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Past, present and future of innovation agencies in Europe

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List of Abbreviations

BBC	British Broadcasting Corporation
CSIRO	The Commonwealth Scientific and Industrial Research Organisation
EU	European Union
GDS	UK Government Digital Service
MTIP	Mission-Oriented Topsector and Innovation Policy
NPM	New Public Management
NWS	Neo-Weberian State
R&D	Research and Development
SDGs	Sustainable Development Goals
SMEs	Small and medium enterprises
STI	Science, technology, and innovation
TAFTIE	European network of leading innovation agencies
UCL	University College London
UK	United Kingdom
WWII	World War II

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Abstract:

The European Union, in the face of mounting geo-political and climate challenges, needs a more effective innovation policy. Currently, its broad experimentalist approach to innovation policies gives Member States and regions autonomy for policy design. However, this often needs more effective organisations and capabilities to take advantage of the policy space. Thus, European countries face quite a substantial rethinking of how innovation policy is designed and implemented through innovation agencies. This policy paper argues that on all levels of European governance, policymakers should pay closer attention to designing and developing organisational ecosystems for innovation, focusing on fostering new capabilities. The paper starts with the assumption that European innovation agencies today face two broad challenges. First, they are tasked with, or engaged in, transforming socio-technical systems (e.g., food, mobility); and second, socio-technical systems fall under over-lapping systems of governance (e.g., food system includes elements from energy, waste management, health, and other policy areas), typically governed by different bodies. The transformation challenge indicates that innovation agencies require a broad spectrum of new capabilities across multiple systems. The governance challenge indicates the need for inter-organisational or distributed capabilities (e.g., division of labour and coordination across multiple organisations). This report discusses how innovation agencies are responding to this dual challenge and what critical steps could be taken to increase their capabilities to tackle the challenges effectively.

Keywords:

Acknowledgements:

"Innovation agencies do not innovate."
Dan Hill, former Director of Strategic Design at
Vinnova, Sweden

1. Introduction[1]

The economist Hyman Minsky once quipped that there are as many types of capitalism as there are varieties of Heinz pickles – namely, 57. While there are perhaps not as many types of innovation agencies in Europe or globally, it is still important to note that there is a great variety of public and often also public-private hybrid organisations supporting innovation activities in society. Innovation agencies form an evolving ecosystem of organisations that changes over time, co-evolving with technology, innovation and public policy.

Today, innovation agencies are often autonomous organisations that implement core elements of science, technology, and innovation (STI) policies. This specific form of innovation agency is relatively recent, emerging in the late 1980s and 1990s, predominantly focusing on supporting entrepreneurship in emerging technologies, innovation and technology development infrastructure, and various collaborations within innovation ecosystems. Today, the European network of leading innovation agencies, TAFTIE, counts forty member organisations across Europe and globally.[2] Many countries also have multiple agencies or units within larger organisations at the national and regional levels, often complemented by organisations and initiatives of the European Commission.

However, as the concept of innovation expands to include institutional, social, public sector and similar innovations, particularly in response to demands for SDGs-relevant policies, this paper assumes that the universe of innovation agencies is also expanding with organisations such as policy labs and similar organisations, as well as ad hoc activities, focusing on creating, testing and scaling innovations across all sectors and activities of societies.

While there is a growing body of literature on the expanding scope of innovation policy, there needs to be more focus on innovation agencies and their evolution. This policy report combines the latest academic work on innovation policy, innovation agencies, policy labs, and similar organisations, focusing on the emerging capacities and capabilities for effective innovation policymaking in this widest sense.

By the early 2000s, policymakers in Europe had realised that a union of diverse Member States requires stronger coordination of national initiatives, without which it would be difficult to compete with a more dynamic US and an emerging Asia, especially in ICT, but also in future technologies. As a result, policymakers recognised the need for more proactive coordination, trying to improve governance of the European Research Area both via stronger top-down coordination of European Research Area initiatives and, probably more successfully, via bottom-up initiatives such as the European Strategy Forum on Research Infrastructures. This, in particular, created and opened up pan-European research infrastructures and the joint programming and technology initiatives between the EU, intergovernmental funding schemes,

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and national schemes and strategies. As the framework programmes continue to be one of the main investment vehicles on the European level, the governance landscape of such EU-wide efforts is loosely experimentalist in nature: broad targets/goals (e.g., twin transition) and policy logics (e.g., smart specialisation or missions) are set on the European level, while Member States and regions/cities have the autonomy to develop context-relevant policy solutions that are assessed and refined through peer learning. While ideally, this should lead to contextual learning and experimentation, the implementation guidance developed by the EU is often quite rigid, hampering learning in policy organisations. This rigidity is often mirrored at the Member State level, while, ironically perhaps, innovators at regional and city levels experience almost the opposite: a bonfire of pilots rarely scaled into full-blown policies, again impeding any opportunity of learning what works in innovation and why. While many pilots aim to disrupt existing unsustainable systems (e.g., in mobility), failure to learn from and scale these initiatives will inevitably weaken public trust in policymakers' ability to tackle key challenges. Furthermore, there are considerable differences between different European countries in their capacities (e.g., levels of investment and other resources) and capabilities (e.g., speed and agility in updating policies and relevant organisations) in innovation. The impact of public administration reforms (e.g., new public management), too, is not evenly distributed across European administrations.

In this context, European innovation agencies today face two broad challenges. First, they are tasked with, or engaged in, transforming socio-technical systems (e.g., food, mobility); and second, socio-technical systems fall under over-lapping systems of governance (e.g., food system includes elements from energy, waste management, health, and other policy areas), typically governed by the EU, national and local-level regulations and institutions. The transformation challenge indicates that innovation agencies require a broad spectrum of new capabilities across multiple systems, while the governance challenge indicates the need for inter-organisational or distributed capabilities (e.g., division of labour and coordination across multiple organisations). This report discusses how innovation agencies are responding to this dual challenge and what critical steps could be taken to increase their capabilities to tackle the challenges effectively.

