

# Innovation bureaucracies: How agile stability creates the entrepreneurial state

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# **Innovation bureaucracies: How agile stability creates the entrepreneurial state**

Rainer Kattel, Wolfgang Drechsler and Erkki Karo

## Abstract

In this paper, we offer to redefine what entrepreneurial states are: these are states that are capable of unleashing innovations, and wealth resulting from those innovations, and of maintaining socio-political stability at the same time. Innovation bureaucracies are constellations of public organisations that deliver such agile stability. Such balancing acts make public bureaucracies unique in how they work, succeed and fail. The paper looks at the historical evolution of innovation bureaucracy by focusing on public organisations dealing with knowledge and technology, economic development and growth. We briefly show how agility and stability are delivered through starkly different bureaucratic organisations; hence, what matters for capacity and capabilities are not individual organisations, but organisational configurations and how they evolve.

**Keywords:** Innovation, Public sector, Entrepreneurial state, Agility, Stability, Bureaucracy

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## 1. The Innovator's dilemma in the public sector

If you have successfully avoided the urge to print this paper out, you owe your reading experience to the forward-thinking investment of governments. Much of the technology in your reading device was funded either directly by the public sector or is a spill-over from this funding. It may have been commercialised and packaged into new desirable and useful products, but the fundamental technologies that makes our modern devices 'smart' were publicly funded (Mazzucato 2013).

But what makes states so entrepreneurial? What is it that makes government machinery dynamic and bold enough to shape the future of innovation? Some may shudder when encountering such questions: aren't governments failing more often than markets? Aren't governments just supposed to provide basic and stable institutions for markets to function and innovate? Hint: no, historically governments have done much more than that. Government has been the biggest and most successful venture capitalist ever.

In the context of anaemic economic growth and persistence of the grand societal challenges — from climate change to growing inequality — recent global public governance debate has not been so much about whether bureaucracies can innovate, but — at least implicitly — about how they can. The more policymakers realise that an increasing number of policy issues are 'intractable' and 'wicked' — meaning, simply put, that we as humans are as much the cause of these problems as we are sources for potential solutions — the more innovation, and public leadership of innovation, seem to matter (Pollitt 2015).

Of course, that something is fashionable does not mean that there is actual substance behind it. One is tempted to paraphrase Oscar Wilde here: policy fashions are a form of shallowness so intolerable that we have to change them every six months. Innovative bureaucracies certainly sound like a fad and this paper does not set out to convince you otherwise. On the contrary, we argue that part of what makes public bureaucracies important for innovation is their simultaneous capacities for agile change — something that sounds cooler if it's called 'hacking' — but also for stability, and crucially, delivering both at the same time. We therefore claim that genuine entrepreneurial states have capacities for 'agile stability', i.e. they are entrepreneurial not in the fashion sense of go-getter startuppery, but oriented towards overall success in context — and in the end, to use another hip yet true concept, human happiness. In our understanding, entrepreneurial states are driven by a set or a configuration of public organisations that make up the capacities for agile stability.

Perhaps not surprisingly, it is Joseph A. Schumpeter (1883-1950) himself, the most important theorist of innovation in the 20th century, who attempted to capture this dilemma of government in a forceful juxtaposition. Writing in 1918 about *The Crisis of the Tax State*, a year before he became Austria's — notoriously unsuccessful — minister of finance, Schumpeter argued:

'In any case, the state has its definite limits. These are, of course, not conceptually definable limits of its field of social action, but limits to its fiscal potential. These vary considerably in each specific case according to the wealth or poverty of the country, to the concrete details of its national and social structure, and to the nature of its wealth. There is a great difference between new, active, and growing wealth and old wealth, between *entrepreneurial and rentier states*. The limits of their fiscal potential may also differ according to the extent of military expenses or the debt service, to the power and morality of its bureaucracy, and to the intensity of the 'state-consciousness' of its people. But they are always there and they may be theoretically determined in general terms from the nature of the state.' (Italics have been added).

