

Reconceptualising the 'policy mix' for innovation

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Abstract

Recent years have seen the emergence, take-up and use of the term 'policy mix' by innovation policy makers and by policy analysts & scholars alike. Imported from economic policy debates, the term implies a focus on the interactions and interdependencies between different policies as they affect the extent to which intended policy outcomes are achieved. However the meaning of the term remains ambiguous. Nonetheless, we argue that the emergence of the 'policy mix' concept into common use in the field of innovation policy studies provides us with a window of opportunity to reconsider some basic and often hidden assumptions in order to better deal with a messy and complex, multi-level, multi-actor reality. We draw upon a range of literatures to re-conceptualise the basic building blocks of innovation policy studies in order to arrive at a useful definition of 'policy mix' tensions and interactions of different kinds across a series of dimensions. We suggest that this reconceptualisation has important implications for the future scope and focus of prescriptive and analytical innovation policy studies.

Keywords

Policy mix; policy complexity; policy interactions; policy instruments; actors; agency; innovation policy.

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1 Introduction

The innovation policy debate has changed in recent years. Policy makers, scholars and analysts alike increasingly focus on challenges stemming from policy complexity. This shift in emphasis is exemplified by the uptake of the term 'policy mix'. Imported from economic policy debates, it implies a focus on interactions and interdependencies between different policies as they affect the extent to which policy goals are realised. Despite these aspirations to a more realistic approach towards policy complexity, there is a risk that complexity is simply 'black boxed' and rendered unproblematic.

Morlacchi and Martin (2009) have recently argued that innovation policy studies are at something of a crossroads. As a discipline it has been extraordinarily successful over several decades in persuading policy-makers of the importance of innovation and the need for active innovation policies. However, in the course of doing so, it could be that the innovation policy research community has lost the 'critical reflexivity' which Morlachhi and Martin feel is necessary to sustain both the instrumental and critical roles of innovation policy research in the longer term.

In this paper we take up the challenge of bringing critical reflexivity to the problem of innovation policy complexity and the idea of the 'policy mix'. We set out the elements we believe are necessary to an analytically useful conceptualisation of policy complexity. We spell out an approach to policy mixes compatible with a more sophisticated, multi-actor, multi-level and dynamic understanding of the processes by which policies emerge, interact and have effects. We do this by reflecting upon some assumptions implicit in much of the innovation policy studies literature and by drawing on insights both from the policy studies literature and from evolutionary economics. We do not discuss the merits of specific innovation policy mixes; nor do we attempt to prescribe rules for designing effective ones. Indeed we will suggest that it is unrealistic to hope to identify unambiguously 'good' mixes. We focus instead on sharpening our approach towards the actors, instruments, institutions and interactions which shape public policy in order to be able to arrive at a useful and more rigorous conceptualisation of the policy mix for innovation.

The paper proceeds as follows. First we discuss the diffusion of the policy mix term, before exploring its relevance for innovation policy studies. Next we begin our problematisation of policy complexity by exploring the setting of policy agendas and the shaping of policy rationales. We next turn to actors and agency in innovation policy processes. Having considered *actors*, we go on to consider policy *action*, discussing the concept of 'policy instruments'. Finally, having discussed action, we turn to *interactions* between public policies, conceptualising a set of dimensions across which interactions can occur and stressing the need for a genuinely dynamic view of policy interaction. In the final section we draw together our conclusions.

2 The origin of the term and its adoption in innovation policy studies

The phrase 'policy mix' emerged in the economic policy literature in the 1960s. Amongst his contributions Nobel Economics Prize winner Robert Mundell (1962) noted that, under one condition, a floating exchange rate, monetary policy becomes a powerful tool for stabilising the economy whilst fiscal policy becomes powerless, whereas under a fixed exchange rate the opposite becomes true. Mundell's concept of the fiscal/monetary policy mix later came to prominence in the economic policy debates around European Economic and Monetary Union (EMU) (see e.g. Claeys, 2006).

A search of the *International Bibliography for the Social Sciences* shows that the term 'policy mix' remains largely confined to economic policy debates until the late 1980's/early 1990s at which point it not only explodes within the economic policy literature but is also extended to other areas of public policy to explore the interaction between different policies/instrument to achieve a particular goal or outcomes (see for instance Stroick and Jenson, 1999 on the 'best policy mix for Canada's young children'). The most significant early diffusion of the concept has been into the literature on environmental policy and regulation (see for instance ETAN Expert Working Group, 1998; Sorrel and Sijm, 2003).

Innovation policy scholars have previously discussed the need for innovation policy-makers to consider a 'mix' of objectives and policy instruments (see e.g. Smith, 1994; Branscomb & Florida, 1998). However the term 'policy mix' seems to have found its way into the innovation policy discourse around the beginning of this decade, via both the environmental policy⁴ and the macro-economic policy discourses⁵. In 2002 the STRATA-ETAN Expert Group on Benchmarking National RTD Policies (later summarized in Soete and Corpakis, 2003) stated that effective policy learning from cross-country comparison requires "an understanding of the ways in which individual instruments are combined into effective policy mixes within national innovation systems".

Subsequently, in response to the Barcelona target for raising R&D investment to 3 per cent of GDP and the Commission's Action Plan, a CREST (European Union Scientific and Technical Research Committee) Expert Group on 'Public Research Spending and Policy Mixes' was charged with stimulating the implementation of parts of the Action Plan via a process of mutual learning under the Open Method of Co-ordination (OMC)⁶. Since 2003-4 CREST activities in particular have driven the 'mainstreaming' of the term into EU policy analysis activities (such ERAWatch and the dedicated 'Policy Mix' project commissioned by DG RTD⁷). The OECD Working Party on Innovation and Technology Policy (TIP) has also conducted a number of reviews to examine policy mixes in volunteer countries with the aim of better understanding how policy mixes differ among OECD countries and provide insight into how such differences contribute to the overall effectiveness of innovation policy. We believe that this uptake of the policy mix term reflects two developments in innovation policy studies.

⁴ The ETAN Expert Working Group mentioned above explored the R&D challenges presented by climate change and included influential innovation policy analysts active in the subsequent dissemination of the term.

⁵ through the conclusions of the Lisbon Council in March 2000, in which the importance of increased R&D expenditures and a favourable macro-economic policy mix are discussed more or less side-by-side.

⁶ For details and reports see: http://ec.europa.eu/invest-in-research/coordination/coordination01_en.htm

⁷ "Monitoring and analysis of policies and public financing instruments conducive to higher levels of R&D investments" Contract No. DG-RTD-2005-M-01-02. See <http://www.policymix.eu/> for more information.