The report is structured as follows: The first section discusses how, historically, innovation agencies have had a dual purpose, on the one hand, to provide stable support to businesses and other actors such as universities and, at the same time, to experiment with cutting-edge, emerging technologies. This dual mandate has led to continuous organisational innovation and renewal, with today's focus on grand challenges spurring a new wave of such changes. The second section looks at the rise of challenge-driven policies (such as missions) and how this has led to the rapid expansion of instruments for how innovation is being supported and the number of organisations engaging in innovation. This section provides an overview of such instruments and organisations. In the third section, the report discusses how innovation agencies are developing (new) dynamic capabilities in attempting to tackle grand challenges. However, these capabilities could be better conceptualised and distributed across innovation agencies. This section offers a way to conceptualise such capabilities and examples of how innovation agencies develop them. Finally, the concluding section offers ideas on how governments could speed up the development of dynamic capabilities within innovation agency ecosystems.

2. Delivering agile stability: the expanding universe of innovation agencies

Innovation agencies, in the broadest sense, are as old as capitalism. Supporting innovation is one of the core activities of governments in market economies. However, looking at the history of innovation agencies, or "innovation bureaucracy"[3] over the past few centuries, we witness a certain organisational sequence and evolution. New agile public innovation organisations (often small at the outset, led by charismatic and entrepreneurial leaders and networks of actors, and acting in the liminal space between public and private sectors) are established to deal with new emerging technological or socio-economic challenges. Over time, these organisations, or rather the tasks they fulfil, become the 'new normal' and are 'mainstreamed' or institutionalised into existing public sector practices.

One way to make sense of this dynamic is to use the analytical lens developed by Max Weber more than a century ago. Weber was interested in ways in which authority, or legitimacy, is generated and exercised, as well as how one type of authority (charismatic) becomes another type (legal-rational or bureaucratic), only to be challenged again by the initial type (charismatic). In the context of innovation agencies, their historical evolution can be understood through two ideal-typical categories of organisation – *charismatic networks* and *expert organisations* – where evolution often oscillates between these two extremes within the same organisation or leads to the emergence of entirely new entities. Dan Breznitz and colleagues have aptly called these charismatic networks "Schumpeterian agencies".[4]

Importantly, these two ideal types of organisation possess rather different capabilities and skill sets, and they perform different functions. Charismatic networks provide agility and dynamism for innovation agencies to search for new directions and ways of doing things, while expert organisations bring long-term focus, predictability and the stability to deliver needed policies and results. This "agile stability" is key to the success of innovation systems as it allows public innovation agencies to complement private sector activities and capabilities in innovation. Innovation agencies create conditions, through various policy options, for the private sector – and for society as a whole – to further explore and exploit existing technological and innovation potential (e.g., through applied research grants for private companies or public vocational education training) to converge on and advance (global) best practices and the socio-technological frontier. This often involves weighing competing policy subjects, taking into account their potential and particular exigencies. Policymakers ask whether they should support an existing electronics company or a new startup in services. Is one sector or economic activity more important than another? These questions tend to be oriented towards medium-term challenges and solutions, spanning one or two typical electoral cycles and summarised in national development and innovation strategies. They are also often about using existing resources effectively and are representations of the existing political and economic landscape.

On the level of innovation systems (regions and countries), agile stability means constantly balancing multiple timeframes and policy cycles: on the one hand, mitigating the risks of the short- and medium-term exploitation strategies of existing industries and economic sectors and, on the other hand, managing the uncertainties of radical innovation, as well as the search for new competitive advantages through new directions and developments. On the level of specific

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3   For more details on these historical patterns of evolution, see Kattel, Drechsler and Karo (2022).

4   See, for instance, Breznitz and Ornston (2014) as well as Breznitz, Ornston and Samford (2018).

industries or sectors, agile stability is expressed perhaps more directly. The automotive industry is an excellent example of this. In the late nineteenth century, cars were an emerging new technology competing with horse-drawn carriages and trains. Over the course of the twenty-first century, the industry went on to mature considerably. Now the incumbent technology, car production in the twenty-first century is itself having to adapt to new challenges of electric and self-driving vehicles. Throughout the evolution of the car industry over the past 150 years, public organisations have played diverse roles, from regulator (of safety and standards) to educator (from technical production skills to public safety awareness), to infrastructure builder (streets, highways), to research funder (electric and self-driving cars). Diverse organisations have played these roles with diverse political and economic networks, administrative cultures, funding mechanisms and evaluation criteria. Yet without these organisations, it is safe to say that cars would not be as ubiquitous, as relatively reliable or as safe as they are today. In other words, the medium- and long-term questions faced by policymakers are answered by diverse organisations that often work in parallel, compete for political and financial resources and go through internal management reforms.

In sum, the fluid and ambidextrous nature of innovation agencies within innovation systems and sectors shows that quite different kinds of organisations are dealing with a range of diverse and constantly evolving tasks. Equally importantly, innovation agencies can go about fulfilling their tasks in quite different ways: some organisations can be involved in directly creating new technologies (e.g., government research institutes), while others can support private companies (e.g., funding agencies through grants) and others, still, can act as intermediaries of knowledge (e.g., engineering or business associations). As argued by Kattel, Drechsler and Karo (2022), innovation agencies can take the shape of the following ideal typical organisational types according to how the organisations go about dealing with innovations[5]:

1.   *Creators*: organisations directly involved in creating new knowledge and technologies, often in codified form (such as scientific publications), for instance, public research institutes;

2.   *Doers*: organisations involved in creating and delivering actual new products or services, for instance, state-owned companies or specialised agencies (e.g. for space exploration or agriculture);

3.   *Funders*: organisations that fund private or public entities involved in innovations, for instance, STI funding agencies or development banks;

4.   *Intermediaries*: organisations that act as knowledge and interest intermediaries, such as engineering or business associations or technology parks and clusters; and

5.   *Rulers*: organisations that create and constrain the legitimacy and space (through politics, policy and regulations) for others and give direction to their missions and tasks, such as ministries, cabinet offices or specialised offices for innovation.

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5   In their 2016 report, Glennie and Bound (2016) offer a similar if narrower typology of today's innovation agencies: First, *Market and System Fixers*, who seek to address failures in markets and networks that impede business innovation and investment in R&D, often without preference for specific technologies or sectors; second, *Industry Builders*, who focus on transforming an economy or creating new sources of economic competitiveness by investing in the development of a set of new sectors or technologies; third, *Mission Drivers*, who aim to induce innovations that address major societal and economic challenges, often in policy areas of significant traditional R&D spending such as defence, energy, the environment or health; and fourth, *System Optimisers*, who work towards ensuring continuous global competitiveness and creating more effective and enabling innovation systems by experimenting with different policy and programme mixes.