Schumpeter's differentiation between entrepreneurial and rentier states<sup>1</sup> can be seen as one of the big theoretical and ideological divides in economics and governance of the 20<sup>th</sup> century. On the one hand, those so-called evolutionary and neo-Schumpeterian economists (following especially the seminal work of Nelson and Winter 1974 and 1982), who study the co-evolutionary dynamics of technological change, industrial and socio-economic structures, and supporting institutions based on real-life assumptions of human behaviour ('bounded' rationality as opposed to 'full' rationality), are interested in understanding entrepreneurial states. This is epitomised by Mariana Mazzucato in her 2013 book *The Entrepreneurial State: Debunking Public vs. Private Sector Myth*, which shows a state that creates bold, challenge-driven and mission-oriented policies (moon-shot projects) and invests into the long-term development of knowledge. This is a state oriented towards positive change, in which bureaucracies should aim for and deliver these ambitious goals (Kattel and Mazzucato 2018).

On the other hand, mainstream economists have been trying to understand rentier states, best embodied in the public choice theories of Gordon Tullock, William Niskanen and others (Tullock et al 2002). These are states where bureaucrats follow their self-interest, build ever larger organisations, because this brings prestige, yet shun responsibility and curb private initiative. These are states oriented towards permanence and status quo, and this theory has popular cliché on its side in the classic rants of citizens against bureaucracy and is well expressed by comedy classics such as *Yes, Prime Minister*, *In the Thick of It* and many others.

In this division, we can detect a loss of ambiguity: governments and in particular public administrations are stuck between the needs of both change and permanence. This ambiguity, however, cannot be resolved; it is in the nature of the public sector. We can also call it the innovator's dilemma in the public sector: how to provide stability and change at the same time, if both are needed, not just to make profits, but to exist to begin with? The state, as Aristotle says, comes into existence so that we can survive and it stays in existence so that we can have a good life (Politics, I.2, 1252 b).

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<sup>1</sup> *Unternehmer- vs Rentnerstaat* in the original German, which today is actually more difficult to understand than the English translation, because *Rentner* in German now means a retired person on a fixed income.

That this ambiguity, or dilemma, has real-life consequences and is related directly to innovation is clearly expressed by John Kenneth Galbraith when he speaks about the bureaucratic symbiosis that leads to industrial policy *and* to inequality:

‘The government, we have seen, contributes notably to inequality in development. Where the industry is powerful, government responds strongly to its needs. And also to its products. It gives the automobile industry roads for its cars, the weapons industry orders for its weapons, other industries support for research and development... What is done for Lockheed is sound public policy. The purchase of pictures for the National Gallery makes dubious economic sense.’  
(1973, 294)

The key point here is how the state and public organisations develop capacities (or capacity, i.e. the space, the option to do something in an intended way) and capabilities (the skills to do so) for maintaining stability *and* for innovation. **Indeed, we offer to redefine what entrepreneurial states are: these are states that are capable of unleashing innovations, and wealth resulting from those innovations, and of maintaining socio-political stability at the same time.** This ambiguity, this balancing act, makes public bureaucracies unique in how they work, succeed and fail. Indeed, there are innovations still in use that were created by public officials two thousand years ago, such as public baths from Roman times, and some of these baths are still used for the same purposes of public health and social gathering (BBC Magazine (online) 2013). There is, or so it seems, nothing comparable in the private sector. Thus, we should expect that the capacities and capabilities required for agile stability are relatively unique to the public sector as well, and we argue that innovation bureaucracies are constellations of public organisations that deliver such agile stability.

In what follows we take a closer look at the historical evolution of innovation bureaucracy by focusing on public organisations dealing with knowledge and technology, economic development and growth. We briefly show how agility and stability are delivered through starkly different bureaucratic organisations; hence, what matters for capacity and capabilities are not individual organisations, but organisational configurations and how they evolve.

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## 2. The roots of modern innovation bureaucracies

Modern public organisations consciously aiming to support innovation, knowledge generation and diffusion, and technological advancement largely emerged during the 19<sup>th</sup> century. It is no coincidence that such organisations *s.v.v.* coalesce with the diffusion of the Industrial Revolution.