First, a general recognition that innovation-driven economic success depends on more than traditionally-conceived S&T policies - exemplified by the emergence of 'systemic' rationales and new typologies of innovation policies that emphasise the role of 'indirect' as well as traditional 'direct' measures, 'demand-side' as well as 'supply-side' instruments (see e.g. Edquist et al, 2000; Soete and Corpakis, 2003; Smits and Kuhlman, 2004; Edler and Georghiou, 2007)⁸. This implies that instruments intended to achieve other policy goals (such as procurement, regulation, education, tax measures, etc) can or should be 'co-opted' to achieve the goals of innovation policy: as Nauwelaers and Wintjes (2008) put it, innovation has "invaded" the agendas of many traditional policy fields (p.286). Borrás (2009) characterises this as a process both of "widening" - the introduction of new and more sophisticated policy instruments - and of "deepening" - an expansion of the realm of action for innovation policy.

Second, we believe that the uptake of the term reflects the realisation that modern states are increasingly characterised by the dispersal of power, not merely upwards and downwards from the national level to supra- and sub-national actors, but also outwards to quasi-state and non-state actors. This realisation is not confined to innovation policy studies and is reflected more broadly in the replacement of traditional state-centric models of government and 'public administration' by new ideas about multi-level, multi-actor 'governance' and the 'New Public Management' (see e.g. Bache and Flinders, 2004; Dunleavy and Hood, 1994).

The two realisations discussed above are not simply the result of changes in scholarly paradigm. Paradoxically, whilst the dispersal of power from traditional state actors just mentioned arguably makes it harder for policy-makers to use traditional direct levers, expectations about the scope for public action remain high. Possibly for this reason, policy-makers have sought new explanations for the relative failure of traditional research and innovation policies to transform the innovation performance of nations.

Despite its new-found popularity in innovation policy studies, the 'policy mix' term is under-conceptualised⁹. The concept is treated as self-explanatory and unproblematic. However, despite this under-conceptualisation, normative assertions are made. We are told that what is needed are 'appropriate', 'effective', or 'balanced' policy mixes (Soete and Corpakis, 2003; CREST Policy Mix Expert group, 2007; UNU-MERIT et al, 2009; Wieczorek et al, 2009). Achieving this is seen as a challenge of 'coherence' and 'co-ordination'. There is a common assumption that policy makers are underutilising the full portfolio of 'instruments' theoretically available to them and that this is a bad thing (see e.g. Smits and Kuhlmann, 2004). This implicit conceptualisation entails not only a normative assumption about the composition of the mix but is also rather static. Change is only considered in the sense that policy complexity is seen as increasing over time, and interactions in the policy mix are overlooked.

Using the term 'policy mix' simply as shorthand for an expanding portfolio of innovation policy instruments involves a value judgement as to what currently

⁸ Supply-side innovation policies represent the older tradition of aid through finance (grants, tax incentives and public venture capital) and aids through the provision of public services (brokerage services, incubators, science parks, etc). Demand-side policies would include relatively new tools (Smits and Kuhlman, 2004) such as the use of regulation and standard-setting to incentivise innovation and promote 'lead markets'.

⁹ The only working definition we can find in the context of innovation policy is that proposed by UNU-MERIT et al (2009, p3), which defines the policy mix for R&D (the focus of that study) as the combination of policy instruments which interact to influence the quantity and quality of R&D investments in public and private sectors.

constitutes (or should constitute) the boundaries of innovation policy¹⁰. This is often accompanied by a second implicit value judgement whereby 'innovation' is transformed from a means to achieving a broad range of public policy goals into a policy goal for a broad range of public policy domains¹¹.

Such prescriptions seem to rely on a model of the policy process that contradicts the very trends the policy mix term is intended to reflect. It is implicitly assumed that policy mixes can be meaningfully considered at a single level of governance and that 'co-ordination' - itself considered to be an unproblematic activity necessitated by growing policy complexity - can in principle be done by a single, objective, rational and neutral overseeing policy maker. In a world of dispersed, multi-level and multi-actor governance patterns 'co-ordination' in this sense is clearly impossible. As Hay (1999, p322, original emphasis) notes, the state as a "complex and institutionally fragmented system (*of systems*) has no innate propensity to proactive and reflexive transformation as a *system*". In order to engage in a process of reflexive self-transformation, the state must not only co-ordinate its multiple activities but also "the process by which these are reconstituted and re-co-ordinated". Acting as a unified actor in this way may be possible only rarely (Hay, 1999, p322).

It is hard enough to see how any policy actor operating within a system of policy systems can at the same time step outside the system and take a rational and objective overview. It is even harder to imagine how the resulting impetus to co-ordination would be legitimated and accepted within that system. Co-ordination can at best mean mutual adjustment between actors and systems within this larger system of systems. It seems to us that this is often not what is implied when innovation policy analysts recommend better 'co-ordination'.

The way the term policy mix is used in innovation policy discourses, then, seems to downplay Mundell's original emphasis on the interactions between policy instruments as they seek to achieve a policy goal¹². It is effectively used as a synonym for 'innovation policy'. In contrast, we believe that if the concept has any utility it must be in forcing our attention to the trade-offs between policies as they impact upon the extent to which the ultimate intended goals or outcomes *of innovation policy* are realised, in a particular space and at a particular time. We now turn our attention to the various elements of the policy process which are relevant to this task.

3 Agenda-setting and policy rationales

Citing Richard Nelson's (1977) *The Moon and the Ghetto*, Morlacchi and Martin (2009) lament that "the genesis of policy problems and research problems is a critical process in STI policy, just as much as deciding how those problems can be addressed, yet we do not have any satisfactory theory for this" (p. 580). However this

¹⁰ Even in making this judgment, analysts and scholars rarely question *why* certain instruments and policy domains are added to the broad innovation policy arena (and why some are consigned to obscurity).

¹¹ Witt (2003) observes that "an implicit presumption in evolutionary economics and its policy making applications is that innovativeness [...] is, by and large, beneficial and therefore ought to be encouraged".

¹² However, whilst in the area of fiscal/monetary policy managing the policy mix means manipulating a small set of fairly stable policy instruments to achieve a single explicit goal, this is clearly not the case for innovation policy mixes. Here the set of instruments potentially in scope is larger but these instruments are also more complex and less liable to be stable over time, from place to place and/or across levels of governance. Whilst the early use of the term in connection with the Barcelona 3% R&D objective does at least fit the concept of trading off different combinations of instruments at multiple levels of governance against a single, well-defined target, once we begin to talk of innovation policy mixes then the goals and objectives of a range of policy domains must be traded-off against the often rather diffuse goals and objectives associated with innovation policy.

process has been extensively explored in the policy studies literature, with agenda setting, advocacy and the evolution of ideas the focus of much recent attention. Determining how political and policy agendas are set and which actors are involved demands a more dynamic perspective than is seen in traditional policy studies (and in nearly all innovation policy studies) and the outcome of this substantial literature on agenda-setting has been a new and promising interest in evolutionary accounts of policy and politics¹³.