However, the organisational dynamic is accompanied by policy dynamics. In the context of Western countries, innovation policy is typically periodised through three frames:

- The post-WWII era of industrial policy in which countries mixed mission- and diffusion-oriented innovation policies;

- The era of competitiveness-focused innovation policies, which developed in the late 1980s as diffusion-oriented or horizontal policies, became dominant, with complementary macro-economic policies focusing on trade liberalisation and price stability; and

- The (re-)emergence of mission- or challenge-oriented innovation policies in the late 2000s.[6]

The latest frame around grand challenges as a 'normative turn' in STI policies has been reinforced by COVID-19 responses that promised to "build back better" as well as the various implications of the war in Ukraine. The key driver behind 'normative' STI policy initiatives is the ambition of achieving a particular type of economic growth (e.g., smart, inclusive and sustainable). As argued by Mazzucato, this constitutes a direct admission that economic growth not only has a rate but also a direction, which means that it can have multiple different directions (Mazzucato 2017). Policymakers have a choice, for instance, of how and how quickly they aim to decarbonise certain economic sectors. These alternative pathways include diverse trade-offs, spillovers and dynamic efficiency changes across sectors. Thus, as Stirling argues, modern-day challenges or missions are not about picking the one and only direction of change but a wider directionality that includes and enables multiple competing and complementary pathways and experimentation along the way (see Stirling 2009, 2024).

The European Union has arguably been the leading policy actor in bringing directionality discussions to the centre of innovation policy through its renewed focus on missions. For over a decade, the EU has attempted to reorient its STI agenda towards grand challenges (Soete et al. 2017). In 2021, the EU's Horizon Europe R&D funding programme commenced, and with it, the EU has committed to providing 53.5 billion euros in funding through Horizon Europe's second pillar, 'Global Challenges and European Industrial Competitiveness', and its five mission areas by 2027. Another aim of the programme is to encourage Member States – and and regions and cities – to refocus their STI policies according to the mission-oriented approach. However, while the EU and other leading economies have promised to increase public spending on various challenges they face, the debate on effectively aligning and absorbing these funds is in the early stages.

While mission-oriented policies have taken Europe by storm, missions are being implemented in widely different ways, depending, in most cases, on contextual factors. The widespread application of this approach is vindicating the decision to place missions at the heart of the normative turn in STI and public policymaking at large. However, to date, it needs to be clarified that this normative focus on directionality is accompanied by organisational changes to deliver on such promises. While there are some interesting practical examples of this shift in actual missions, most missions are implemented through existing institutions and policy schemes, with the result that missions are understood through existing organisational capabilities, as well as epistemological and analytical tools. As such, many missions are constrained to business-as-usual practices and incremental changes in both policies and organisations (see also succinct discussion by Tõnurist 2023). Indeed, there is a risk that the concept of missions as a shift

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6   Key references include Ergas (1986); Foray, Mowery and Nelson (2012: 1697-1702); Schot and Steinmueller (2018: 1554-1567); Kattel and Mazzucato (2018: 787-801).

towards understanding policymaking as a bottom-up experimentation aimed at solving the deeper challenges faced by society will be overrun by political events such as inflation, the cost-of-living crisis and the return of more traditional, mercantilist industrial policies, such as tariffs on advanced industrial goods.

Arguably, one of the key missing pieces in implementing missions and other similarly challenge-focused policies is the organisational development that innovation agencies need to undertake (Mazzucato and Kattel 2024). The current challenge for European countries can be summed up in this evolving policy context: what the EU has missed so far is complementing the policy of directionality with the organisational ecosystem to operate effectively within the set directionality. The current generation of STI policies needs to be complemented by evolution in innovation agencies.

3. Tackling grand challenges with innovation agencies

Alongside the normative turn towards framing innovation policies through specific challenges or directionality, we are also increasingly witnessing an epistemic shift within certain innovation agencies (for more detailed arguments, see Kattel and Mazzucato 2023). The adoption of working practices from (strategic and user-centred) design and agile software development is driving the emergence of new, often peripheral, public organisations (such as various policy and innovation labs) and networks (task forces, ad hoc events such as hackathons, swat and crisis teams, volunteer movements). These working practices focus on agile processes such as prototyping and experimentation, relying on epistemological frameworks from action research and ethnography rather than economics or public policy analysis. These new innovation agencies have brought experiential, experimental and techno-solutionist 'hacker' routines to public organisations in an attempt to formalise within organisations what can be called bureaucracy hacking (Kattel, Drechsler and Karo 2022). These new routines can also be seen as responding to the need to simplify existing, but often overly complex and technical, policy design and engagement practices, particularly in the aftermath of new public management (NPM) reforms (Kattel et al. 2023). The key challenge for innovation agencies is deciding which kind of new practices to adopt and mainstream and which practices to confine to largely – and often intentionally – peripheral labs and networks (Begovic et al. 2021).

There is an emerging STI (and beyond) policy landscape where normative approaches to goals meet agile organisational practices; for brevity, we can call them challenges-based policies and practices. There is considerable variation in the design of challenge-based policies and practices. These approaches are highly diverse, with large, powerful, well-funded programmes alongside smaller, minimally-funded initiatives, each with their respective organisational structures, as summarised in Table 1 below.

Table 1 exemplifies how innovation agencies are evolving by either incorporating new agile practices or collaborating in networks where such practices are used. This new, emerging shape of innovation agencies could be called neo-Weberian as it aligns well with the idea of Neo-Weberian State (NWS). In public administration literature, there has been a discussion of the Neo-Weberian State's emergence over the last decade, particularly focused on the European context. Conceived by Pollitt and Bouckaert in the early 2000s, it has been at the forefront of debate since the explicit discussion in the 2011 edition of their paradigmatic *Public Management*

Reform textbook (Pollitt and Bouckaert 2011; Pollitt et al. 2008/09; Bouckaert 2023).