There are five key trends that help to explain the birth of *modern* innovation bureaucracy in the West:

- a) The evolution of knowledge networks through learned bodies — academies, royal societies, etc. — across Europe that actually predated the Industrial Revolution, were tightly interwoven with political structures through 'competitive patronage' of talent (Mokyr 2016) and played a crucial role also in the 19<sup>th</sup> century as networks for both knowledge and what would today, be called applied research.
- b) The emergence of polytechnics and engineering education (related to both military and civilian needs) in Europe (e.g. Ecole Polytechnique; Haber 1958) and the US (mostly military engineering at West Point), which created a supply of engineers and technicians for both public and private sectors.<sup>2</sup>
- c) The development of a professional managerial class both in private companies (e.g. in railroads, armouries and others) and in the public sector (e.g. military procurement practices of the Quartermaster Department during the US Civil War).<sup>3</sup>
- d) The rise and importance of various business associations (e.g. *Interessenverbände* in Germany) in the late 19<sup>th</sup> century, which enabled close networks among politics, industry and bureaucracy (Wehler 1974). These associations were important, particularly in the European context, for the emergence and success of cartels and tariff-driven industrial policy.
- e) The importance of state-owned companies for managing strategic trade routes and imperial ambitions. While the East India Company is undoubtedly the best known case, there were numerous others (e.g. the Hudson Bay Company, the Dutch *Verenigde Oostindische Compagnie*, etc.). This is also the clearest case outside the military where innovation bureaucracies impacted many lives, both positively and negatively — often very negatively indeed.

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<sup>2</sup> Lundgreen (1990) argues that engineers also played a crucial role in some countries in professionalising the civil service in the early 19<sup>th</sup> century and helping to bypass existing 'patrimonial' structures.

<sup>3</sup> For the current purpose, it is not important whether professional managers were 'born' in the private or public sectors (for this discussion, see Chandler (1977), Hoskin and Macve (1988) and (1994), and Wilson (2006)). It is, however, important that in both sectors, this happens around the same time, in the mid-19<sup>th</sup> century.

In the Western context, the five trends represent the basic architecture of innovation (eco-) systems (Freeman 1987; Lundvall 1992; Nelson 1993) and engender almost all forms of modern innovation bureaucracies: it is as difficult to think of any such organisation without engineers (technical skills) working in them as it is to imagine them without a professional level of (middle) managers. Classic and important cases, which we have outlined before (Karo and Kattel 2016, 15-22), are first of all DARPA in the United States and then Finland, as a paradigmatic European success case. Overall, as we will see later, the differences in how organisational variety has evolved in the US (engineered and pushed through despite political criticism and legitimised via a national defence narrative) as compared to Finland (through corporatist and consensual high-level agreements and coordination) illustrate the possible range of different institutions and their development, as long as the basic requirements as outlined above remain maintained.

In the non-Western context, which with regard to positive examples of innovation and innovation bureaucracy is, in theory and practice, almost exclusively Asian (and, here, mostly the Confucian countries of East and Southeast Asia), *this* kind of innovation bureaucracy is a child of the global-Westernised modernisation that largely happened after, and as a consequence of, WWII. The exceptions are, as one would assume, first, Japan, which modern-Westernised much earlier, from the late 1860s, and has basically behaved in this respect like the Weberian-European country it administratively was and partially still is. And second, the British colonies of Hong Kong and also Singapore, which since about the mid-20th century have developed, if not innovation bureaucracies proper, then certainly the five elements mentioned above, at least in proto form (Drechsler 2018).<sup>4</sup>

On first impression this would indicate that historically, innovation bureaucracies resemble quite strongly the 'Weberian thesis' formalised in the 1980s by mostly Western scholars trying to understand East Asian development (more on Max Weber below). These traditional accounts (from Johnson 1982 to Wade 1990 and Evans 1995), or at least the mainstream reading of them, emphasised Weberian rational bureaucratic models of policy-making and legitimisation: capabilities for coherent industrial policies and the autonomy to implement them were created through Weberian pockets of excellence (key nodal organisations based on merit-based recruitment and career systems — Evans and Rauch 1999; Nistotskaya and Cingolani 2014) that were 'embedded' in broader industrial networks for policy intelligence and feedback (Evans 1995). Yet, looking back at the early set-up of the Western industrial and Asian developmental states, we can notice a much more diverse sets of organisations providing capabilities for both policy implementation and policy innovation.

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<sup>4</sup> The non- or pre-capitalist innovation bureaucracy that existed, and still exists to various extents and in various forms, in all these countries before, which was often extremely successful and productive, based on and part of Confucian governance, is an entirely different and still intuitively surprising story for most Western and many Eastern readers (see Drechsler 2020). This both profoundly challenges and confirms our thesis on innovation bureaucracy, and since these countries are so eminent today (in addition to Japan, Hong Kong and Singapore, they include Mainland China, Taiwan, Vietnam and South Korea), this needs special attention for the innovation discourse as well (see Drechsler 2018).