The innovation policy literature sometimes implies that theory-based rationales are the primary driver of policy development. The policy process is seen as proceeding in linear discrete stages, implying a one to one mapping between scholarly ideas and policy rationales, and between policy rationales and policy instruments. Accounts of shifts in innovation policy are mapped onto changes in scholarly ideas, with the implication that the former are caused by the latter (e.g. Ruivo, 1994; Elzinga and Jamison, 1995). Conversely, when giving policy recommendations, innovation scholars implicitly assume an unproblematic and straightforward translation of these into the formulation of innovation policies. These accounts risk reducing 'the policy maker' to a passive recipient of rationales from outside, implying an expert-driven or technocratic policy process with little or no role for politics. In contrast, the policy studies literature treats ideas about cause-effect relationships as but one amongst many factors shaping public policy. As Kay (2006) puts it "policies cannot be analyzed apart from the policy making process".

Kingdon's seminal work on agenda-setting in public policy (1984) has attempted to understand the genesis of policy ideas and "what makes them catch on and survive in certain communities and at certain times". Kingdon uses the term 'policy primeval soup' to depict the development process of policy proposals as an evolutionary one. Policy systems will contain a plethora of ideas at any given time and these ideas compete in a complex selection environment (see also Slembeck, 1997). At various times 'policy windows' open and specific ideas come to prominence. The development of policy 'streams', Kingdon argues, combines gradual and incremental evolution with instances of punctuated equilibrium. Similarly, Baumgartner and Jones (1993) depict the political system as characterised by considerable stability, punctuated with periods of volatile change. They see policy change in Schumpeterian terms, discussing the generation and (creative) destruction of 'policy monopolies' which display a common political understanding in relation to the policy of interest, accompanied by an institutional arrangement that reinforces that understanding. The prominence of a particular idea (the exploitation of windows of opportunity or the breaking up of policy monopolies) is often contingent on the action of 'policy entrepreneurs'¹⁴ (Kingdon, 1984), actors with a particular interest in the success of the policy. Such entrepreneurs may be incentivised by personal interest, the promotion of certain values, or the mere satisfaction of being part of the policy action.

What then is the role for theory as a particular subset of 'ideas' in this agenda setting

¹³ Inspired by influential studies of agenda-setting and policy dynamics of Kingdon (1984) and Baumgartner and Jones (1993, 2002) a number of political scientists have proposed conceptualizing policy processes in an evolutionary way (e.g. Kerr, 2002; John, 2003; Kay, 2006). In parallel a number of evolutionary economists have explored the dynamics of policy processes (Slembeck, 1997; Witt, 2003; Pelikán and Wegner, 2003; Moreau, 2004; Paraskevopoulou, 2010). However, few connections are made between the two literatures (one exception being the work of van den Berg and Kallis, 2009).

¹⁴ Policy entrepreneurs are characterised, much like business entrepreneurs, by "their willingness to invest their resources—time, energy, reputation and sometimes money—in the hope of a future return" (Kingdon, 1984: p.129)

process? Laranja et al (2008; 825) argue that scholarly theories are seldom adapted “wholesale in a one-to one transfer of ideas to policy” but rather that attractive elements of scholarly ideas tend to be ‘cherry-picked’ by policy makers. Majone (1989) suggests that policy makers use theory in a selective way to justify policy action and indeed policy choices are influenced by norms, beliefs, goals and pressures that differ from those in the academic community. Policy makers may use theories to justify policies but more often policies may be rationalised retrospectively. Majone also notes the artificiality of distinguishing between policy analysis and policy advocacy, ‘policy innovations’ being the result of objective analysis combined with advocacy and persuasion.

Clearly it is important to differentiate between rationales derived from, or directly implied by, scholarly theories and the specific rationales explicitly or implicitly used by policy makers to justify the design, selection and use of particular policies. Laranja et al (2008) distinguish between meta-rationales (high-level philosophies about the proper modes and limits of government action) which influence in turn the way in which specific ideas are taken up and interpreted in the policy process; and specific policy rationales, the adoption of which is guided by the meta-rationales in operation at the higher level¹⁵. The idea of meta-rationales is akin to the term ‘policy paradigm’ proposed by Hay (2002, inspired by Thomas Kuhn (1962)), namely packages of related ideas that act as a filter for possible responses to problems. Importantly, new rationales seem not to simply substitute for old ones (Braun, 2006; Laranja et al, 2008). As ideas are institutionalised, they become the foundation for shaping (allowing and/or constraining) the context in which future policy choices are made (Steinmo, 2003; Pelikan, 2003; Kay, 2006).

At best, then, scholarly theories suggest specific actors, institutions, relationships, spaces or other phenomena as targets of policy action in order to achieve certain objectives. In turn these specific policy rationales may themselves imply (or at least inspire) specific instruments or policy mix choices. In this view concepts and theories developed and critiqued by scholars on the one hand, and specific policy rationales held by policy makers on the other, constitute distinct, albeit interacting, bodies of knowledge. Fundamentally, the specific rationales formulated by policy makers, whether explicit or implicit and in need of unearthing, should be the starting point for any evaluation of the effectiveness of policy action - rather than theoretical rationales retrospectively mapped onto policy actions by scholars. These policy rationales themselves almost always come in a ‘mix’ (Braun, 2006).

4 Actors and agency

Although innovation policy analysts are heavily influenced by evolutionary-structuralist understandings in their approach to innovation processes, policy prescriptions often explicitly or implicitly assume that policy action is confined to the selection of discrete and well-defined instruments - or the development of new ones - by a single, purposive, (boundedly) rational and disinterested ‘policy maker’ – often implicitly synonymous with national government or ‘the state’.

In reality, making and implementing public policy is rarely the preserve of a single actor or group of actors (Howlett and Ramesh, 2003) and the ‘two realisations’

¹⁵ Meta-rationales can prevent certain sorts of conclusions being drawn from otherwise influential theories and concepts. This can lead to an over-emphasis on one lesson from a body of theory at the expense of other, possibly equally significant, lessons.

discussed in Section 2, above, make this kind of simplification increasingly untenable. Hay (1999, p320) appreciatively quotes Schmitter's (1985, p33) comment that the state is "an amorphous complex of agencies with ill-defined boundaries, performing a variety of not very distinctive functions". Hay further notes (p321) that "although a complex variety of agencies and institutions claim their authority and legitimacy to intervene within civil society and the economy from 'the state', this state in itself displays precious little capacity to behave as a singular actor". Indeed Hay suggests that the main unifying principle behind this diversely interested set of actors and institutions is a shared path-dependent trajectory of periodic transformation or reinvention.

This tendency to consider the state (or the 'policy maker') as a single, rational or boundedly-rational actor reflects the early influence of welfare economics on mainstream policy studies. As this influence has progressively waned, new ideas have risen in turn. Howlett and Ramesh note a move towards a more "open-ended and empirically informed" neo-institutional analysis in policy studies. They also note the rise of interest in *learning* by policy actors and in discussion, argument and persuasion as integral parts of a policy process increasingly conceived "as a process of learning by trial, error and example" (Howlett and Ramesh, 2003, p47). The insights offered by these neo-institutionalist and 'argumentative' approaches are increasingly being synthesised as 'actor-centric' institutionalism (Rhodes, 2006; Scharpf, 1997). In this view "policy is the outcome of the interactions of resourceful and boundedly-rational actors whose capabilities, preferences, and perceptions are largely, but not completely, shaped by the institutionalised norms within which they interact" (Scharpf, 1997, p195, quoted in Rhodes, 2006).

