson and Winter 1982), organizational variety is one of the key drivers of technological and private sector innovation. While market is the context where organizations with different routines and capacities compete, it is the organizational variety and its constant evolution (if necessary, supported by public policies) that maintains the dynamism necessary for innovation. Mintzberg (1989) looks at these configurations also from the perspective of an evolutionary life cycle (i.e. organizations emerge in the entrepreneurial

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²⁹ Weber argued that new organizational forms (or change from one form to another) emerge through conflicts between old and new leaders and staff (Weber 2009, 154-155).
³⁰ Lam 2006 uses Mintzberg to discuss private sector organizational innovations.
configuration and grow to other forms until potentially declining through political forces) where organizations can make good or bad internal choices on configurations, but are mostly affected by the external competitive environment.

While in the public sector context, such competitive forces are missing, organizational variety – as a proxy for the variety of routines and capacities – may still be a necessary condition for maintaining the potential for policy innovations and innovation policy impact. First, catching-up stages and more mature stages of technological life cycles require managing visible risks and implementing efficiently established and known policy solutions that can be done through more established and institutionalized (bureaucratic) routines and capacities (stability, patient capital, long-term orientation). Second, progress at the techno-economic frontier is about dealing with uncertainty and coming up with policy innovations that require more flexible and adaptable forms of organizations and governance.

We can build (Table 2) a more elaborate analytical taxonomy that combines two aspects of the organizational variety: organizational configurations and their specific routines and capacities. Mintzberg provides key characteristics – in terms of routines and capacities – of these configurations, but he has elaborated them mostly from the perspective of private sector organizations. Yet, he also recognizes that almost all organizational configurations may be also present in the public sector: most commonly machine bureaucratic, diversified and professional configurations. While in the private sector context, these would mostly be competing organizations, in the public sector we often expect these organizations to coordinate and cooperate between themselves and contribute to common public policy goals (which does not mean that there are no conflicts, as we argued above). As machine bureaucracies or diversified configurations (the most common configurations in the public sector), public sector organizations may attempt (at least temporarily) to maintain different configurations and routines even in single organizations; or create separate organizations to carry out specific tasks, such as innovation (or some professional roles).

Thus, for analyzing public sector organizations and organizational variety, we have extended Mintzberg’s framework by adding (in Table 2) specific organizational routines that are considered as the most important in the functioning of public sector organizations (see Pollitt and Bouckaert 2011).

**Table 2. Taxonomy of organizational variety and capacities**

<table>
<thead>
<tr>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entrepreneurial</strong></td>
</tr>
<tr>
<td>Organization routines</td>
</tr>
<tr>
<td>Strategic management routines</td>
</tr>
</tbody>
</table>
Personnel management routines

<table>
<thead>
<tr>
<th>Limited personnel, no systemic routines, needs based development</th>
<th>Standardized work and skills and recruitment processes</th>
<th>Divided between headquarter and autonomous divisions</th>
<th>Dependent on training to standardize the skills of its professionals</th>
<th>Variety and mix of skills, openness to learning and experimentation</th>
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</thead>
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Financial management routines

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<tr>
<th>Flexible; emergent</th>
<th>Efficiency and process oriented</th>
<th>Autonomous divisions, output oriented</th>
<th>Mixed; based on professional autonomy</th>
<th>Flexible, not efficiency oriented</th>
</tr>
</thead>
</table>

Coordination routines

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<tr>
<th>Direct supervision</th>
<th>Standardization of work processes</th>
<th>Standardization of outputs</th>
<th>Standardization of kills</th>
<th>Mutual adjustment</th>
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</thead>
</table>

Location in the policy system

<table>
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<tr>
<th>Peripheral or within machine and/or diversified organizations</th>
<th>Central policy implementation units with public accountability</th>
<th>Central/core policy units (whole policy fields)</th>
<th>Specialized service providers (between core and periphery)</th>
<th>Peripheral or in new domains, or as parts of machine/diversified organizations</th>
</tr>
</thead>
</table>

Capacities

<table>
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<tr>
<th>Simple/initial developments and changes</th>
<th>Efficiency, transparency, Accountability</th>
<th>Concentration of different focuses</th>
<th>Professional proficiency</th>
<th>Learning and complex innovations</th>
</tr>
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</table>

Trade-offs

<table>
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<tr>
<th>Responsive, with mission VS vulnerable, restrictive, unstable</th>
<th>Efficient, reliable VS obsession with control, no initiative, autonomy</th>
<th>Autonomy, diversity VS costly, reluctance to innovate, requires measurable goals</th>
<th>Democracy, autonomy VS professional discretion, reluctance to innovate (unless collective action)</th>
<th>Innovative, effective VS inefficient (communication, coordination)</th>
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</table>


In terms of politico-administrative feedbacks, innovative (and to lesser extent entrepreneurial) configurations – being most flexible and ad hoc – can be linked or integrated (temporarily and before they become assimilated) into different organizational configurations. Machine bureaucracies where policy and implementation are often separated can be (temporarily) made more dynamic by shifting roles, i.e. policy formulators implement and implementers formulate policies (Mintzberg 1989). The same way innovative configurations can be made to work on behalf of other organizations, or policy domains i.e., operating adhocracies (or operating innovative configurations) concentrate on ‘contract’ project work while administrative adhocracies (or administrative innovative configurations) work for own internal projects/goals.