For example:

- a) In *Japan*, the famed Ministry of International Trade and Industry (MITI — see Johnson 1982) was not the sole and nodal policy planning agency, but through organisations such as the National Institute of Advanced Industrial Science and Technology (AIST, which was separated from MITI as an independent body only in 2001) it also encompassed within its organisational structure dynamic technological and research capabilities. Its advisory and deliberation councils and soft tools of policy-making (white papers, administrative guidance) blurred the lines between public and private, as well as political and technocratic, initiatives (Watanabe and Honda 1992; Evans 1995).
- b) In *South Korea*, while the Economic Planning Board became, next to presidential ones, the central coordinating body of economic and financial policies, the country also developed its broader innovation bureaucracy. Between 1967 and 1969, the Science and Technology Agency, which in the 1990s became the Ministry of Science and Technology, was set-up as a rather flexibly organised umbrella department of the Prime Minister's Office (with freedom to hire top-level staff outside normal rules) to plan and coordinate overall science and technology strategies (Seong 2011). Further, for transferring and localising foreign knowledge and supporting the selected firms, throughout the 1960s and 1970s South Korea relied on an extensive network of government research institutes, such as the Korea Institute for Science and Technology (KIST) and Korean Advanced Institute of Science (KAIS), which were established as flexibly organised and formally independent foundations under the leadership of President Park (Hwang 2011; Moon 2011).
- c) In *Taiwan*, while the Industrial Technology Research Institute (ITRI) is often highlighted as its secret weapon (see Breznitz 2007), it was only part of a broader and emerging system of national planning and coordination bodies. Initially, the system centred around the science bureaucracy led by the National Long-Term Science Development Council, which became the National Science Council in the late 1960s (see Greene 2008). Eventually, the main logic of industrial and science and technology policy became to support the export-oriented SME sector by socialising the innovation-related risks of SMEs. For this, the country relied on the Industrial Development Bureau under the Ministry of Economic Affairs to provide analytical capabilities and enable key national research institutes, especially ITRI, to license in promising technologies from abroad, and develop and transfer them to firms that would develop export products (Breznitz 2007; Wong 2011). This formal innovation bureaucracy was complemented by 'parastatal' networks and agencies, which performed technology testing, quality assurance, etc. (Hsieh 2016).

It is this configurational diversity and co-evolution of innovation-supporting public organisations and their broader embeddedness in the innovation ecosystems that makes these countries, and the state generally, entrepreneurial.

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### **3. The blueprint of modern innovation bureaucracies: mission mystique and bureaucracy hackers**

What do innovation bureaucracies actually do, and how do they emerge and evolve? Let us exemplify this with the story of the Physikalisch-Technische Reichsanstalt (PTR), a relatively obscure organisation established in 1887 in a small German town of 30,000 people, Charlottenburg, which until 1920 was a separate city next to Berlin. We owe quantum mechanics to this organisation.

Without quantum mechanics, there would be no computers, tablets, mobile phones, let alone satellites. In other words, much of 20<sup>th</sup> and 21<sup>st</sup> century electronics would not exist and, obviously, all the content that runs on it, from space communication to social media. As McKinsey has calculated, by 2016 the value of global data was larger than that of global trade in goods (McKinsey Global Institute 2016). Yet it is possible to imagine a world without quantum mechanics. The 1880s are not that far from us. We still read and discuss Dostoevsky or Zola, and we enjoy Monet and many other cultural phenomena from the pre-quantum mechanics era (and men still dress like this when they are lawyers or bridegrooms), but when we think about economic development and innovation, the aftermath of WWII is as far as we tend to look back.

While the main mission of the PTR, to develop physical standards and measurement instruments, does not sound wildly exciting or innovative for today's readers, it played an important role not only in the pioneering work of Max Planck and others in quantum physics, but it was also a crucial cog in the rise of German industrial leadership, particularly so for the electrical industry, helping to create global players that still exist today, such as Siemens and AEG (Cahan 1989, 154).

It took more than 15 years of discussions to establish the PTR, but its success was phenomenal: by the early 1900s it was the global leader in its fields, helping to win two Nobel prizes (Wien in 1911 and Planck in 1918 (Cahan 1989, 7)) and propel the German electrical industry from a backwater to become an internationally dominant force: 'Between 1875 and 1907 the number of factories increased from 88 to more than a 1,000 and the number of employees from slightly less than 1,300 to more than 91,000' (Cahan 1989, 17). In other words, the PTR was one of the key drivers in shifting the global technology and innovation leadership from the UK to Germany and the US.