The NWS posits that a new paradigm of the state has emerged in the era of post-NPM reforms. The NWS emphasises the importance of public organisations in providing public services and, at the same time, recognises the need for more citizen engagement in the design and delivery of public services. In innovation policy, neo-Weberian agencies can be characterised by the emergence of long-term societal goals (e.g., climate goals) as core elements of policies, which are accompanied by the incorporation of new methods and analytical tools such as user-centred design, foresight and policy labs.

Table 1. Typology of challenge-based policies and practices

Type	Features	Institutional form
Foresight and future thinking	Raising awareness and readiness for future challenges and scenarios	Both as established organisations and ad hoc processes
Digital teams / agencies	Rapid transformation of key public services, agile way of working	Both centralised and decentralised teams, mostly outside existing organisations
(Policy) labs	Encouraging user-centric approaches, testing, experimentation, quick iteration	Typically, new organisations outside existing systems/ organisations compete for projects (in-house consulting)
Sandboxes	Encouraging risk-taking and experimentation	Time-bound, separate legislation within existing organisations
Hackathons	Mobilising stakeholders and trialling multiple solutions, experimentation	Unique ad hoc events
Technology prizes	Solving specific technological challenges, creating market awareness	Unique ad hoc events
Challenge prizes	Mobilising stakeholders around issues, increasing awareness	Unique ad hoc events
Purpose-oriented procurement (innovative, sustainable solution)	Creating markets and increasing capabilities for new solutions	Part of routine procurement processes and organisation
Missions	Tackling socio-economic challenges through multi-stakeholder cross-sectoral collaborations	High-level political leadership, lead agencies (innovation, development banks)

Source: Maldonado and Kattel 2024; Goulden and Kattel 2024

The neo-Weberian innovation agency is an ideal-typical simplification and synthesis of such conceptual discussions and empirical developments. It serves as a heuristic to understand ongoing changes in innovation policy and its implementation. Yet, we should not see these as super agencies capable of solving societal challenges on their own; on the contrary, neo-Weberian agencies understand that part of their role is also to utilise the wider organisational configuration of public agencies in developing new capabilities for driving innovation in society.

Let us briefly look at some examples (more detailed discussion in Kattel, Drechsler and Karo 2022). The Swedish innovation agency Vinnova has attempted to change its ways of working over the last few years by creating, among other things, the new post of strategic design director (for a critical reflection, see Rohracher, Coenen and Kordas 2023: 336-349). This is an attempt to bring in new capabilities nested in human-centric design. As a result, Vinnova's mandate is being reframed from one focused primarily on technological issues to one tackling socio-economic challenges and transforming related socio-technical systems. This has meant considerably enlarging the circle of key stakeholders and transforming working practices at the agency. For instance, one of the missions it has chosen is rethinking food systems to provide healthy, sustainable food in Swedish schools. To deliver this, Vinnova is working with the entire food delivery value chain, or food system, from producers to users (children and parents) and spurring innovations (via funding), helping to shape markets and transform existing systems from energy production and transportation to waste management.

Thus, it is an attempt to combine a relatively long-term view of investing in new technologies with short-term changes in day-to-day habits around eating. One can argue that what Vinnova is trying to do is to develop capacities and capabilities for agile stability. While Vinnova is only at the beginning of its transformation, its blueprint is becoming increasingly adopted by other Nordic countries and beyond. Importantly, Vinnova – founded in 2001 through a merger of seven research councils as a traditional innovation funder/intermediary – is part of a larger ecosystem of innovation organisations that provide complementary capacities and capabilities. What we are witnessing are attempts to redefine and redesign the borders of this ecosystem, enabling it to deliver increasingly complex policy missions, such as transforming food systems. In the era of competitiveness and growth policies, nobody would have considered schools and pupils as integral components of an innovation agency's ecosystem, but the success of delivering sustainable food systems may, in fact, largely depend on how children and schools act and collaborate with organisations like Vinnova. These new forms of collaboration and co-creation, in turn, help Vinnova learn and design new routines and capabilities to support new forms of sustainability innovations.

Another example comes from the digital government. The UK's Government Digital Service (GDS), created in 2011, has become a global gold standard in public sector digital agencies (Clarke 2019: 1-31) and is another fascinating example of a neo-Weberian agency and of agile stability in action. Perhaps the most fundamental change brought about by GDS is the reform of public digital procurement through spending controls on procurement contracts and the creation of a new digital marketplace for bids (Kattel and Takala 2023: 1-15). This has enabled thousands of SMEs to bid and win public tenders, breaking existing oligopolistic markets and creating new, more open IT markets around government digital transformations. At the same time, GDS also radically changed the government's digital presence by creating a unified gov.uk website. Through this, the entire user experience of the UK government was transformed. Both reforms were based on user research and design practices to make information and services readily available and digitally usable. The capabilities GDS introduced into government were shaped around a redefined value proposition focused on user needs, facilitated by a new wave of talent capable of executing this vision. It is worth noting that many of the people hired by GDS from outside the civil service did not come from the private sector but from organisations

such as the UK's public service broadcaster, the BBC, and other similar public bodies or third-sector organisations.

In recent years, GDS has become the standard-bearer for the digital and design profession within the UK government and now focuses on professionalising digital skills across the UK government. The hackers and doers have become the new mandarins. Its initial new capabilities around user-centred design have become increasingly part of the routine skills many departments and agencies have in-house, rather than relying on a central agency.

Importantly, in both cases, various new capabilities and skills are interacting with the existing institutional and political infrastructure. These new capabilities evolve in interactions with other public sector actors within the broader innovation ecosystem and often also in partnership with private actors and citizens. Indeed, as seen in the examples above, new capabilities are pivotal for more direct engagement with the private sector and with citizens and for reframing the purpose of such engagements. This indicates different relationships with stakeholders and, accordingly, changing requirements for skills and capabilities.