The policy studies literature uses the terms 'policy subsystem' (or sometimes 'policy network') to describe the set of state and non-state, national and international actors and institutions that shape policies focused on a particular policy area in a particular jurisdiction at a particular time (see for instance Howlett and Ramesh, 2003; Rhodes, 2006).

"the policy subsystem is a space where relevant actors discuss policy uses and persuade and bargain in pursuit of their interests... These interactions... occur in the context of various institutional arrangements surrounding the policy process, which affect how the actors pursue their interests and ideas and the extent to which their efforts succeed. A policy subsystem includes both actors who are intimately involved in a policy process as well as others who are only marginally so"

(Howlett and Ramesh, 2003, p53-4).

Those actors who participate more frequently and more directly are often described as belonging to 'interest networks' whilst those involved to a lesser extent are described as belonging to 'discourse communities'. The nature of the relationship between the interest networks and discourse communities that compose a policy subsystem are seen as important shapers of the *content* of public policy in that area. Almost an infinite variety of actors and institutions in the 'policy universe' may actually or potentially constitute a policy subsystem. Composition varies by country, by policy domain and over time (see for instance Howlett and Ramesh, 2003).

These influential mainstream policy studies approaches stress the variety of actors, state and non-state, individual, networked and corporate, that may be involved in policy processes. Yet despite the focus on a range of state and non-state 'actors' in systemic accounts of innovation, we argue that actors are largely seen as passive in relation to public policy *for* innovation. Prescriptive innovation policy studies continue, in the welfare economics tradition, to treat policy as if it were the product of a unitary

'policy maker'. Even descriptive and analytical studies tend to focus on a single unitary state actor or on a limited set of state actors, perhaps operating at multiple levels of 'governance' (e.g. regional and European 'policy-makers'). Other actors are only considered insofar as they perform or contribute towards the performance of systemic 'functions' (often a single explicit function being mapped onto a specific actor type)^{16,17}. Any suggestion of agency in relation to public policy is in the very limited and uni-directional sense that such actors are passive targets, to be transformed by policy-induced learning into exhibiting behavioural changes. Despite the emphasis on institutions, actors, relationships and learning in the source literature, then, systemic approaches to innovation policy often implicitly privilege the *structure* of the system whilst downplaying agency¹⁸. However, if public policy is *part* of the system then the agency of actors must be acknowledged both in relation to innovation processes and also to processes shaping policy problems and solutions.

Prescriptive innovation policy studies also run the risk of conflating *actor types* with the *roles* that actors may play in policy-making, policy implementation and in the innovation process¹⁹. Yet making a clearer distinction between 'actor types' and 'role types' could be particularly important for comparative studies and policy learning, as we might expect that different types of actors may play similar roles in different national or regional contexts, or at different times. It could also help redress the tendency of some innovation policy studies to downplay variety within actor categories (e.g. individual researchers, SMEs, universities)²⁰. Actors may play multiple roles. The roles they elect to play may be in tension with or even in contradiction with the expectations or demands of other actors or the constraints of institutions. Individual human actors are members of organisations, research groups, disciplinary communities and policy networks which, as collectives, can all have agency and which may play different and contradictory roles from those played by the individuals that make them up.

Considering actors as playing roles in processes (policy processes, innovation processes), rather than seeing them as simply fulfilling a specific function in a pseudo-mechanical 'system', acknowledges the reality that 'actors' are defined by their agency. This agency is of course enabled, shaped and constrained by the behaviour and expectations of other actors and by institutions, which themselves

¹⁶ Systemic approaches to innovation policy tend to classify actors according to knowledge producing, knowledge using, intermediating or policy-making functions, although the literature is somewhat split on whether functions reside in actors and institutions or whether functions are a property of the system itself (see e.g. Chaminade and Edquist 2006 versus Van Lente et al 2003. Hekkert et al (2007) seem to ascribe functions both to the system and to individual actors).

¹⁷ The use of function by Howells (2006) in his discussion of innovation intermediaries and intermediation is a typical illustration of these difficulties. Van Lente et al (2003) paint a similar picture in their account of 'systemic intermediaries', one in which the terms actor, organization and institution are used all but interchangeably. Intermediary is neither an actor class nor is intermediation a function – rather intermediation is a role which can be played – or claimed - by a variety of actor types.

¹⁸ Such accounts are often rather circular: for instance Hekkert et al (2007) assert that a "well-functioning" innovation system will "probably lead to a climate in which entrepreneurial activities blossom" - entrepreneurial activities being one of the functions they identify as being required from such a well-functioning system.

¹⁹ A rare acknowledgement of the agency of 'system' actors in relation to policy can be found in the account of innovation system governance by Kuhlmann and Shapira (2006). Aghion, David and Foray (2009) also make a plea for more consideration of the dynamic roles human actors play not just in the innovation process but in the policy process from those who seek to improve innovation policy design and implementation. Galli and Teubal (1997) stress that organizational actors may play multiple roles. Finally, Wieczorek et al (2009) acknowledge the distinction between actors and the roles that they play, although they slip back into a functional view of the 'innovation system' for much of their analysis.

²⁰ Although Bobrow (2006) suggests that this tendency is not confined to innovation policy debates.

have been shaped by earlier action and institutions²¹. It is not the aim of this paper to propose a theory of action for innovation policy studies but understanding actor roles is important and we identify below some very simple categories of role in the policy process which might be played by individual, group, network or organisational actors, whether state or non-state, domestic or international (Table 1, below).

Table 1: some idealised actor roles in the (innovation) policy process

Policy Principals²²	Actors mobilizing government resources in order to achieve a policy goal or goals.
Policy Entrepreneurs	Actors promoting a policy problem / solution package.
Policy Targets	Actors targeted by policy action for behaviour change, or new actors (organisations or networks) created by policy action in order to fill a perceived gap in the system
Policy Implementation Agents	Existing or newly created actors in receipt of resources from a policy principal in order to achieve a policy outcome
Policy Beneficiaries	Actors who benefit (or lose out) from the impacts/outcomes of the policy action (e.g. patients in the case of healthcare innovation).

None of these idealised roles need be mutually exclusive. Multiple actors may play similar roles, whilst individual actors may play multiple roles simultaneously (e.g. target and implementation agent, implementation agent and entrepreneur²³) or different and multiple roles at different times. A similar role may also be played by different actors at different times. Policy action often creates new actors – organisations or networks – which then go on to play other roles. Relationships can also be nested. For instance research funding agencies play two simultaneous roles, as agents of policy principals (typically ministries responsible for science and technology) and as principals who in turn transfer resources to their own agents (researchers, groups, teams or institutes) to actually perform research).