We can summarize our discussion above in Table 3 that depicts organizational variety (and corresponding variety of capacities) according to Weber and Mintzberg.

### Table 3. Synthesis of Weber and Mintzberg

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<th>Weber I</th>
<th>Weber II</th>
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Weberian types I and II characterize extremes that flank various types of organizations (innovative and entrepreneurial organizations verging towards Weberian charismatic organizations; and machine and diversified organizations towards professional organizations). All of these organizations exist within politico-administrative and business-administrative interactions that in turn determine what kinds of capacities and routines exist within these organizations.31

IV Discussion: innovation bureaucracy and entrepreneurial state

In her recent paper, Mazzucato argues that one of the crucial questions for the innovation research is to understand “how should public organisations be structured so they accommodate the risk-taking and explorative capacity, and the capabilities needed to envision and manage contemporary challenges?” (2014, 8) Further, “key concern should be to establish which skills/resources, capabilities and structures are useful to increase the chances that organizations will be effective both in learning and establishing symbiotic partnership with the private sector – and ultimately succeed in implementing mission-oriented and transformative policies.” (Mazzucato 2014, 17)

In this paper we have argued that the current debates on how to organize government actions to support innovation have over-concentrated on single-organization research (different ‘agencies’ and labs) and single-variable explanations (Weberian nodal agencies vs peripheral Schumpeterian agencies). We argue that instead of single-form explanations for how to organize government actions to support innovation, we might gain greater understanding of these questions by focusing on organizational variety in the context of public policy-making and implementation. Indeed, understanding public organizations in their respective politico-administrative and business-administrative feedback context, and what kinds of routines emerge from these, should be the first task towards more entrepreneurial state. We can even argue that lack of entrepreneurial activity (as discussed by Mazzucato) is itself a result of existing routines: public organizations operate in politico-administrative context where risk taking, long-term thinking, etc, are not simply frowned upon, but other routines have become to dominate over these routines and switching to new ones

31 Take for instance the US case: one can argue that the key public institutions of the US innovation system have been in fact defense-oriented core federal departments (from defense to health and energy, i.e. DoD, NIH, DoE) and the networks of agencies (NASA, CIA, Office of Naval Research, DARPA, NSF) and federal laboratories created for implementing policy through the hybrid networks between public and private actors (to steer private R&D, negotiate support and leverage resources for state-directed defense-oriented projects). See Block and Keller 2011, Weiss 2014.
comes at a considerable cost (both politically and administratively). History tells us that under such circumstances new functions/policy goals and new organizational forms emerge to deal with pressing challenges. It depends greatly on whether challenges are brought forward by private actors or by political leadership as this plays an important role in what kind of organizational configurations will be chosen to deal with new challenges or in rejuvenating existing organizations. Our research shows that organizational variety is perhaps important in itself, as it allows for some functions of innovation policy to be fulfilled in relative stability (e.g., basic research funding under peer-review) but in other areas more experimental solutions could be sought (e.g., active industry participation in applied research evaluations).

Thus, one of the lessons from our research is that entrepreneurial state requires diversity of public sector organizations dealing with innovations and technological change. Second lesson is that there is a crucial difference between initiating new policy goals vs changing existing policy goals and organizations, that is, the crucial difference between policy innovations and policies supporting innovations. Third lesson is that in innovation policy arena there are multiple public organizations and these organizations compete for funding and political support, thus conflicts between policy goals and organizations are bound to be numerous. Accordingly, one of the key issues is how to coordinate the activities and capacities of various public organizations. This would typically call for political leadership to proactively address coordination issues.

As for further research, there is a need for systemic research what role technology and techno-economic paradigms play in evolution of innovation bureaucracies, what are country-specific and the sectoral differences; and how does globalization of innovation and production networks, and of policies and of policy elites under WTO and multilateral agreements, influence evolution of innovation policy capacities. It would also be important to understand whether non-Western contexts (with viable alternatives to Western modernization paradigm and with different cultural-religious contexts) play a role in how innovation bureaucracies evolve.

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