In the European context, as mentioned above, its current framework programme for STI relies heavily on the idea of missions, and its implementation offers an interesting example of how and why new capabilities are needed for such ambitious policies. In terms of implementation, national-level mission-oriented policies are predominantly implemented by existing R&D and innovation agencies, mostly through upgrading existing policy instruments (for more detailed arguments, see Kattel and Mazzucato 2023). While European missions often target wide democratic engagement practices to build a renewed legitimacy for transformational policies, there is still little evidence that overall policy practices have changed fundamentally. Rather, we see many European countries building missions incrementally into their existing policy and organisational landscapes. Thus, for instance, the Netherlands introduced the so-called Topsectoren approach in 2012 to strengthen coordination and collaboration between various R&D system actors. While originally the primary goal of this approach was to improve the match between the knowledge demands of innovative firms and the activities of research institutes, it gradually shifted towards more transformative goals such as 'Mission-Oriented Topsector and Innovation Policy' (MTIP), now containing 25 missions across four overarching themes. While much of the Topsector governance has evolved into MTIP governance, perhaps the most marked difference is the creation of mission teams as cross-sectoral steering bodies for missions. Similar incremental approaches can be found in most European countries that implement missions. However, what is clearly missing in most cases is the focus on new organisational capabilities and developing the overall organisational landscape of innovation agencies.

Another interesting example is the future of European defence R&D and industry. With the mounting geopolitical challenges and uncertainty, EU leaders are moving towards a stronger focus on defence R&D and industry. In contrast to civilian STI policy, defence is still predominantly a national issue in Europe, and thus, common market and procurement mechanisms still need to be developed. As the security threat from Russia increases, it is easy to foresee a scenario in which security becomes an existentially important issue and, thus, a new mission area for the EU, particularly for those Member States geographically closest to Russia. However, the critical danger lies in the possibility that increased defence expenditures will strengthen a narrow military-industrial complex. Instead, defence should be viewed as a distributed and complementary capability that helps to tackle Europe's core challenges and, indeed, achieve its missions, as captured in the current strategies (Kattel and Soete 2024). However, such development of defence R&D and industry would require a serious focus on new capabilities across STI, cohesion policy and defence landscapes to align multiple policy arenas and organisational ecosystems. The defence sector would need to build neo-Weberian agencies

that are able to focus on long-term goals as missions but also interact with a wide set of actors in public, private and third sectors to ensure spill-overs from defence into civilian sectors.

4. The emerging dynamic capabilities in innovation agencies

The paper started with the assumption that innovation agencies today face the dual challenge of transforming socio-technical systems and managing the overlap of these systems with broader governance frameworks. In the previous section, the paper discussed emerging neo-Weberian agencies that attempt to tackle both challenges by developing novel capabilities for internal practices and outward engagement with the ecosystem. The new capabilities are predominantly dynamic, aiming to change existing ways of working and engagement. This section provides an overview of these emerging capabilities. Importantly, given the double challenge described above, it is not enough that innovation agencies are working to develop new internal capabilities but, as this section asserts, there is a need for 'meta-governance' across multiple agencies within the same ecosystem.

A quick search in Google's Ngram viewer shows that the reference to "state capacity" – as perhaps the broadest proxy for public sector capacities and capabilities – in published books has grown exponentially since the late 1980s. It is, however, not a coincidence that the focus on state and public sector capacities emerges more broadly in the shadow of NPM, neoliberal governance, and policy reforms. Rather than understanding governance as a collaborative effort between all sectors, these reforms gave normative preference to business practices (Mazzucato and Kattel 2020). Increasing focus on public sector capacity as a concept should thus be understood as an attempt to rebalance our understanding of how change happens in societies – through cross-sectoral co-creation – and as an effort to build the capacity of public organisations to work together to tackle socio-economic challenges.

When we look at academic conceptualisations of public sector capacities and capabilities over the past decades, we can summarise these discussions through three inter-connected layers:

- state capacities;

- organisational routines; and

- dynamic capabilities of public organisations (Kattel et al. 2024; Kattel 2022).

4.1 State capacity

The concept of state capacity emerged in writings on 'developmental states' from the mid-1980s onwards to describe the ability of national governments to "implement official goals, especially over the actual or potential opposition of powerful social groups or in the face of recalcitrant socioeconomic circumstances" (Skocpol 1985: 3-38). More generally, researchers using the concept have understood state capacity as resulting from the development of coherent bureaucratic institutions staffed by civil servants with expertise relevant to their roles, building on the ideas of Max Weber and the political 'autonomy' of the state or its ability to act without undue interference from other economic actors and interest groups (Evans and Rauch 1999: 148-765). Both of these aspects require raising and deploying financial resources, including through taxation and investment. In this sense, state capacity can be seen as a

structural feature of the state, encompassing many of its institutions and organisations as the foundation for its activities.

In the context of European innovation policy and agencies, we can detect somewhat of a paradox in the state capacity dimension. On the one hand, European policies provide ample space for Member State-level experimentation (e.g., there is no single blueprint or even any specific guidance on how to interpret and design mission-oriented policies). On the other hand, once the EU is funding policies and helping with their implementation, it tends to focus on the ability to absorb EU funds and on the ability to provide administrative transparency (e.g., Member States create or change existing agencies into implementation agencies for EU funds, separating policy and implementation). We can argue that such an imbalanced understanding of autonomy is the key feature of state capacity in Europe. Importantly, such a view of state capacity is forming organisational routines in many innovation agencies across Europe.

4.2 Organisational routines

The idea of organisational routines originates from evolutionary economics, particularly from the seminal work by Nelson and Winter (1982), who describe the idea of routines as follows:

> *We use this term to include characteristics of firms that range from well-specified technical routines for producing things, through procedures for hiring and firing, ordering new inventory, or stepping up production of items in high demand, to policies regarding investment, research and development (R&D), or advertising, and business strategies about product diversification and overseas investment. In our evolutionary theory, these routines play the role that genes play in biological evolutionary theory. They are a persistent feature of the organism and determine its possible behavior (though actual behavior is determined also by the environment); they are heritable in the sense that tomorrow's organisms generated from today's (for example, by building a new plant) have many of the same characteristics, and they are selectable in the sense that organisms with certain routines may do better than others, and, if so, their relative importance in the population (industry) is augmented over time.*

Importantly, routines are neither good nor bad; there is no ideal routine to obtain or learn. In brief, organisational routines can be defined as the abilities necessary to activate the set of resources (including financial resources, tangible and intangible assets, and staff skills) that an organisation needs in order to achieve organisational goals. In public organisations, these resources are embedded within formal and informal routines or 'tasks' and can be grouped into six types that are required to perform policy functions: analytical, planning, coordination, evaluation, policy and participation.[7] Typically, the focus of these capabilities is on ensuring the stable and durable functioning and performance of organisational mandates.