The establishment of the PTR, who was involved, how and why, its initial resources and its organisational evolution in time offers an almost archetypal look into how (successful) innovation bureaucracies are established and how they evolve.

The PTR was established on land donated to it by Werner Siemens, one of the leading industrialists of the time. Moreover, Siemens also lobbied the German government heavily for the PTR, provided initial funding for the organisation (covering initial construction costs) and recruited its first leader in Hermann Helmholtz, one of the outstanding German scientists — and science organisers — at the time (Siemens 2008, 430-433; Drechsler 2002). In fact, Siemens also provided, based on his own experiences as an industrialist, its organisational blueprint (departmental division, hierarchy of authority and control) and guidelines on how to build it up.

Siemens' idea was to find an initial charismatic leader for the new organisation who would then create a 'scientific bureaucracy' for the PTR (Cahan 1989). This organisational model served as a best practice case for other German research and development bodies — most notably the Kaiser-Wilhelm-Gesellschaft, founded in 1911 and renamed Max-Planck-Gesellschaft in 1946 — and for the British National Physical Laboratory (established in 1898) and the American National Bureau of Standards (established in 1901) as well. Particularly in Germany, the PTR blueprint of advancing cutting-edge science and at the same working closely with, and providing services to, industry came to dominate its innovation bureaucracy. In other words, the model was not a theoretical model, but almost a 'natural' best practice that emerged and evolved through past and present attempts to build innovation bureaucracies in the private and public spheres.

We propose that the role played by Siemens and others similar to him is not that of just a policy entrepreneur (as this term doesn't take the institutional context into account), but that of a *bureaucracy hacker*: somebody highly skilled at navigating existing bureaucracy and political networks, and with enough clout to nudge changes, to open enough doors for new ideas and new ways of doing things. The term bureaucracy hacker comes, of course, from Silicon Valley. In a blog post for 18F, the US government digital agency, Greg Godbout and Noah Kunin argued that what 18F is doing is hacking bureaucracy: 'Hackers are problem-solvers. We consider ourselves hackers in that positive sense: productively disruptive and curious' (2014). 18F was created in 2014 by a group of Presidential Innovation Fellows — a programme designed to bring in 'entrepreneurs-in-residence' to partner with civil servants (see Mergel 2017). We argue that such 'hacking', solving problems and building, initially, ad-hoc collaborations and teams is very much part of innovation bureaucracy dynamics. Yet, as we have seen in the case of PTR, while the 'hackers' like Siemens act as powerful change agents, what they aim to create is focused on providing a stable service (in PTR's case to emerging industry) and developmental trajectory (in PTR's case to in-house R&D activities).

Further, what bureaucracy hackers are extremely good at is creating mission mystique, a term coined by Charles Goodsell (2011). Mission mystique is essentially a bespoke belief system, unique to the specific organisation: 'The mission mystique agency is endowed with an aura of positive institutional charisma that is derived from the nature of its mission and how well it is carried out — hence the term mission mystique. It is felt both within and without the organisation. To career employees, the mystique fosters a personal commitment to advancement of the mission. To attentive outsiders, it generates admiration and respect' (Goodsell 2011, 477-478). Mission mystique, creating and sustaining it, is a key part of innovation bureaucracy and allows it to take on the dynamic changes within, and leadership of, innovation processes.

We argue that PTR is, in terms of bureaucracy hacking and mission mystique, an historical blueprint of innovation bureaucracy organisation. Structurally as well as ideologically, the PTR looks to us, as when it was established, a very modern and familiar setup:

- a) It was born out of an acute sense of lagging behind in terms of industrial might in emerging industries (with important military and defense implications) and in nationally funded long-term basic research, which the private sector did not fund (Cahan 1989, pp. 31-32);
- b) Parliamentary debates evolved around whether to establish the PTR on local or federal level, to create a wholly new institution, or to attach it to an existing one (Reichstag 1886/7);
- c) In terms of hierarchy, it was created by and accountable to Parliament, with quite detailed and technical periodic reporting (see e.g. Reichstag 1890/92, 1892/93);
- d) It was formally an (imperial) governmental agency under the Ministry of Interior (*Reichsamt des Innern* — its Staatssekretär served ex-officio as chairman of the PTR's board); its status as an agency also meant that the members of the PTR were remunerated by imperial-agency pay scales, which in the early 1900s became a problem as university salaries increased more rapidly (and universities offered more academic freedom and prestige by that time) (Cahan 1989, p. 192);
- e) It was managed by a president who oversaw two distinct (initially even in different physical locations) sections, one for, in today's language, basic research and the other for development (industrial contracts); each section had a similar hierarchical structure (head of the section, members organised in teams, assistants) (Cahan 1989, pp. 72-81); and
- f) Its funding easily outmatched that of similar organisations in the US (which invested only about half of what Germany did) and Great Britain (six times less than Germany) (Cahan 1989, p. 133), and this even without Siemens' contribution in land and capital.

The key organisational features, such as being a government agency, working in teams and needing to provide services to industry, became some of the reasons for its relative decline and being superseded by its own clones, as it were, the institutes of the Kaiser-Wilhelm-Gesellschaft.

The sequence of events that established the PTR was: a (private) charismatic push; a sense of urgency that generated the agility to create an organisation for a new or emerging area of activity; discussions and conflicts with existing establishments over directionality; the leveraging of political networks for support; after an initial period the institutionalisation of more standardised procedures and routines within the organisation, providing a set of stable, predictable services; and the emulation of its success by, and challenge from, other new organisations. In our view this serves as an almost ideal-typical case of how innovation bureaucracies come about and evolve.

Crucially, as is always the case with such industrial transformations in a particular country, one organisation rarely does it alone. For innovations to diffuse, spaces for knowledge creation are hardly ever enough as innovation needs not only knowledge, but also significant amounts of patient funding, as well as interactions and arenas for networks in which 'systems of innovation' can emerge. This is also the case with PTR: its success is as much due to its founding and organisational principles as it is to the co-evolution of other innovation bureaucracy organisations alongside it, partially inspired by its success. Created in the same period as PTR and to enable long-term (patient) industrial financing by private investment banks (Sraffa 1930), one of the

earliest and successful central banks, the German *Reichsbank*, was directly under the guidance of the Imperial Chancellor, yet it was initially privately owned and followed corresponding management practices (Riesser 1911). Over the course of the 20<sup>th</sup> century, not only did central banks' functions change rather drastically, focusing on fiscal and monetary policy (and since the 1980s increasingly only on monetary policy), they also underwent rather significant organisational changes: while up until WWII it was typical that a central bank was closely related to, if not situated in the finance ministry (that is, governed by normal civil service rules), central banks are now typically public autonomous bodies with their own laws and regulations (Goodhart 1988). In consequence, central banks have ceased to be part of the innovation bureaucracy altogether, although in the beginning it was a key area of theirs. Thus, other financing organisations (R&D agencies, loan guarantee agencies, public and private venture funds) have emerged as new elements of innovation bureaucracies, carrying out similar functions.

Equally important to the success of German industry in late 19th Century were industry cartels. While private sector business interest associations and cartels have their origins in medieval guilds and later in the city management of markets (specifically limiting competition, but also guaranteeing delivery and quality; Schmoller 1900, 313-315), perhaps the most prominent case of publicly supported private cartels is also the late 19<sup>th</sup> and early 20<sup>th</sup> century German industrialisation effort, later emulated in the UK and many other countries. Typically, organisational configurations were very loose in the sense that the public sector's role was to coordinate various public policy fields and organisations from competition and intellectual property viewpoints, and to help forge linkages with research institutions and applied education institutions.

While private cartels have become effectively outlawed in modern economies, during the post-WWII era, the management of competition was a crucial function of developmental agencies in East Asia. The anti-trust agencies of today deal mostly with investigating price collusion and fixing, rarely dipping into the innovation arena (with some notable exception, e.g. the EU vs Microsoft/Google cases). Today's equivalents of cartels are a variety of R&D consortia, cluster organisations, technology parks, business incubators and accelerators, etc. In all of these organisations, their public leadership and organisational resources are secondary, and private funding, initiative and management practices dominate, although with highly varying degrees of success.

