Public Procurement as an Innovation Policy – proposing a conceptualization for analysis and evaluation

Yanchao Li yanchao.li@mbs.ac.uk

Manchester Institute of Innovation Research (MIOIR)

Abstract

Despite the fact that public procurement of innovation (PPI) has become an increasingly popular policy tool, there has been a severe lack of holistic approaches to analyzing or evaluating PPI policies. This paper addresses this gap by proposing a conceptual framework which links the multiple levels and aspects of the design and implementation of PPI policies. It builds upon several strands of literature and offers a systemic understanding of public procurement as well as innovation policies. PPI policy is positioned as a cross-domain policy which is inherently a mix of procurement and innovation related interventions. The paper moves on to present a ‘system mix’ – ‘policy mix’ conceptualization, and propose the use of ‘vertical’ as well as ‘horizontal coherence’ as qualitative criteria to evaluate the appropriateness and implementation of PPI policies. It then illustrates the use of the framework through applying it to the case of PPI policies in China. Three implementation channels of PPI policies, namely ‘centralized, routine mechanisms for PPI’, ‘major technological equipment commercialization’, and ‘demonstration programmes for emerging technologies’ have been identified and analyzed. The three policy channels realized different degrees of vertical and horizontal coherence owing to their respective rationales and institutional settings. The use of the conceptual framework can aid the conduct of ex ante as well as ex post evaluation of PPI policies, which can further inform the policy design and implementation processes.

Keywords: public procurement, innovation policy, conceptualization, analysis, evaluation

*COMMENTS ARE WELCOME – if you have any please send them to yanchao.li@mbs.ac.uk
1. Introduction

Public procurement has long been recognized for its potential to drive innovation (see e.g. Rothwell 1984; Geroski 1990; Dalpe 1994; Edquist et al. 2000). More recently this particular policy instrument has been termed public procurement of innovation (abbreviated as PPI hereafter) (Georghiou et al. 2014): in the context of this paper this refers to ‘public procurement activities that stimulate, or aim at stimulating the creation, improvement, adoption and diffusion of innovations’.

In the broader context of innovation policy instruments which now increasingly possess a ‘systemic’ feature enlightened by system-of-innovation (SI) perspectives (Smits & Kuhlmann 2004; Edquist 2011), PPI is considered as a type of demand-side policy despite the fact that it has the potential to impact powerfully on both the demand and supply sides of innovations, e.g. in the case of pre-commercial procurement (Edler 2013; Rigby 2013). The functioning of PPI as a policy instrument is rather sophisticated, involving different rationales depending on factors such as demand structures, technological life cycles, market development stages and nature of procured items (Rothwell & Zegveld 1981; Edquist & Hommen 2000; Edler et al. 2005; Edler & Georghiou 2007; Uyarra & Flanagan 2010; Rolfstam 2012b). Those key dimensions imply the possibility of a variety of approaches to the design and implementation of PPI policies. In the most general sense, ‘innovativeness’ can serve as an essential criterion embedded in public authorities’ everyday procurement routines, i.e. what Edler & Georghiou (2007) referred to as ‘general procurement’; on the other hand ‘strategic procurement’ encourages the demand for specific technologies in order to nurture sector-specific lead markets and aid the diffusion of innovative solutions by lowering their entry/transaction costs (ibid.). Other policy approaches such as ‘cooperative procurement’, ‘catalytic procurement’ and ‘experimental procurement’ are also being actively debated (Uyarra & Flanagan 2010; Edquist & Zabala-Iturriagagoitia 2012).

Nevertheless, the ways by which the design and implementation of the different idealized types of PPI may be analysed and evaluated have been rarely discussed in the literature. Although policy implications have been drawn based on the historical use of PPI in different regions especially in the United States (US) and Nordic countries, PPI policy development, like the development of demand-side innovation policies in general, ‘is characterized by policy imitation rather than evidence, reasoning, and informed learning’ (Edler et al. 2012, p.2). Analysis of PPI activities has mostly taken the form of case studies focused on concrete procurement processes at the micro level, as conducted in e.g. Edquist et al. (2000), Edler et al. (2005) and Lember et al. (2010). While those cases provided in-depth knowledge about the associated issues and pitfalls of PPI as an activity involving multiple stakeholders, the analytical approach adopted by them remains descriptive and not
sufficiently informative especially when a holistic understanding (including evaluation) of PPI as a higher-level (e.g. national, regional, or sectoral) policy is required. In practice, recent years have seen a new wave of interest in PPI by policymakers from OECD countries and beyond (Edler & Georghiou 2007; OECD 2011; Lember et al. 2013; Vecchiato & Roveda 2014); correspondingly there is a strong need for analytical and evaluation approaches to informing policy making and its implementation. The lack of approaches to evaluating PPI as a multi-level (micro, meso, and macro) policy has been recognized by Edler et al. (2012) as a ‘severe evaluation gap’.