In the European policy context, long-term planning is the overarching routine expressed through multi-year policy cycles formulating agreements on priority areas, specific policy programmes (e.g., Horizon Europe) and respective expenditures. One of the key problems of such programmes is their limited space to pivot in the middle of policy and funding programmes. Such a rigid approach undermines the ability to learn from implementation; policy cycles become drawn out over multiple years, with key learning occurring at the end of such cycles. Such a paradox – long-term planning without agile learning – all but guarantees that most learning and adaption occurs on the level of policies. If a policy is ineffective, we need a new policy rather than different implementation practices and organisational development. The problem lies in the fact that any analysis indicating a policy is not working is often outdated.

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7   See further Karo and Kattel (2018: 123-150), where we unpack these routines in more detail.

The effectiveness of such policies gets lost in bureaucratic inertia, which in turn becomes the dominant organisational routine. Such relatively stable routines can be, and some argue should be, complemented by short-term adaptability and the introduction of new processes. This complementarity is achieved through a subset of organisational capabilities: dynamic capabilities.

4.3   Dynamic capabilities

As we can see from above, one of the key challenges faced by public organisations is their ability to learn from their own policies and their ecosystem. European innovation policy development and evaluation are typically practised as a waterfall; new initiatives are rolled out as finished programmes and evaluated after a few years or even at the end of the policy cycle. Such an approach makes it more difficult for the main public organisations responsible for the policy (e.g., a government department) and implementing agency (e.g., an innovation agency) to know about the effectiveness of their current instruments and policies. Policy analysis and evaluation is time and resource-intensive, but separating it from day-to-day activities diminishes learning within existing teams and organisations. Accordingly, innovation agencies find it challenging to pivot towards socially relevant issues, to discontinue ineffective activities, or to quickly scale new effective practices and instruments. In other words, European innovation agencies tend to be poor at dynamic capabilities, and the emergence of neo-Weberian innovation agencies can be understood as an attempt to create these dynamic capabilities.

Dynamic capabilities are specific abilities embedded in routines that enable organisations to adapt their resources, processes and skills in response to an evolving strategic environment. The concept first emerged in the 1990s from the strategic management literature to identify a "firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (Teece, Pisano and Shuen 1997). In the last decade, it has been increasingly used to analyse the public sector's ability to adapt in the face of new and ever more complex societal challenges.

There has yet to be an established consensus on the number and content of public sector dynamic capabilities. Following recent research based at the UCL Institute for Innovation and Public Purpose, this paper proposes a typology of these capabilities as follows[8]:

- **Sense-making (system awareness):** the ability to scan and make sense of the environment where a public organisation operates in order to analyse opportunities and threats. This can be broken into 'low order' routines: i) strategic thinking to discern potential challenges; ii) analytical thinking to discern potential opportunities; and iii) analytical thinking to discern political leverage and bargaining.

- **Connecting (policy coordination):** the ability to coordinate the connections, interfaces and linkages between the functions performed by a public organisation in relation to the external environment. This can be broken into 'low order' routines: i) vertical coordination among leadership and frontline of the public organisation; ii) horizontal coordination among silos/departments in the public organisations; and iii) inter-organizational coordination between the public organisation and other relevant ones.

- **Seizing (action as experimentation):** the ability to take advantage of emerging opportunities within a public organisation's external environment. This can be broken into 'low order' routines: i) strategic investment and allocation of non-monetary resources; ii)

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8   This builds specifically on Rainer Kattel, Mariana Mazzucato, Rosie Collington, Fernando Fernandez-Monge, Iacopo Gronchi, Ruth Puttick (2024). For a more detailed discussion, see Rainer Kattel (2022).

decision-making procedures that avoid bias and welcome innovation; and iii) stakeholder management.

- **Shaping (transforming contexts):** the ability to change a public organisation's internal resources in view of changes in the external environment. This can be broken down into 'low order' routines: i) management and prioritisation of stable financial funds; ii) insourcing and outsourcing of goods, human resources, projects, and processes; iii) management, reskilling and reshaping of human resources.

- **Learning (organisational learning):** the ability to control and manage how the routines developed by a public organisation are monitored, assessed, and ultimately discarded or institutionalised. This can be broken into 'low-order' routines: i) politico-administrative learning; ii) politico-economic learning; and iii) techno-economic learning.
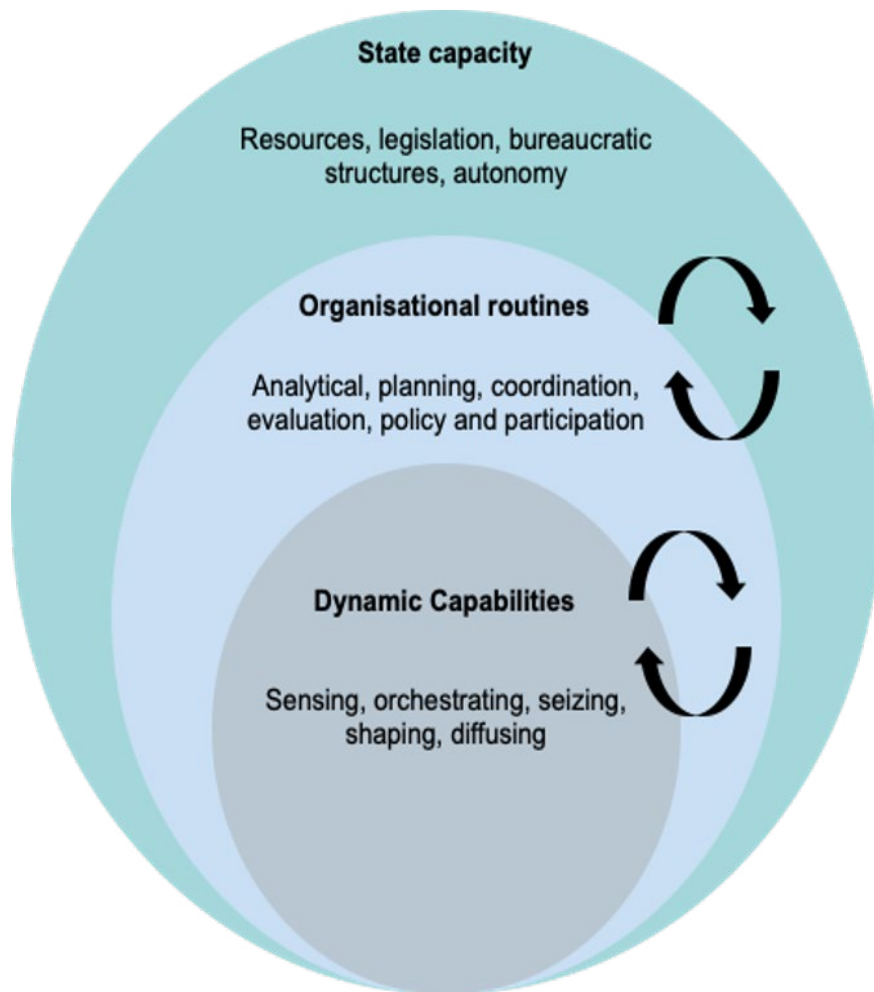
In sum, dynamic capabilities identify the set of specific abilities that enable the renewal of existing public organisations and their dominant organisational routines. Ultimately, dynamic capabilities should enable (re-)alignment in order to produce stronger policy design, better policy implementation, and successful policy outcomes.