5 Policy action and instruments

As we have seen, much innovation policy research reflects the traditional interest of economic policy research (Slembeck, 1997; Gunningham and Sinclair, 1999) and more generally of applied policy studies (Howlett and Ramesh, 2003) in the strengths and weaknesses, costs and benefits of single policy instruments. Policy instruments

²¹ March and Olsen (2006) describe how institutions (in their terminology ‘rules of action’) shape the roles actors play in multiple senses, including in the important indirect sense of providing beliefs and expectations which shape the ways in which actors chose to exercise their agency.

²² We borrow here some terminology (only) from principal-agent theory. Peters (2005, p362) critiques a tendency to think of instrument choice in “rather simple principal-agent terms, with delegation from one principal (the legislature or the minister) to a public agent, which uses an instrument to produce action”. Hence our use of the term in the plural.

²³ For instance innovation ‘intermediaries’ are often amongst the strongest advocates of ‘systemic’ policies

are widely seen as being substitutable, at least in principle (Landry and Varone, 2005). Public policy is thus a toolbox from which the optimal tools are (or should be) selected. In this view what ends up in the 'policy mix' is taken for granted whilst the problem of potential policy interaction is simply a matter to factor into tool selection. The only obstacle to adding policy instruments to the mix is cost.

In the real world 'policy instruments' are intangible and, as a piece of social technology have a high degree of what science and technology studies scholars call *interpretive flexibility*, carrying quite different meanings from time to time, place to place and actor to actor (see e.g. Bijker, Hughes and Pinch, 1989)²⁴. The context and implementation of an instrument can be fluid over time as instruments are interpreted and reinterpreted in the light of changing rationales. Implementation is another factor here, and decisions taken during implementation may be critical in determining the impacts of policy action, potentially leading to major variations in 'the same' instrument across time and space quite independently of differences in strategies, policy rationales or meta-rationales (see e.g. Slembeck, 1997)²⁵.

To illustrate this flexibility, consider the recent proliferation of 'innovation voucher' schemes, an idea transferred far and wide from the originating instance in the Netherlands. Innovation Vouchers are generally treated as a coherent 'instrument', with essential similarities from place to place, context to context. Yet the rationale, goals and means all vary from country to country. Table 2 illustrates this variety for selected EU member states, based on InnoPolicyTrendChart entries. This variation is important because the actual impact such schemes have may depend as much on the implementation mode (e.g. how the vouchers are publicized, how and to whom they are allocated, what supporting guidance and brokerage is put in place to help firms find knowledge providers) as on whether the broad rationale usually offered (that such schemes are a 'demand-side' corrective to traditional approaches) is correct or not.

With almost any policy instrument there will always be a fundamental uncertainty about *which* aspect of that instrument is actually responsible for any observed effect (Bressers and O'Toole, 2005). "Policy instrument" is therefore not a completely unproblematic concept. Instruments are not necessarily stable over time and across space whether in terms of rationales, goals or means. Instruments frequently 'harden' over time into new actors and institutions²⁶ which become part of the changed context in which future policy processes (and innovation processes) occur.

²⁴ In a similar vein Lauscoumes and Le Gales (2007) use Callon's (1986) concept of problematization to treat instruments as (boundary) objects around which conflicting actors can come together.

²⁵ It is almost a truism to say that policy studies tend to ignore or downplay implementation (see e.g. Barrett, 2004 for an account of the decline in interest in implementation studies).

²⁶ Aghion, David and Foray (2009) ask the question whether organisational actors and institutions should be considered as system structures or policy instruments, or both.

A number of approaches are taken to policy instruments across the different literatures (principally in law, public administration, policy analysis and economics) which explore them. Linder and Peters (1998) argue that, despite the diversity of perspectives, there is often overlap in terms of assumptions. They argue that most studies focus on the presumed objective merits of individual instruments, attempt to classify instruments according to simple ideas about modality²⁷, and tend to overemphasise the economic impacts of instruments at the expense of social and political ones. They also argue that most approaches omit to explore how instruments are actually chosen and given life. Finally, they identify a 'constitutivist' turn in which instrument design and deployment are emphasised as negotiated processes which construct a new reality. So Van Nispen and Ringeling (1998) are highly critical of the instrumentalist 'tool' metaphor which dominates seminal reviews such as those of Hood (1983) and Salamon (2002). For them, treating 'instruments' as objects "runs the risk of reification" (Van Nispen and Ringeling, 1998, p206), categorising instruments into typologies run the risk of privileging formal means over less formal means, and treating instrument selection as an optimization calculation ignores not just bounded rationality and information asymmetry but also the effects of culture, fashion, habit, interest and politics. Lauscombe & Le Gales (2007, p.3) also criticise the functionalist orientation of much of the literature on policy instruments, arguing that instruments are not "neutral devices" but rather bear a history, values and are thus social as well as technical.

Certainly the content of public policy is broader still than action (or inaction) as effected through 'instruments'. Policy encompasses aims, objectives, visions, rationales and models of action. Policy also plays rhetorical and performative functions. Policy-making activity can be an end in itself – being seen to have a policy about a problem can play an important political role regardless of whether that policy leads to effective action to solve the problem. As Ringeling (2005) notes, instruments can be goals from the perspective of a particular governance style or from the perspective of actors in the policy process. Values and interests are bound up with instruments. In the words of Bressers and O'Toole "the wrong end of the system from which to approach the question of policy instrument selection is from the instruments and those who choose them" (2005. p151). Public policy goes beyond instruments seen as tools or simple combinations of tools.

²⁷ One of the best known typologies of instrument modalities is the 'NATO' typology of Hood (1983, revisited in 2007). Modelling policy as a cybernetic process of 'effectors' and 'detectors', Hood distinguishes between four classes of tool, respectively those mobilising resources of 'nodality' (Government's central position in information and social networks), 'authority' (legal or official power), 'treasure' (financial resources) and 'organisation' (the human and capital resources Governments can deploy). Hood does not consider 'tools' used *within* Government. In his review of instrument approaches Howlett (2005) makes the potentially useful basic distinction between substantive policy instruments, those which directly intervene in social or economic life, and 'procedural' instruments, 'soft' instruments which seek to affect the participation of selected actors in the governance process itself.

6 Policy interactions and trade-offs

Almost always, the influence of policy instruments is effectively a blend, or combination, of different instruments, sometimes enacted at different times and often for somewhat different purposes. Instruments are not parachuted onto an empty stage to debut a policy-relevant soliloquy.

(Bressers and O'Toole, 2005, p134).

The idea of interactions and trade-offs between policy instruments is fundamental to the policy mix concept as it has originated in macroeconomic policy debates. Yet as we have seen innovation policy studies has tended to remain focused on the analysis of individual, standardised and interchangeable policy instruments, or easily-understood combinations of non-interacting instruments (Witt, 2003). However, as we have already argued, nominally similar policy instruments are not necessarily stable in terms of their rationales, goals, use and impacts across time, space or policy domains. Nor does public policy pursue a single goal or even a coherent and hierarchical set of goals - rather it pursues a broad and ever-changing range of more or less explicit and implicit, final and intermediate goals and objectives, many of which will conflict in the sense that one can only be obtained at the expense of another (Klappholz, 1964). It is these policy rationales and policy goals²⁸, and the means by which they are implemented, that are often in tension or conflict in a policy mix.