This paper makes an initial attempt to address this gap by proposing a conceptual framework to assist analysis and evaluation. The term ‘evaluation’ involved in this paper refers more to the qualitative evaluation of appropriateness and implementation which is concerned with the design and process of policies, rather than that of effectiveness which is concerned more with policy outcomes. This paper firstly develops an understanding of public procurement by appreciating its systemic nature and multiple functions including promoting innovation (Section 2), then develops an understanding of innovation policy by reviewing SI and ‘policy mix’ related perspectives (Section 3). Section 4 moves on to synthesizing the two broad strands of literature, conceptualizing PPI policies through a ‘system mix’ – ‘policy mix’ framework, and proposing the use of ‘vertical and horizontal coherence’ as evaluation criteria. In Section 5, the conceptual framework is operationalized and applied to the case of China to assess the Chinese PPI policies that were launched and implemented during 2006-2011. The paper concludes in Section 6 with a short discussion.

2. Understanding public procurement

2.1 Public procurement as a multifaceted government activity

Public procurement is commonly defined as the process whereby public bodies (e.g. government agencies and state-owned enterprises (SOEs)) acquire various goods and services that they need for their activities from third parties (Arrowsmith et al. 2000; OGC 2008). The expenditure on public procurement takes up approximately 15-20% of an OECD country’s GDP (Piga 2011); this number is considered even higher in developing countries where governments are making tremendous investment in public infrastructure (Anderson et al. 2012).

The very large size of public procurement markets creates a need to regulate procurement activities in order to guarantee proper use of public money. For this purpose, considerations such as transparency, equality, integrity, accountability and anticorruption are widely treated as primary principles in domestic procurement regulations in most organizations, sectors, and countries.
(Arrowsmith et al. 2000). On the other hand, the large scale implies a great potential in utilizing public procurement as a leveraging policy instrument to pursue other socioeconomic goals such as employment, SME development, sustainability, support for minorities, and promoting innovation (Kashap 2004; McCrudden 2004). Public procurement to fulfil those additional tasks and goals are frequently titled as ‘secondary’ (Uyarrar 2012) or ‘horizontal policies’ (Arrowsmith 2010). Those secondary/horizontal policies based on public procurement have historically facilitated the development of many leading countries such as Sweden, Japan and the US (Edquist et al., 2000; European Commission, 2006).

In addition to these domestic regulations and policies promoting various goals, public procurement activities are likely to be affected by another set of rules, i.e. regulatory regimes imposed by international organizations represented by the World Trade Organization (WTO). WTO has been promoting international free trade through various multilateral and plurilateral treaties. The most influential one on public procurement is the plurilateral Agreement on Government Procurement (GPA) which puts ‘non-discrimination’ as the top priority (Anderson & Arrowsmith 2011). Signatory countries are required to negotiate on the degree of openness of their home public procurement market during the accession process. While this type of treaty greatly enhanced the mutual access to public markets, they posed a significant challenge for member countries who want to provide preferential support for domestic target groups. The ‘policy space’, i.e. ‘the scope a nation has for building its own national development strategy and its relationships with the world economy and markets’ (Muchhala 2007, p.1) has been considerably constrained as a result (Kattel & Lember 2010).

All of the diverse principles and tasks have made public procurement a complicated, multifaceted public activity. Balancing the multiple goals and tasks has proved to be a tricky issue for both policymakers and procurement practitioners (Schapper et al. 2006). PPI as a national or regional innovation policy belongs to the category of ‘secondary’ or ‘horizontal’ policies, which implies that the design and implementation of PPI policies undoubtedly need to take into account, if not give way to, primary tasks and international obligations.

2.2 Public procurement systems – actors, institutions and interactions

Either explicitly or implicitly, the processes, institutional settings and other aspects related to public procurement are often treated as a ‘system’ (see e.g. Arrowsmith et al. 2000; Thai 2009). Thai (2009) considers that four pillars form the key elements of a procurement system, namely ‘procurement

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laws and regulations’, ‘procurement workforce’, ‘procurement process and methods’, and ‘procurement organizational structure’ (p.8). In particular, the procurement process is ‘the heart of a sound procurement system’ (ibid. p.3), shaped by factors such as elements (e.g. laws, regulations, workforce and procurement methods) of the system and linkages among those elements.

At the micro level, the design, planning and organization of procurement procedures, e.g. should open or restricted tendering be adopted, should dialogues between procurers and suppliers be permitted, what are the evaluation criteria, have fundamental influence on the nature, process, and outcomes of public procurement (Arrowsmith et al. 2000). At higher levels e.g. regional and national levels, laws, regulations and government and administration norms also shape the trajectories of procurement processes by enabling or constraining them (Thai 2009a). Moreover, public procurement systems are far from being isolated. Arrowsmith et al. (2000) pointed out that an adequate ‘procurement environment’ is crucial in supporting the implementation of regulations and policies related to public procurement. An important dimension of a supportive procurement environment is considered to be a competition-based, fair market (Fiorentino 2006; Anderson & Kovacic 2009). Friendly market conditions can enhance the functioning of public procurement since principles such as openness, transparency and equality are more likely to be adhered to (ibid.). As for PPI, competition can increase the likelihood to stimulate innovative solutions (Edler & Georghiou 2007). The procurement environment in general can be considered as the overall context where the procurement system is situated, influenced by various socioeconomic, political, and cultural circumstances.