The relationships between different levels of capacities and capabilities are summarised in Figure 1.

Examples of neo-Weberian agencies, such as Vinnova in Sweden and GDS in the UK, can be analysed through the lens of dynamic capabilities. In both cases, the organisations developed a novel set of capabilities, particularly around sense-making approaches and tools (strategic design for missions and user-centred agile design for digital solutions, respectively), seizing (experimentation) and learning (diffusing new practices across the organisation). But just as importantly, both organisations attempted new ways of orchestrating the ecosystem (Vinnova through a massive outreach campaign; GDS through the professionalisation of key digital skills across the government) and focused on reshaping some of the core routines, such as procurement. In both cases, the dynamic capabilities enable the rethinking of main organisational routines and, as is evident, particularly in the case of GDS, feed back into state capacity via re-establishing the government's autonomy in the digital markets and led to much better use of existing financial resources.

Importantly, while dynamic capabilities apply to individual organisations, it is also key to understand how organisations such as innovation agencies working in the same ecosystem complement each other. Thus, some of the dynamic capabilities can also be distributed across multiple organisations working together. For instance, going back to Vinnova's school food and sustainable street missions, it is clear that Vinnova alone cannot deliver on these ambitious goals, no matter how strong its dynamic capabilities are. It needs a broad coalition of public and private actors to collaborate with. The latter requires many of these organisations to build their own dynamic capabilities and change their predominant organisational routines.

Figure 1. State capacity, organisational routines and dynamic capabilities

State capacity

Resources, legislation, bureaucratic
structures, autonomy

Organisational routines

Analytical, planning, coordination,
evaluation, policy and participation

Dynamic Capabilities

Sensing, orchestrating, seizing,
shaping, diffusing

Source: Kattel et al. 2024

A good example of such ecosystem focus is how Australia's applied research agency, CSIRO, is implementing its approach to mission-oriented policies. As shown in Figure 2, in implementing missions, CSIRO emphasises continuous dialogue and interaction with the organisations they fund in order to ensure that learning processes are both quick and iterative – both within CSIRO and among its partners. Ideally, such approaches should lead to changes in organisational routines across the involved actors, thereby enhancing the state's overall capacity to shift the directionality of socio-technical systems. In order to govern and manage such an ecosystem, CSIRO developed a portfolio approach to missions, with new managerial structures, collaboration and evaluation practices.

Figure 2. Mission implementation framework by CSIRO (Australia)

Stage gates framework
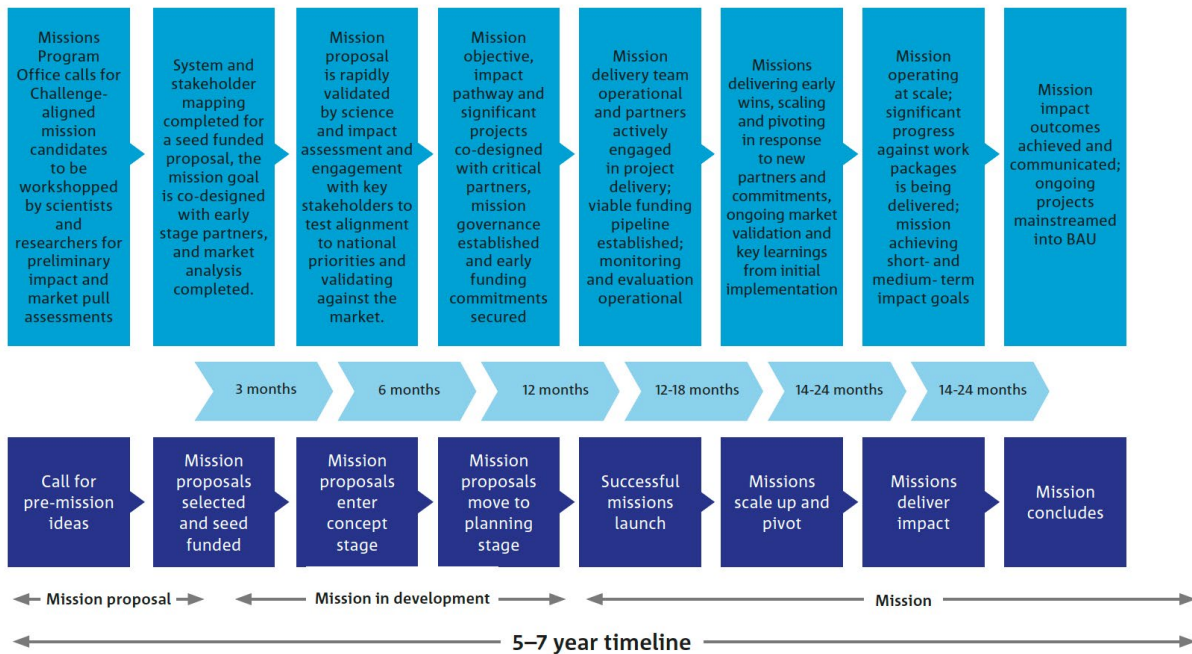
Source: CSIRO 2023