In discussing rationales, actors and roles, and instruments, we have already argued that goals, rationales and implementation choices are key in determining the effects of public policies. These effects are felt across space and across time. Whilst a good deal of academic attention is devoted to the spatial implications of public policy much less attention has been focused on the time dimension (Pollitt, 2008). Kay (2006) critiques the treatment of time in policy analysis, noting that most 'dynamic' accounts are really exercises in comparative statics relating to the time horizons of policies (e.g. short/medium-term/long-term impacts of policies). This snapshot view fails to account for "different rhythms, cycles and process speeds in the policy learning" (Kay, 2006: p.7). Pollitt (2008) also emphasises the importance of non-linear, path-dependent dynamics in public policy and the interaction between these and other kinds of dynamics – electoral, budget and planning cycles, economic cycles, organisational life cycles etc. Partly because of these different cycles, different classes of actors can have very different conceptions of time. The result of these dynamics is that goals, rationales and instruments can all change or disappear, existing actors can change through learning, adopting new roles and discarding others, whilst new actors enter the arena, new institutions are formed and existing ones are modified, lose their meaning or depart the stage.

Public policy, then, unfolds over time. The impact of a policy depends on when it is implemented and on the path previously followed, not only by the target 'economic system' (in the sense of David's (1987) 'narrow window', the brief period in which the policy maker can influence a dynamic economic system) but also by the policy process²⁹. Public policies, just like innovations, display irreversibility and path-dependency: they are adopted not on a tabula rasa but in a context of pre-existing policy

²⁸ in Kay's (2006) term 'policy values'.

²⁹ We have already discussed windows of opportunity in policy agenda-setting.

mixes and institutional frameworks which have been shaped through successive policy changes (Uyarra, 2010). Past decisions clearly constrain the range of options available for current decision makers (Kay, 2006; Bardach, 2006). Steinmo (2003), tracking the evolution of tax policy in the 20th century, notes how successful policy ideas become institutionalised and thereafter form part of the foundation for the beliefs of actors. Kay (2006) also sees past policy decisions as 'legacies' that are gradually institutionalised, restricting or enabling options for future policy makers. This accretion of policies and institutions is a well-known phenomenon, although one little explored empirically (Bardach, 2006). The unintended outcomes of complex policy interventions can even create new problems that displace the original policy problem, as Wildavsky (1979, quoted by Bardach, 2006) famously demonstrated in connection with the US Medicare and Medicaid programmes.

Some policy processes simply take a long time to play out (Pollitt, 2008). A corollary of this is that each use of a policy instrument constitutes an intervention at a certain moment in a continuous stream of events that both condition and constrain the evolution of a given instrument *and* which will be influenced by it (Pelikan, 2003). Interactions can arise between short and long term, direct and indirect effects - perhaps even undermining the original intended goals. Because we must grant a wide range of actors agency in relation to the shaping of policy we must acknowledge that the learning induced by previous policy actions can have impacts on future policy choices. This learning effect impairs attempts to understand cause and effect relationships over time (Witt, 2003; Wegner, 2003). It is not difficult to find examples of policies which have induced learning on the part of the actors over time, learning which has arguably partly offset any impacts of the policy as originally conceived³⁰. Thus learning - the accumulation of knowledge and routines which open up new behavioural possibilities - is not constrained to innovation processes. It also occurs in policy processes. The idea (after Metcalfe, 1994) of the adaptive and learning policy maker, present in many innovation policy studies, exemplifies a concept of policy learning which acknowledges the challenges of state intervention in a context of economic uncertainty and path dependence, but which tends to overlook the similarly uncertain and path-dependent evolutionary dynamics inherent in the policy process itself.

We have argued that the sheer complexity of the policy process precludes any static-comparative analysis of instruments as if they were stable, discrete and independent units. In the words of Ringeling (2005, p192) single instruments can never be evaluated because "their actual state is influenced by the fact that they always come in a mix" (or more commonly, they are added to an existing mix). However few studies have systematically explored interactions between different instruments, whether across time or across the other dimensions of the policy process.

Writing in the environmental policy literature, Gunningham and Sinclair (1999) hypothesise four classes of policy instrument mix: those that are inherently complementary; those that are inherently incompatible; those that are complementary if sequenced; and those whose complementarity or otherwise is essentially context specific. They argue that in 'context-specific' cases it is likely to be the *goals* of the policy instruments in combination which are conflicting, rather than the fundamental mode of operation or rationale of the instruments themselves. UNU-MERIT et al (2009)

³⁰ The UK Research Assessment Exercise presents a good example of a repeated policy intervention which has over time induced learning by participants which goes beyond the intended behaviour change to constitute 'game-playing'.

hypothesise a similar set of general classes of interaction, although they admit a far greater influence of ‘context’ in shaping the precise way in which specific classes of instrument are likely to interact. Going further still, Bressers and O’Toole (2005, p137) identify five kinds of interaction between instruments in a ‘blend’ or mix (Table 3).

Table 3: Five forms of influence or confluence in policy instrument ‘blends’ or mixes

Source: Authors based on Bressers and O’Toole, 2005, p137.

Increased intensity of policy intervention	Multiple instruments targeting <i>a specific actor or group of actors</i>
Integration of multiple instruments into one interactive process between government and target groups	Multiple instruments targeting different actors/actor groups involved <i>in the same process</i>
Instruments and actions at different levels of governance	Interactions between instruments and actions taken at <i>different levels of multi-level governance</i>
Competition and co-operation between different but interdependent policy fields	Interactions and tensions <i>across policy areas/domains</i>
Mutual strengthening or weakening of the effects of interventions at different points of action in the broader system	Interactions mediated through processes in a broader system

The approaches discussed above are primarily focused on interactions in what we might call ‘designed’ mixes – the intentional combination of two or more instruments. The time dimension is present only in the limited sense that sequencing of instruments is acknowledged to be important (A followed by B is not the same as B followed by A), and to the extent that ‘context’ is acknowledged as a potential shaper of interactions. We have already argued that the actor and institutional context in which instruments operate will be crucial in determining their effects.