Owing to its multiple facets as mentioned in last section, a public procurement system involves a wide range of stakeholders including but not limited to procuring agencies, suppliers, end users, policy makers and implementers, operators (e.g. in cases of public transportation), and policy beneficiaries (e.g. minorities and SMEs). Although in general they are regulated by macro-level, formal rules, those different stakeholders behave according to their respective institutional contexts and their personal logic of appropriateness (Edler et al. 2005). This heterogeneity of stakeholders implies a high degree of difficulty for goal alignment, stakeholder coordination, and policy implementation in practice (Telgen et al. 2007; Thai 2009b).

For the purpose of this article we reflect on SI perspectives (see e.g. Freeman 1987; Lundvall 1992; Metcalfe 1995) which emphasize similar aspects (although under different titles) that form an innovation system, namely ‘elements’, ‘institutions’, ‘interactions’ and ‘relationships’. In the context of a public procurement system, regulations, laws and other (formal as well as informal) rules affecting procurement activities can be considered as ‘institutions’. By ‘institutions’ we draw from
North (1991) and mean ‘the humanly devised constraints that structure political, economic and social interaction’ (p.97), or to put it simpler, the ‘rules of the game’ as noted by Nelson & Sampat (2001). The ‘procurement workforce’ together with other stakeholders can be considered as actors who together with institutions belong to the category of ‘elements’. Public procurement systems, vis-à-vis innovation systems, are open systems featuring dynamics of procurement/innovation processes shaped by the interactions and relationships among all elements in all the four pillars, and contextual factors.

3. Understanding innovation policies

3.1 Innovation systems – actors, institutions, interactions, and policies

The innovation process is considered to be the core activity of an ‘innovation system’, which is defined by Lundvall (1992) as ‘the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge’ (p. 2). Be it national, regional or sectoral, an innovation system can be characterized by components (e.g. actors, infrastructure and policies), institutions and interactions between them (Freeman 1987; Cooke et al. 1997; Breschi & Malerba 1997). Interactive learning between core actors such as suppliers and users contributes to the innovation process by fulfilling various system functions such as demand articulation, knowledge development and diffusion and resources mobilization (Hekkert et al. 2007; Bergek et al. 2010).

From the perspective of SI, some historically neglected dimensions concerning innovation have gained attention, such as the demand side (Edquist & Hommen 1999). Demand (both individual users and certain arrangements of collective demand) can influence the innovation process by stimulating new solutions, selecting alternative designs, providing feedback to the supply side to improve solutions, and in some cases performing as (co-)innovators together with suppliers (Schmookler 1966; Malerba et al. 2007; Uyarra & Flanagan 2010; Stefano et al. 2012).

Institutions including laws, regulations, standards and norms as the ‘rules of the game’ provide ‘stability’, set ‘preconditions’, and structure the interactions between various aspects of the system (Johnson 1992). Institutions are so important that some authors define innovation systems in a rather institutionalist way, as ‘a set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process’ (Metcalfe 1995, p.38). Institutions are meanwhile influenced by actors and other elements; radical changes are likely to be caused by the implementation of innovation policies. Barrett (2004) notes that a policy is ‘both a statement of intent by those seeking to change or control behaviour, and a negotiated output
Emerging from the implementation process (p.253). Institutions and policies interact with each other. On the one hand, an innovation policy is a ‘force for change’ working on the innovation systems, trying to redirect the dynamics towards desired performance. On the other, the design and functioning of policies is based on and influenced by the existing framework of institutions (Edquist et al. 2000).

Influenced by the systems thinking in innovation study, the design and evaluation of innovation policies increasingly feature holistic analysis of system dynamics. Diagnostic approaches such as identifying ‘system failures’ and analysing ‘system functions’ have gained ground (Woolthuis et al. 2005; Hekkert et al. 2007); they aim to identify policy gaps by detecting the weaknesses of status quo. Underpinned by those rationales, the variety of innovation policy instruments has moved far beyond research and development (R&D) support; in fact, Lundvall & Borrás (2005) compared ‘science’, ‘technology’, and ‘innovation’ policies, and concluded that innovation policies should cover all the issues related to innovation and target at ‘overall innovative performance of the economy’ (p.615). In this sense the scope of innovation policies is fairly broad, varying from context to context.

3.2 Cross-domain innovation policies and the notion of ‘policy mix’

The broadening scope of innovation policy instruments brought about the overlapping of the policy domain of ‘innovation’ with other domains, such as the domain of public procurement in the case of PPI. As discussed in Section 2.1, public procurement has been associated with various primary and secondary tasks already; PPI as a ‘cross-domain’ policy involves stakeholder groups in addition to the existing groups concerning public procurement. We draw from the notion of ‘policy mix’ to enable the understanding of PPI as a ‘messy and complex, multilevel, multi-actor’ phenomenon (Flanagan et al. 2011, p.702). Analytical approaches based on ‘policy mix’ appreciate the multiple aspects of innovation systems rather than oversimplifying them (Poel & Kool 2009; OECD 2010; Cunningham et al. 2013).