As indicated by those cases of the developmental state, the PTR and German innovation story is not unique. Seventy years after PTR was established, in 1967, the South Korean government entered the arena of quantum mechanics-driven technologies by establishing the Korean Institute for Science and Technology (KIST), based on almost identical rationales and blueprints. By this point, though, debates on the 'expiration' of such an organisational model of public research institutions for building industrial capabilities were on the policy agenda not just in South Korea, but elsewhere.

Further, the KIST case was not a direct emulation of German best practice, but rather an attempt to emulate, with US aid money, the Battelle Memorial Institute in the US (Moon 2011). Indeed, the US post-WWII innovation bureaucracy, especially centering on the DARPA model supported by the broader military-industrial ecosystem (Weiss 2014) and broader innovation system (Block and Keller 2015), is even more covered in current mainstream literature than the original German case (see Karo and Kattel 2016, 15-19).

Simply put, the sequencing and evolution of innovation bureaucracies occurs again and again over centuries and in the different contexts of capitalist development, and it can be explained theoretically by the great German sociologist and economist Max Weber (1861-1920), who had his own intimate connection with the emergence of Germany as an industrial leader, but not in the way usually assumed.

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## 4. Innovation bureaucracies as a theoretical concept: Max Weber!

Often a straw man for the bureaucratic, legalistic and rigid organisations named after him, Max Weber in fact described a variety of ways in which authority (or legitimacy) is generated and implemented, and he also described how one type of authority (charismatic) becomes another type (legal-rational or bureaucratic), only to be challenged again by the initial one (charismatic). For Weber, authority leads to action and the latter needs an organisational form to be effective. Changes in authority are accordingly accompanied by changes in organisational forms, and so the latter might indeed play out as conflicts between organisations.<sup>5</sup>

Indeed, innovation policy is an area where these Weberian dynamics play themselves out rather well. We argue that innovation bureaucracies fall into two ideal-typical categories of organisations — **charismatic networks** and **expert organisations** — and that their evolution is often an oscillation between the two extremes, within the same organisation or leading to the emergence of new ones.<sup>6</sup> These two types of organisation possess rather different capabilities and skills sets, and they perform different functions in the system. **And it is precisely those two types of organisation and their respective capacities which are crucial for the delivery of the agile stability of the entrepreneurial state.**

Historically, the idea that different systems of management are suited to different tasks can be traced back to Ferdinand Tönnies' research into *Gemeinschaft und Gesellschaft* (organic and mechanistic forms of society; 1887). Although Tönnies himself, one of the founding fathers of German sociology, was only concerned with society itself, Max Weber developed some of his

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<sup>5</sup> For a discussion of such dynamics, see Weber's *Wirtschaft und Gesellschaft* (2009, 154-155).

<sup>6</sup> Such organisational fluidity is, in fact, a rather established norm in business history, where Chandler, Kocka and others initially argued that the German business firms developed along more hierarchical lines, but discussions have evolved in the light of new historical research showing that many leading German firms at the time — Siemens, Thyssen, Zeiss and others — had fluid yet professional managerial cultures (Fear 2005).

categories in direct response to this, his classic work, his idea was picked up, with direct reference to Tönnies, by several management theorists, starting with Burns and Stalker (1961). They describe mechanistic and organic management structures: the former to manage stability, the latter to manage change. This was followed up by Robert Duncan (1976), who talked about ambidextrous organisations that can both explore and exploit at the same time for the first time; then by Henry Mintzberg (1989), who distinguished between five dominant organisations with different capabilities; and maybe most famously by James March (1991), who differentiates between organisations to exploit existing opportunities and organisations to explore new opportunities.<sup>7</sup>

We argue that innovation bureaucracies basically come in two organisational forms: one type captures a network of private and public actors, and it is typically small, fluid and deals with new emerging issues and sectors; and another type that is larger, based on expertise and skills, more hierarchical, and aiming to enhance existing capabilities in the private sector through more complex and large-scale activities (provision of demand, regulation, long-term funding, guidance of sectors, etc.).

We argue that it is typically not just a single new organisation with a charismatic leader, but rather a charismatic network of bureaucracy hackers that enables new organisations to emerge.<sup>8</sup> Such networks involve a number of leaders from various sectors (business, academe, politics, bureaucracy) that seek to solve an emerging (socio-political and/or technological) challenge. Such networks are carried by a certain naiveté, or as Albert Hirschman described it, they operate under the principle of *the hidden hand*: charismatic networks take on tasks they think they can solve without realising all the challenges and risks involved, and this may result in unexpected learning and creativity — and in new organisations (Hirschman 1967). Importantly, the charismatic nature of such networks enables the creation of mission mystique that attracts talent and is important for legitimising the new emerging organisation.