When we look at the European Union and its Member States, there is no 'meta-governance' of building and developing dynamic capabilities across multiple innovation agencies in various socio-technical systems. Moreover, in any given socio-technical system, innovation agencies are bound to be on different governance levels (central, regional, local) and of different types. Thus, we can again detect a somewhat paradoxical situation. On the one hand, the European Commission encourages experimentation within broad goals and practices (e.g., smart specialisation, twin transitions, and missions), yet progress tends to get hindered by the bureaucratic inertia of EU funding administration at the Member State level. On the other hand, regions and cities, in particular, are carrying out pilot after pilot, establishing all sorts of policy labs, while lacking the coordination needed to translate successful pilots into broader, systemic change. Thus, as Radosevic and Zoretic argue about smart specialisation strategy, "particularly in institutionally less developed countries and regions, there is often a clash between the requirements for experimental governance and the public policy demand for predominantly procedural accountability. Our central argument is that the experimentation dimension cannot be added to the conventional policy cycle without altering it" (Radosevic and Zoretic 2024: 1693-1712). Pilots can be seen both as expressions of an experimentalist approach and as results of NPM-inspired projectification. EU-funded pilots, in particular, tend to be tied to deliverables and milestones set in contracts that leave little room for pivoting when context or on-the-ground learning calls for it. Thus, paradoxically, pilots become "a new form of iron cage, with a relative lack of flexibility and action space." (Mukhtar-Landgren 2021: 1485-1511). The experimental policy frameworks die under the weight of countless pilots.

5. Conclusion: What can be done to make innovation agencies more effective?

In their 1971 article on public choice, Ostrom and Ostrom propose that "a system of public administration composed of a variety of multiorganizational arrangements and highly dependent upon mobilizing clientele support will come reasonably close to sustaining a high level of performance in advancing the public welfare." (Ostrom and Ostrom 1971: 203-216). In the context of innovation agencies, the first part of their argument seems particularly relevant today. Rather than thinking of innovation agencies as a single type of organisation, policymakers should aim to develop a landscape of diverse innovation agencies with varying strengths and dynamic capabilities. Thus, what becomes pivotal is the overall governance of diverse agencies and distributed capabilities. However, such design of institutions is almost entirely absent in European, and indeed global, thinking and practice about innovation agencies.

While the COVID-19 pandemic, inflation and military conflict have woken governments up to the realities of what it takes to tackle massive crises, the question policymakers now face is what it would take for governments to replicate such focus over the longer term in a way that addresses critical challenges for societies, from health crises to the climate emergency, and how they can develop and implement the ambitious policies required to respond (Mazzucato and Kattel 2024). Particularly in liberal democracies, ambitious change requires wide engagement across society to ensure that radical changes will have widespread benefit and resonance. This will not happen overnight. The key challenge or even paradox at the heart of the current generation of mission-oriented policies is the need to develop ambitious policy goals which are implemented through myriad public organisations and policy programmes based on experimentation (ibid.). Such experimentation is what differentiates today's missions from those of the Moonshot era: societal challenges, such as making food systems more equitable and sustainable, cannot be solved in the same way as going to the Moon. Socio-technical systems consist of multiple technology systems (in the case of food, these include everything from energy to waste management), widespread and often disconnected actors, and the need to change cultural norms, values and habits. Transforming such systems requires a broad portfolio of activities working towards a common goal without dictating how different sectors and actors should solve their own challenges. A single agency cannot feasibly manage such portfolios. The organisational landscape's design is, therefore, more important than ever before.

The European innovation policy and agency landscape is experiencing a peculiar imbalance of agility and stability. On the level of European and national policies, there is almost too much focus on stability (long-term plans implemented through administratively rigid organisations), and on the level of regions and cities, there is almost too much agility (thousands of pilots and labs with little scaling and diffusion precisely because of this very administrative rigidity).

The diversity of tasks innovation agencies face is bound to increase as expectations of their impact on the directionality of socio-technical regimes are increasing. As system transformations are highly complex processes, the innovation agencies need to be up to dealing with uncertainty and complexity. The implications for today's innovation agencies are manifold:

- Innovation agencies at all levels of governance should focus on building dynamic capabilities internally to speed up learning what works and what does not. This requires investment into new capabilities and a new approach to hiring and upskilling staff.

- New capabilities, such as emerging design, experimentation, and agile working skills, need

to be codified and standardised into professions and career tracks. This should make it easier to recruit new staff and to plan and resource training programmes.

- The training programmes should be developed across various innovation agencies to facilitate multi-agency communities of practices, which should enable better collaboration and co-creation in the future.

- There needs to be a conscious effort to design and govern the ecosystem of multiple innovation agencies as a pool of distributed and collaborative ecosystems of capabilities. This may take the shape of a high-level governing body or similar structure that allows for overall coordination on the level of policies and capabilities.

At the level of the European Commission and the EU Member States, the focus should shift towards achieving stronger cohesion in the institutional division of labour and organisational design of the innovation policy agencies.

- The European Commission should continue its experimentalist approach to policy. However, it needs to pay much more attention to organisational ecosystems and capabilities within these ecosystems. Today, too many promising policy ideas either fail to scale after pilots or are implemented by agencies without significant capabilities in iterative policy design and quick learning.

- Member States should focus on the 'meta-governance' of innovation agency landscapes and consciously design and build organisations with diverse yet complementary capabilities. This requires taking ownership of the innovation agency ecosystem and building governance structures. Further, it would also require focusing on longer-term goals, moving away from objectification and short-term goals, and evaluating policies on the level of portfolios or programmes rather than on the level of pilots and individual projects. This would allow more risk-taking while also helping cultivate a higher tolerance for failure.

- Regions and cities are often the focus of experimental policies, yet their organisational capabilities are not enough to scale successful policy and implementation innovations.

In the language of this paper, one can argue that European regions and cities have over-emphasised agility in terms of pilots and labs, while nation-states, on the other hand, are erring on the side of stability. It should be one of the key issues for the new incoming European Commission to adjust its role in the innovation agency ecosystem as a driver of dynamic capabilities throughout the system.

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