As a conceptual framework, ‘policy mix’ is still subject to conceptual ambiguity. The most common connotation of ‘innovation policy mix’ refers to the mix of different types of policy instruments (Poel & Kool 2009; Flanagan et al. 2011; Borrás & Edquist 2013). Nonetheless, we agree with OECD (2010) that ‘policy mix’ is a rich concept and has two distinct meanings. The first meaning is ‘the alignment of different dimensions of policy, particularly between supporting rationales, strategic tasks and instruments deployed’ (ibid. p.256), which emphasizes the importance of the ‘logical flow’ between various dimensions of a certain policy. The second meaning is ‘mixes of types of domain areas, mixes of types of rationales, mixes of types of strategic tasks and mixes of types of instruments’ (ibid.
p.259), which emphasizes the balance and coherence between various policies with respect to certain dimensions. In particular, we consider that policy mixes of the first meaning can be considered as ‘vertical mixes’, while policy mixes of the second meaning can be considered as ‘horizontal mixes’. To make an innovation policy ‘appropriate’, all the dimensions mentioned above need to be aligned and coherent with others.

As discussed in Section 3.1, innovation policies influence and are meanwhile influenced by other elements of the innovation system. Figure 1 (adapted from Figure 4.3 of OECD, 2010) briefly illustrates the mutual influence between innovation system (the left hand side) and innovation policies (the right hand side). The vertical flow of the various dimensions is inherently the logic of policy design, and the horizontal mixes concern interactions between different policies.

Figure 1 The dynamics of policy mixes

Source: Author adapted from OECD (2010) and Flanagan et al. (2011)

‘Policy mix’ as a conceptual framework can serve a dual purpose including both policy design and evaluation; on the one hand, it can guide the design of innovation policies which can ‘effect’ the
dynamics of the innovation system; on the other hand, it can be employed as a diagnostic instrument to ‘detect’ weaknesses and problems of the system (OECD 2010).

### 3.3 Evaluating the design and process of policies – some considerations

Existing approaches to innovation policy evaluation is overwhelmingly supply-side- and effectiveness-focused (Edler et al. 2012; Georghiou 1998). This article is concerned with evaluating the design (appropriateness) and process (implementation) of PPI policies, on which the existing literature has very limited coverage. Edler et al. (2012) as an initial attempt to address the evaluation of demand-side innovation policies pointed out several challenges including ‘the difficulty of establishing a relevant baseline’, ‘the inability of public statistics constructed in supply-side mode to capture actions’, ‘the need to engage with actors who do not necessarily see themselves as part of the initiative being evaluated’, ‘long timescales and potential wide geographical scope’, ‘measures that span from micro to macro’, and ‘blurred boundaries between implementation and impact’ (p.1). These challenges are appreciated in the building of conceptual framework in Section 4.

With respect to the evaluation of policy process, researchers consider that rather than quantitative approaches, qualitative approaches such as case studies built upon stakeholder surveys/interviews are instrumental in uncovering policy dynamics and in-depth causal mechanisms (Patton 1987; Clarke & Dawson 1999; OECD 2011; Edler et al. 2012).

It is necessary to define ‘appropriateness’ here as the term remains ambiguous despite the fact that policy researchers and practitioners frequently refer to it (see e.g. Papaconstantinou & Polt 1997; GAO 1990; OECD 2010). ‘Appropriateness’ is unavoidably subjective since, as noted above, during the policy process different actors behave according to their own perceptions and logic. Through the lens of ‘policy mix’, the ‘appropriateness’ of a certain policy implies a requirement that different vertical and horizontal dimensions should be in line with each other. More specifically, the ‘fit’ of different policy instruments, including feasibility and acceptability, is highlighted as a prerequisite of a policy to be ‘appropriate’ (Ringeling 2005). According to Edler et al. (2012), ‘appropriateness’ is best expressed as ‘are the right things proposed, is the scale right’, while ‘implementation’ concerns the question ‘are the things done rightly’ (p.6). In evaluating what is ‘right’, they proposed a set of evaluation questions concerning the rationales and logical consistency among policy instruments, and the coherence of the implementation process with the original design of the policy. A major implication for this study is that the evaluation of appropriateness and implementation involves at least a justification of the policy design, and investigation into the policy implementation process.
Also ambiguous is the term ‘policy process’, which has been barely discussed in the area of innovation policy research. In the wider research area of public policy, the policy process is seen as inherently an empirical one, influenced by various factors such as stakeholders’ ideologies, attitudes and behaviour (Pressman & Wildavsky 1973; Hill 1997). Both top-down and bottom-up approaches have been proposed to analyze the process linking policy design and policy outcomes, i.e. the implementation process (see e.g. Pressman & Wildavsky 1973, and Lipsky 1978). More recently there have been attempts to integrate the two extremes and analyze different modes and structures that emerge from the policy process (see e.g. Hjern & Porter 1981; Matland 1995). This study draws from those existing perspectives. We argue that PPI policies as mandates from higher governance levels go through not only the ‘design’ and ‘implementation’ stages but also an intermediary ‘articulation’ stage. According to Adach (2011), ‘policy design’ is defined as *the process of analysing and identifying the problem, specifying the policy objective, and conceptualizing and selecting specific prescriptions for achieving the policy objective.* This study defines ‘policy articulation’ as *the process of taking a policy written at a higher level of principle and breaking it down into its key components, and the ways in which they are related, which may then be implemented;* and that ‘policy implementation’ is *the process by which a policy is turned into actions which have been given the specific objectives and resources needed to progress that policy.* By linking those three stages together the innovation policy process can be further characterized.