In the context of innovation, such networks coalesce around existing bureaucratic structures (e.g. military organisations, public universities), typically focused on long-term goals and stability. In this sense, we can argue that public sector structures that are expert-driven and stability-oriented are primary forms of any innovation bureaucracy. The primacy of public bureaucratic structures can be also detected in language: late 19<sup>th</sup> century German firms like Siemens used a peculiar term for their managers: *Privatbeamte* or private bureaucrats.

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<sup>7</sup> More recently, management research centres around the concepts of dynamic capabilities (e.g. Teece 2016; Helfat and Martin 2015) and ambidexterity (e.g. O'Reilly and Tushman 2004 and 2008).

<sup>8</sup> We differ here from institutional entrepreneurship literature as we do not focus only on organised interests (DiMaggio 1988); charismatic networks are indeed based on individuals.

In the history of innovation bureaucracy, we can therefore detect **two ideal-typical Weberian organisations** and their cyclical evolution. It is important — and hence we underline this point — that both come from, and are key components of, the cohesive work of one (extremely paradigmatic) thinker on organisation, public administration, economic growth and innovation, not set against each other but treated together. This gives us a broad hint that in a very profound sense they are intertwined; they belong together. These two forms are:

1. **First**, historically most forms of innovation bureaucracy start as one type of Weberian organisation — what we can call **Weber II**: charismatic, dynamic, **agile** networks, often innovating in emerging policy areas by proposing new initiatives and regulations, standards, or forms of cooperation, and frequently residing outside typical government operations. They may look like public-private partnerships, but can have high level political support, or enjoy societal prestige, and they often create their own agenda and rules. The networks are led and galvanised by bureaucracy hackers: skilled operators with good connections among business and political elites. However, these charismatic networks utilise and reconfigure existing bureaucratic structures.
2. **Secondly**, with time they move (or rather 'grow') themselves into the 'original' type of Weberian expert organisation — what we therefore call **Weber I**, because they are the 'original', well-recognised Weberian structures: professional, centrally governed, **stable**, predictable organisations, staffed with high level (technical) experts and strong in enhancing private sector innovation capabilities through public policies that support scaling and diffusion of innovations during fairly stable conditions of technological maturity or, conversely, during catching-up or mission-dominated periods. This means that the instrumental performance of these organisations is related to long-time horizons, predictability and cost-efficiency that allows for patient regulation and public investment in long-term and complex activities necessary for industrial development and catching-up.

In a further step, with new complex societal challenges, technologies and/or ideologies emerging, some expert organisations of the innovation bureaucracies can be pushed towards more charismatic forms, again through different reforms and revitalisation attempts. In reality, however, we see more attempts to achieve this via adding new organisations to the innovation bureaucracies through the mushrooming of various innovation labs and teams in the public sector explicitly working in agile, open ways. Importantly, these new organisations co-exist with existing innovation agencies, science funders and so on.

We can see in Weber I and Weber II organisational archetypes of innovation bureaucracy from which the formation of hybrid forms is possible and, indeed, to be expected. **In fact, the co-existence and co-evolution i.e. the continuous hybridisation, is what makes the agile stability of entrepreneurial states possible.**

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## 5. Summary

Entrepreneurial states are capable of unleashing innovations, and of creating wealth resulting from those innovations, and of maintaining socio-political stability at the same time. History tells us that governments create capacity for innovation through new organisations or new organisational forms, often led by charismatic outsiders or networks of such people. Yet, this agility is not enough, the new strengths need to become part of 'the routine', part of what governments do in daily life — this capacity for rejuvenation is at the heart of innovation bureaucracy. Without it we can't change the restrictive narrative that limits the public sector to just being a market fixer — and this means that we will risk losing the important innovations of tomorrow. But innovation bureaucracy needs to deliver in the mid and often long-run as well, sometimes more sometimes less depending on the context. Hacking alone cannot accomplish that. We argue that innovation bureaucracies are configurations, constellations of public organisations that deliver agile stability. Such balancing acts make public bureaucracies unique in how they work, succeed and fail — a difficult task indeed, but in the case of innovation bureaucracies, one that is vital for the overall success, now and in the future, of human living-together in time and space.

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