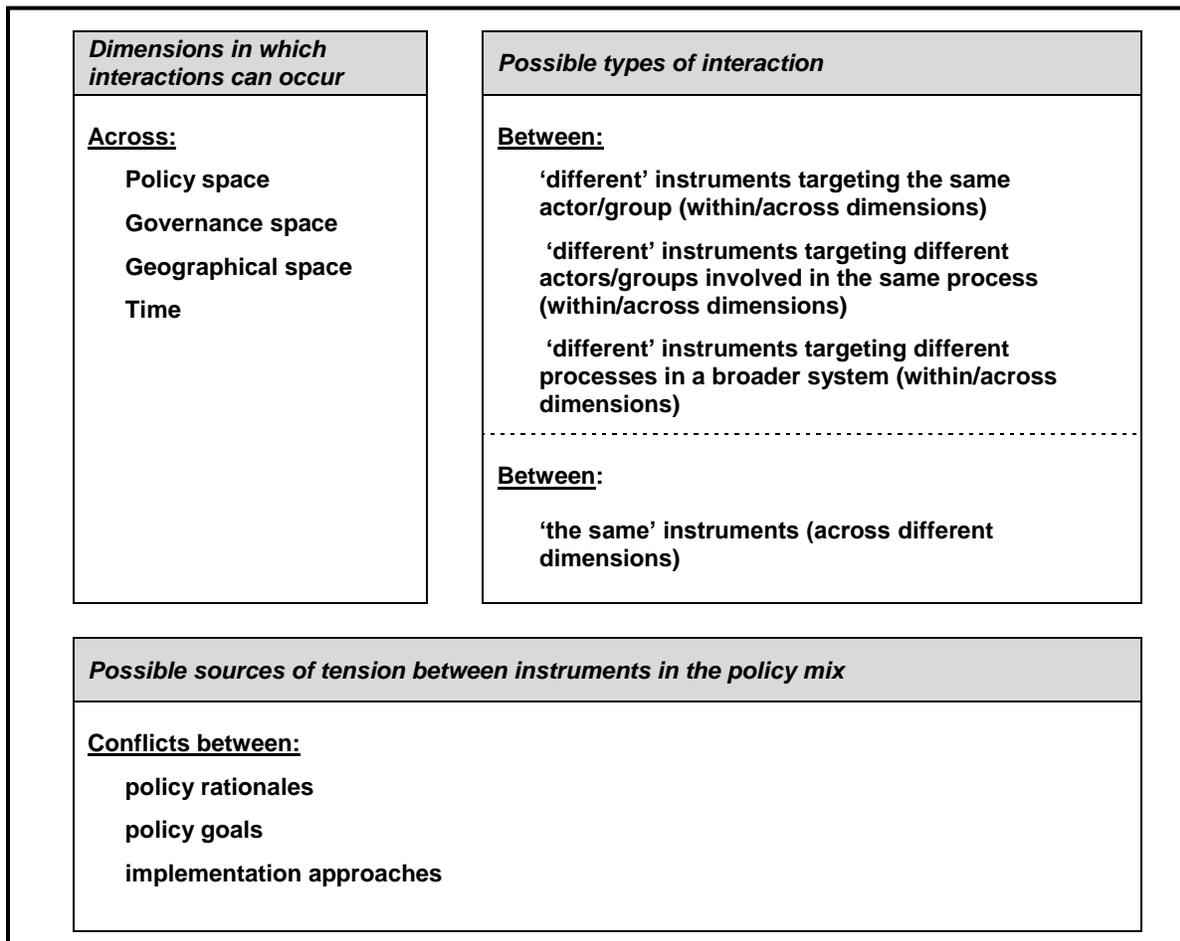
The implications of this for policy mixes are, first, that it seems highly unlikely that, regardless of theoretical complementarities, complementarities *in practice* can be achieved by the simple accumulation of instrument after instrument. At some point theoretically complementary instruments may begin to interact in negative or contradictory ways if layered one upon the other. In other words these characteristics of interactions are *relative* (an instrument is only complementary or negative in relation to another instrument or mix of instruments) and *potentially transient*. Policy instruments are flexible and evolve over time, and, because the wider institutional and actor environment in which they operate can also change, the kinds of interaction seen may change over time, and from context to context, place to place. If complementarity is not a simple matter, then nor is substitution. It seems difficult to imagine that two different policy instruments could ever be perfect substitutes – and the extent to which instruments might substitute for one another will change over time.

7 Conceptualising interactions in the policy mix

We believe that the Bressers and O’Toole framework summarized in Table 5 presents a useful starting point from which to build a more sophisticated conceptualization of policy mix interactions. Figure 1 below illustrates our conceptualization in terms of dimensions, forms of interaction and potential underlying sources of tension. Bressers and O’Toole’s five categories seem to us to be partially overlapping. At the same time we suggest that several of their ‘forms of influence’ are better seen as different *dimensions* in which interactions can occur. First, there is the dimension of *policy space* - the abstract ‘space’ in which different policy domains exist. There is a *governance space* dimension, representing interactions across multiple levels of governance. In addition to these abstract ‘spaces; there is also a *geographical space* dimension in which policy mix interactions occur. Finally there is the dimension of *time*.

Figure 1: Conceptualising policy mix interactions: dimensions, types and potential sources of tension

Source: Authors own elaboration



Putting these four dimensions to one side, we are left with three kinds of policy mix interaction from the original five of Bressers and O’Toole, namely interactions between instruments targeting the same actor or group of actors, interactions between

instruments targeting different actors/groups involved in the same process, and interactions between instruments targeting points of action which may otherwise seem to be far removed but which interact because the processes or actors targeted prove ultimately to be linked by other processes in a broader 'system'. To these we would add a further possibility. So far we have considered interactions between 'different' instruments. However we must also allow for the possibility that 'the same' instruments will interact with each other across one or more of the possible dimensions (for instance, between different levels of governance or over time). Finally, we should remember the sources of potential tension between instruments already discussed: conflicting rationales, conflicting goals and conflicting approaches to implementation.

Some of these different kinds of interactions are identifiable in the policy mix affecting innovation within the North West region of England (for a fuller account see Flanagan and Uyarra, 2008; Uyarra and Flanagan, 2010). When considering the impact of public policy on innovative activity in the region, we can see a policy mix that is complex in terms not only of levels of governance and policy domains, but also in terms of actors, roles, rationales and goals. Most of the science and innovation activity in the Northwest of England occurs outside the direct influence of what regional innovation policy there is. To the extent that it is influenced by public policy, it is largely driven by national non-innovation policies (such as defence, health, energy and security) and the actions of firms and major public sector organisations such as the National Health Service (NHS) pursuing their own goals. The effects of this 'non-innovation policy' are a major challenge for the region. Indeed, 'vulnerability' to outside economic and policy change is a key concern driving the region's formal innovation policy. The policy mix also has a complex temporal footprint, with many of the policy decisions most important in influencing innovation activity in the region today having been made in the distant past. This kind of case illustrates why we need to go beyond simple 'toolbox' or portfolio approaches. Whilst regional authorities consider an ever expanding menu of policy options in order to address region-specific problems, the focus of attention cannot be solely on regional initiatives and regional providers of innovation-related services but rather must be on the totality of factors influencing innovation in the region.

Examples like this bring home the profound difficulty of achieving a more active governance of the policy mix affecting innovation. Whilst formal and informal mechanisms often exist to promote 'co-ordination' (minimising negative interactions and maximising positive ones) within the domain of 'innovation policy' across multiple levels of governance, formal or informal mechanisms for evaluating and governing the wider policy mix affecting innovation are largely absent. In our view many innovation policy studies systematically underestimate the challenge complexity poses to policy co-ordination. There is a tendency to view complexity as arising from the widening and deepening processes described earlier (perhaps also acknowledging the uncertain, multi-actor nature of the innovation process) whilst downplaying the dynamics of the policy process itself as a source of complexity. Co-ordination is seen as the unproblematic outcome of 'better governance', something which can be achieved through the application of new (procedural) governance approaches of the kind described by Braun (2008) (see e.g. Smits and Kuhlmann, 2004). However, such instruments may introduce further complexity into the system to be 'co-ordinated', both directly by the simple addition of new actors, new roles, new institutions, but also indirectly by virtue of their inherent interpretive flexibility. This problem may be exacerbated by the fact that it is rather easier to create new mechanisms than it is to remove ones that have become institutionalised.