4. Conceptualizing public procurement of innovation (PPI)

4.1 A ‘system mix’ – ‘policy mix’ framework

Based on the existing literature it has been observed that PPI processes possess characteristics of both innovation and procurement activities. On the one hand, given that innovation inevitably involves uncertainty and interactive learning, risk management and stakeholder coordination have been identified as the top issues to be dealt with in PPI practices (Edler et al. 2005; Tsipouri et al. 2010; Uyarra et al. 2014). On the other hand, the multiple tasks and objectives associated with public procurement (see Section 2.1) imply that PPI has to comply with primary principles such as transparency and equality, and different institutional settings such as international, domestic, as well as organizational rules (Kattel & Lember 2010; Rolfstam 2012a). Special techniques and strategies are often required to implement PPI since appropriate timing and procedures are needed to conduct procurements on the one hand, and ‘capture’ innovation on the other (OGC 2004; Wilkinson et al. 2005). Different circumstances in terms of technology life cycles and public procurement cycles lead to different functioning rationales of PPI (Edler & Georghiou 2007; Hommen & Rolfstam 2009; Uyarra & Flanagan 2010).
As discussed in Sections 2 and 3, the settings of both public procurement and innovation can be considered as ‘systems’ constituted of their respective actors, institutions and interactions. A ‘system’ (i.e. an organized whole interacting with the context) view (Bertalanffy 1968) is carried on here to conceptualize PPI. As a policy instrument ‘crossing’ the procurement and innovation systems, PPI is unavoidably influenced by both systems; a PPI process is inherently a procurement activity on the one hand, and an innovation activity on the other. PPI dynamics are shaped by actors, institutions and interactions from both systems. In particular, various stakeholders from both systems with diversified interests (e.g. suppliers, users, government officials, procurers, and intermediaries) impact on PPI processes. PPI is situated in the ‘intersection’ of both systems, and consists of, by nature, ‘interactions’ between the procurement and innovation systems. In particular, as both the innovation and the public procurement systems are open systems interacting with their contexts including various political and socioeconomic circumstances, PPI is further influenced by those factors as well. In a nutshell, the dynamics of PPI can be conceptualized as a ‘system mix’ vis-à-vis ‘policy mix’. Figure 2 provides a simplified illustration of this conceptualization.

Figure 2 Conceptualization of PPI

Source: Author (TLC – technology life cycle; PPC – public procurement life cycle)

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2 See Edler & Yeow (2013) on the roles played by intermediaries in bring the supply side and demand side together.
As discussed in Section 3.1, innovation policies are considered as ‘forces for change’ influencing the innovation dynamics; correspondingly procurement-related policies are forces for change influencing procurement activities. A deliberate PPI policy is hence a force for change to impact on PPI dynamics, while PPI dynamics is (to a certain extent) manifestation of PPI policy implementation outcomes. Figure 1 offers an approach to situating policies with respect to system dynamics; the right hand side illustrates the logic and components of the policy design, while the left hand side illustrates the interactions between various dimensions of the policy (implementation) process. In order to better link the two sides and evaluate the PPI policy process, we proceed with the approach adopted in Figure 1 and integrate the various dimensions of policy design and articulation (i.e. rationales, instruments, designed structures for action and implementation) with dimensions of policy implementation (i.e. the actual implementation processes and policy outcomes), as shown in Figure 2. Policy implementation might or might not follow the logic of policy design, influenced by various factors throughout the process. On the one hand, policy design influence PPI processes through implementation; on the other hand, diagnosing PPI processes can facilitate the evaluation of PPI policies to inform further policy learning.

Reflecting on the perspectives related to ‘policy mix’ as reviewed in Section 3.2, we argue that a PPI policy is both a vertical mix of different aspects and stages of the policy process (namely, the goals, rationales, instruments, designed implementation structures, actual implementation processes, and outcomes), and a horizontal mix of procurement and innovation related interventions. For PPI policies to work effectively all the dimensions should be coherent with the others. The vertical dimension connects the policy with lower-level dynamics, i.e. the macro-level policy design with meso-level policy articulation and with the micro-level PPI processes. Vertical coherence is vital to guarantee the coherence between the policy and micro-level PPI processes. Horizontal coherence with the context, i.e. procurement and innovation systems and even broader political economic environment, is a prerequisite, given that for the procurement system there are primary goals to be fulfilled, and for the innovation system there are other policies with which PPI has to coordinate. The PPI phenomenon can hence be analysed through this ‘system mix’ framework, and the policy can be evaluated by adopting ‘coherence’ as a criterion.

4.2 Evaluation concepts – vertical and horizontal coherence

As elaborated in Section 4.1, both coherence between vertical dimensions and coherence between horizontal dimensions are considered as prerequisites to realize appropriateness and effective implementation of PPI policies. To operationalize the conceptualization, this section clarifies the
definitions of vertical and horizontal coherence as qualitative evaluation criteria, and briefly describes the concrete approaches employed by this study, as summarized in Table 1.