The absurd - but logical - outcome of seeking to manage complexity with new coordination mechanisms is that additional coordinating mechanisms will periodically have to be introduced to coordinate the older ones, and so on and so forth in an infinite regress of the kind predicted by the well-known 'map and the territory' metaphor³¹. In fact Lindblom (1958) offered a similar critique of the assumption that policy processes need active co-ordination (and therefore the creation of new roles, structures or institutions for co-ordination) several decades ago³². With a large number of explicit and implicit, and potentially mutually conflicting policy goals at play in the messy real world, Lindblom (1959) famously argued that policy 'agencies' must of necessity proliferate in tandem with the number of policy goals and that the only co-ordination possible is a dynamic adaptive mutual co-ordination. In this view agent complexity is the unavoidable resultant of goal diversity: ongoing mutual adaptation between agents is not a symptom of fragmentation but the only possible route to 'co-ordination' between diverse goals. For his part Braun (2008) concludes that co-ordination, though difficult, is worth attempting. However he warns against co-ordination becoming an end in itself.

8 Conclusions

The emergence of the policy mix concept into common use in the field of innovation policy studies provides us with a (narrow) window of opportunity to re-conceptualise the fundamental assumptions behind innovation policy analysis in order to better deal with a messy and complex, multi-level, multi-actor reality. We have argued that the way in which the term 'policy mix' is often used puts innovation policy complexity into a black box rather than tackles it. The literature treats policy makers as translators of theoretical rationales into action, denies agency to actors in relation to policy change, remains focused on a superficial analysis of instruments (despite the supposed emphasis on the mix and interactions) and treats policy interactions as something to be designed away by 'better' co-ordination. As a community of policy scholars, we are running the risk of conflating means with ends and maps with territories.

In this paper we have explored the ways in which innovation policy studies treat actors, instruments, institutions and interactions in order to be able to arrive at a more useful conceptualisation of the policy mix for innovation, stressing the need for a genuinely dynamic view of policy formulation and policy interaction. In our view policy processes are best thought of as a subset of the broader category of innovation processes. Drawing upon insights from the policy instruments literature, we have shown that policy processes are no more amenable to instrumental rationality than are innovation processes. Rather the focus for innovation policy analysis should be on incremental/adaptive learning, experimentation, reflection, debate and argument about means/ends, and even creative tensions. A key role for innovation policy studies should be to highlight the trade-offs and tensions inherent in any policy mix and to promote open debates about them.

³¹ Any map of a territory would, to be truly accurate, have to contain a representation of itself representing the territory, including a map representing the territory, and so on, in infinite regress.

³² Ironically Lindblom was criticising the Dutch economist Tinbergen for over-rationalising the policy process. Tinbergen (1952, 1956) proposed an approach to the modeling of economic policy problems that emphasized clear and distinct policy goals. In Tinbergen's view there must be as many instruments as goals in order to model the trade-offs and resolve the 'best' solutions. Today it is the (evolutionary) economists who are stressing the profound challenges of co-ordination (see for instance Aghion, David and Foray, 2009) and it is innovation policy scholars who often downplay them.

Policy mix interactions manifesting themselves in relation to innovation policy outcomes have a complex, multi-level, multi-actor - and temporally distributed - character. Both specific instances of interaction and repeated instances of particular classes of interaction will often be difficult to detect. As well as a challenge to scholarly analysis this is a practical issue for policy learning. Some of the innovation policy studies literature explicitly acknowledges the multi-level, multi-actor and negotiated nature of public policy (e.g. Kuhlmann and Shapira, 2006). Even where they are explicitly discussed, however, processes of negotiation and the need for 'compromise' are often seen as unproblematic outcomes which can be assured by soft policy innovations such as the better use of 'strategic policy intelligence' and better 'co-ordination'. Yet such instruments have even more interpretive flexibility than the traditional substantive levers of public policy. How can we hope to tell when these instruments are working well? Even if we can tell, how can we attribute that success to a particular cause-effect relationship?

Despite the importance attached to 'strategic policy intelligence' in recent innovation policy analysis, little empirical attention has been devoted to actual processes of policy learning. A much greater empirical effort is needed to investigate actual, as opposed to idealised, processes of policy learning, and to better understand the roles experts, analysts and evaluators play in those processes vis a vis other actors. Sadly, much innovation policy analysis today, at least in Europe, rests on a limited empirical foundation consisting largely of commissioned evaluation studies (often of single instruments) or template driven 'monitoring' exercises. Such processes cannot form the empirical basis for sensible learning or prescription. We need to move towards substantial empirical innovation policy histories akin to the innovation histories which provided most of our understanding of the innovation process. This means not just histories of individual instruments, as implied by Lascoumes and Le Gales (2007), but histories of policy *mixes*. We argue that the conceptualisation introduced above presents a useful framework within which such rich empirical histories could be conducted.

As analysts we need to understand and treat policy-making *as it is* and not as we would like it to be. Innovation policy studies has progressively built up a normative structure around an idea of 'innovation systems' partly inspired by and claiming legitimacy from empirical and comparative innovation studies and from evolutionary accounts of technological and economic change. However this normative structure assumes an underlying or achievable rationality and coherence to the 'system' as a target for policy action which is unrealistic³³. A set of self-referencing and widely-repeated recommendations is at risk of becoming a kind of STI policy folk wisdom, rarely fully explained and rarely questioned.

Policy dynamics are probabilistic rather than deterministic. A better understanding of the policy process can no more enable us to predict policy outcomes than a better understanding of the innovation process has enabled us to predict innovation outcomes. This is effectively acknowledged by the recent 'evolutionary turn' in mainstream policy studies³⁴. An evolutionary theory of the policy process cannot be predictive or firmly

³³ see Caracostas, 2007, for a critique from the perspective of a veteran policy-maker.

³⁴ and by those evolutionary economists who have started to explore the policy process, such as Moreau (2004), Witt (2003), Pelikán and Wegner (2003) and van den Berg and Kallis (2009).

prescriptive about specific policies. However it can tell us about the constraints on and potentialities of public action (Kerr, 2002: p334). The scope for successful policy action in an evolutionary world is more limited than in the idealistic but mechanistic world inhabited by many innovation policy studies, and any policy action will shape and constrain the future. Acknowledging this should be our starting point for thinking about the prescriptive scope of innovation policy studies in the future. As Richard Nelson noted in *The Moon and the Ghetto* (1977, p18): "the coin of rational analysis is likely to be devalued by trying to achieve what cannot be bought by rational coin".

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