The definitions of criteria and approaches to evaluating PPI policies adopted here are inherently in line with the notion of a ‘logic model’ (Jordan 2010) or ‘logic chart’ (Edler et al. 2012) which has been recognized as a means of ‘relating activity to objectives and effects’ (ibid. p.3). The various challenges and considerations for evaluating the appropriateness and implementation of innovation policies, as reviewed in Section 3.3, are addressed here. In particular, the logical consistency among policy instruments and the compliance of the implementation process with the original design of the policy form the essential baseline of evaluation.

Table 1 Vertical and horizontal coherence as criteria for evaluation

<table>
<thead>
<tr>
<th>Definition</th>
<th>Vertical coherence</th>
<th>Horizontal coherence</th>
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<tr>
<td></td>
<td>The status that goals, rationales, instruments, designed implementation structures, actual implementation processes, and outcomes of the PPI policy are logically consistent with each other. Designed coherence is likely to increase the chances of actual coherence.</td>
<td>The status that PPI policy is coherent with horizontally-linked policy domains, i.e. the innovation system and the procurement system, and their wider contexts.</td>
</tr>
<tr>
<td>Approach</td>
<td>• Designed vertical coherence</td>
<td>• Detecting ‘lack of coherence’</td>
</tr>
<tr>
<td></td>
<td>Justifying the rationale and logic of the policy design; from goals to implementation structures, are all the elements coherent? Any mismatches?</td>
<td>‘Lack of coherence’ can be adopted as a qualitative indicator for evaluating coherence; it would be manifested for example in the policy domains proceeding under their own logic without regard for other domains, and potentially therefore creating contradictions and inconsistencies. Lack of coherence may result from the existence of factors hindering policy process, or from the absence of factors supporting policy process.</td>
</tr>
<tr>
<td></td>
<td>• Actual vertical coherence</td>
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<tr>
<td></td>
<td>Judging the actual implementation of the policy. From design to implementation, and from outcomes back to goals, are the elements coherent? Any mismatches?</td>
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Source: Author
5. Applying the framework to the case of China

5.1 Methodological issues

We now move on to illustrating the use of this conceptualization for PPI policy evaluation through the case of China. The Chinese political system has been recognized as a sophisticatedly bureaucratic and seemingly centralized one (Lieberthal & Oksenberg 1988; Blanchard & Shleifer 2000; Martin 2010). The three conceptual levels of policy process defined by this paper (see Section 3.3), i.e. the macro level of policy design, the intermediary/meso level of policy articulation, and the micro level of policy implementation, in general mirror the national, regional and micro levels in practice. The national level concerns the design and articulation of PPI policies by the central government including the State Council and ministerial agencies. The regional level, including provinces/municipalities and lower-level localities, is the intermediary level that links macro-level policies to micro-level practices, playing a critical role in shaping the process of policy implementation. The micro level mostly involves dynamics of stakeholder interactions centered on concrete innovation and procurement cycles, which are the ultimate activities that PPI policies target to influence. Guided by the ‘system mix – policy mix’ conceptualization, the evaluation framework developed for the case of China (Figure 3) looks into the three levels of policy process, and vertical and horizontal coherence issues.

Figure 3 PPI policy evaluation framework for the case of China

Source: Author
Through the framework presented in Figure 3, conceptual issues are translated into practical issues for which empirical knowledge is needed. Evaluating China’s PPI policy based on the conceptualization proposed in Figure 2 requires knowledge about China’s innovation and public procurement systems, knowledge about PPI policies and practices at the national, regional and micro levels, and knowledge about the wider context where the innovation, procurement and PPI processes are situated. This approach is consistent with perspectives raised in Edler et al. (2012), that both the horizontal and the vertical coordination issues should be considered in evaluating implementation, and that evaluation should connect ‘at least the micro and the meso if not the macro levels’ (p.12).

A methodology of ‘embedded case study’ (Yin 2009) has been employed. The case is constituted of several levels of analysis and different units of analysis are adopted at each level. The two types of unit of analysis adopted in this study are PPI policy channels crossing multiple levels of governance and the ‘larger unit of analysis’ (ibid. p.52), i.e. China’s PPI policy process as a whole. Data to build the above mentioned different aspects of knowledge have been collected through an extensive documentation search across national and regional PPI related policies, as well as over 50 interviews with stakeholders including policymakers, policy practitioners, procurers, suppliers and users at different levels. Data analysis was directly guided by the evaluation framework presented in Figure 3, which is underpinned by the conceptualization proposed in Section 4.

The following three subsections address the core parts illustrated in Figure 3, i.e. knowledge about the context of PPI in China in terms of the innovation and procurement systems, characterization of China’s PPI policy processes, and evaluation of the appropriateness and implementation of the Chinese policies.

5.2 China’s public procurement and innovation systems – key features

This section summarizes the key features of China’s public procurement and innovation systems taking into account the dimensions outlined in Section 4.1. Table 2 presents a brief characterization.

As part of the efforts to transform its economy from a centrally-planned to a market-based one, China started domestic procurement reforms in the mid-1980s through adopting tendering procedures in large-scale procurements (Wang & Zhang 2010). Although its recent development has been well influenced by international regulations (Chou 2006; Wang & Zhang 2010), the procurement system appears rather detached from international practices in terms of institutional settings.
Formal institutions of the current system are fundamentally underpinned by two primary laws, i.e. the Law on Government Procurement (LGP 2002), and the Law on Tendering and Bidding (LTB 1999), which are supervised by two ministerial-level authorities, i.e. the Ministry of Finance (MOF), and the National Development and Reform Commission (NDRC). The LGP regulates procurement activities of fiscally-funded organizations only, accounting for approximately 2% of China’s GDP, while the LTB regulates all formal tendering procedures operated by both public and private organizations. Therefore, the scope of the LGP is much narrower than that of public procurement regulations adopted by the signatories of the World Trade Organization (WTO) Agreement on Government Procurement (GPA); while the scope of the LTB is in effect much larger than that of the LGP, it remains ambiguously defined.

Table 2 China’s public procurement and innovation systems – key features

<table>
<thead>
<tr>
<th>Characterization of policies in each system (policies as ‘forces of change’ influencing system dynamics)</th>
<th>Public procurement system</th>
<th>Innovation system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
<td>Anti-corruption; budget-saving</td>
<td>Socioeconomic development</td>
</tr>
<tr>
<td>Theoretical rationales</td>
<td>Enhance transparency, accountability and efficiency through tendering and competition</td>
<td>Overcome system and market failures to facilitate innovation processes and support the broader environment for innovation</td>
</tr>
<tr>
<td>Instruments</td>
<td>Procurement classification and catalogues, procedures, e-platforms</td>
<td>Diversified policy instruments ranging from R&amp;D support and fiscal measures, to public procurement and regulations</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>Policy practitioners (policymakers and implementers), suppliers, procurers, operators, end users</td>
<td>Policy practitioners (policymakers and implementers), policy beneficiaries including suppliers and users</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dynamics of each system (system dynamics to an extent as manifestation of PPI policy implementation outcomes)</th>
<th>Public procurement system</th>
<th>Innovation system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors</td>
<td>Suppliers; public agencies and organizations undertaking procurement, at various levels, regions and sectors</td>
<td>Suppliers; users (public as well as private); universities and public research institutes; public agencies responsible for innovation at various levels, regions and sectors</td>
</tr>
<tr>
<td>Institutions</td>
<td>Two primary laws, regulations and implementation underpinned by the laws; procurement norms/unwritten rules affecting procurement activities</td>
<td>The Law on Science and Technology Advancement, industrial and other regulations, standards, broader institutional context influencing innovation</td>
</tr>
<tr>
<td>Interactions</td>
<td>Centred on procurement cycles; formal interaction between bidders and procurers; informal interactions between actors are not encouraged but pervasive</td>
<td>Centred on innovation cycles; diverse types of formal and informal interactions are encouraged to achieve interactive learning</td>
</tr>
</tbody>
</table>

Source: Author

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Public procurement activities beyond the scope of LGP while within the scope of LTB are hence regulated in a rather decentralized way, fragmented across sectors and across levels of government. NDRC plays a role even more powerful than MOF as it supervises procurement activities of SOEs. Region- and sector-specific agencies form the main actors undertaking public procurement, serving their need for purchasing goods/services for their own use and delivering public services. Due to the lack of unified national-level regulations, provinces and their lower-level governments have published numerous regulatory measures to carry out procurement. Implementation regulations published by ministries and levels of governments formed the ‘backbone’ of the Chinese public procurement regulatory system (Wang & Zhang 2010). These regulations often compete rather than coordinate with each other due to their contradictory institutional roots (ibid.).

Interactions between actors, especially those between procurers and suppliers, are supposed to be limited, taking the form of public tendering regulated by formal institutions and policies concerning anti-corruption and budget-saving. Nevertheless, fieldwork suggests that informal institutions and informal interactions between actors play a strong and multifold role in shaping procurement processes, mitigating the flaws and fragmentation of formal institutions on the one hand while competing with top-down policy implementation on the other.

Similarly to the procurement system, China’s innovation system has experienced rounds of reforms, driven by major policy changes since the 1970s (see Baark 2001; Gu & Lundvall 2006; Xue 1997; OECD 2008; Gu et al. 2009; Liu 2009). Despite reforms China’s NIS governance approach has maintained some characteristics of a centrally planned one (OECD 2008). Main target groups of government interventions have been actors from the public sector (universities and public research institutes) rather than firms from the private sector. The most recent policy milestone has been the National Medium- and Long-Term Programme for Science and Technology Development – an outline (2006-2020) (see State Council 2006b; hereafter the MLP), which aims to build a firm-centred national innovation system (NIS) undertaking ‘indigenous innovation’. The MLP was accompanied by the launch of a portfolio of diversified STI policy instruments (see State Council 2006a). The overall policy move featured a strong catching-up intention, underpinned by ‘a more systemic understanding of innovation’ (Liu et al. 2011, p.930).

There has been a widening range of government agencies involved in innovation policy making and implementation. The State Council Leading Group on Science, Technology, and Education composed

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4 Informal institutions refer to institutions that are ‘...created, communicated, and enforced out-side of officially sanctioned channels’ (Helmke, G. & Levitsky, S., 2004, p. 725).
of ministers and representatives from innovation-related agencies has the top-level authority in policymaking and governance. It reviews, discusses and approves major plans and decisions related to STI development, and also functions as a coordinating and monitoring body for policy implementation. Key ministries governing China’s NIS include the Ministry of Science and Technology (MOST) as the main body for innovation policymaking, the MOF overseeing financial and taxation systems, the Ministry of Industry and Information Technology (MIIT) in charge of the development and implementation of industrial policies, and the NDRC in charge of China’s macroeconomic issues, socioeconomic development agenda, national investment and crucial sectors such as energy and raw materials (see Liu et al. 2011 for a detailed account).

Below the central government are regional governments and agencies. The institutional settings of different levels of government are similar; the lower level in principle conforms to the higher level (Martin 2010). In contrast to the political centralization, regions have a high degree of financial autonomy owing to waves of reforms towards financial decentralization (Zheng 2007). The role played by regional governments and their agencies in shaping China’s innovation policy processes should not be underestimated. ‘Significant disparities’ across different regions in terms of innovation performance have been observed (Arbolino 2011; Li 2009). This unevenness has been attributed to regional disparities in GDP per capita, public infrastructures, human resources and knowledge bases, and interactions and linkages between elements of innovation systems (ibid.).

The responsibility for innovation has been divided horizontally across ministries and vertically across levels of governments. This governance structure, although clarified in appearance, has made several aspects of innovation policies (from supply-side e.g. supporting R&D to demand-side, e.g. industrial regulations, and to financial issues) fragmented across different players, notably across MOST, MIIT, and MOF. Liu et al. (2011) noted that ‘...There has been and continues to be serious fragmentation of decision-making responsibilities and co-existence of institutions, old and new, with seemingly conflicting roles and mandates’ (p. 930). The diversification of innovation policies requires coordination between more types of government agencies than the traditional S&T system led by MOST. The increasing complexity of Chinese innovation policy dynamics corresponds with what has been observed in the broader, international context (Flanagan et al. 2011).

5.3 Characterizing the Chinese PPI policy approach – three major channels

China started the use of PPI policy in 2006 when the MLP was launched. Article VIII-3 of the MLP states that responsible government agencies should: ‘...Formulate implementing regulations of the People’s Republic of China (PRC) Government Procurement Law to encourage and protect indigenous
innovation. Establish a coordination mechanism for government procurement of indigenous innovative products. Government practices a first-buy policy for major domestically made high-tech equipment and products that possess proprietary intellectual property rights. Provide policy support to enterprises in procuring domestic high-tech equipment. Develop relevant technology standards through government procurement...’ (State Council 2006b, p.54).

Following the MLP a range of supporting policies and implementation measures were announced by joint agencies to build PPI policy approaches. By integrating findings from policy documentation and fieldwork, this study identified three main channels of PPI policy process, namely a centralized PPI mechanism based on innovation and procurement catalogues (channel 1), policies promoting the commercialization of major technological equipment (MTE) (channel 2), and PPI elements in demonstration programs targeting at emerging technologies (channel 3). The three policy channels are classified and characterized in Table 3 based on the conceptualization developed in Section 4.1. The classification should be considered as an exploratory rather than conclusive one, since the PPI policy dynamics in China proved to be very complicated and constantly changing, with diverse implementation structures across regions and sectors.

Backed by a set of policy measures issued by MOST, NDRC and MOF (see e.g. MOST et al. 2006; MOST et al. 2009; MOF 2007), policy channel 1 has been the most explicit and controversial one. Its rationale was to enhance inter-departmental coordination by bringing the innovation and procurement systems together through catalogues of accredited innovation products (see Figure 3 for the flow chart of the design of this channel). Innovation catalogues and the corresponding PPI catalogues were supposed to be used as a reference for government procurers to buy new products (Li 2011; Li 2013; Li & Georghiou 2014). The central government appeared determined in implementing this channel and more than half of the regions responded actively by articulating national policies. During the transitional stage when the national catalogues were not yet produced, regions demonstrated both compliance and autonomy characteristics, with diverse approaches and progresses of implementation. The overall outcomes, impacts or effectiveness had not been formally evaluated when the channel got abolished in July 2011 in response to international concerns of China’s tendency towards protectionism (USCBC 2011).
Table 3 Characterisation of PPI policy channels identified in the context of China

<table>
<thead>
<tr>
<th>Channel</th>
<th>1: Centralized, routine mechanism for PPI</th>
<th>2: Major technological equipment (MTE) commercialization</th>
<th>3: Demonstration programmes for emerging technologies (taking the new energy vehicles (NEV) and LED lighting programmes as examples)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goals</strong></td>
<td>To promote indigenous innovation based on the existing government procurement system</td>
<td>To promote the commercialization of ‘first (set of) MTE’</td>
<td>To promote the uptake and diffusion of emerging technologies</td>
</tr>
<tr>
<td><strong>Rationales</strong></td>
<td>Enhancing demand-supply communication; establishing a routine mechanism treating ‘innovation’ as an essential criterion (‘general procurement’)</td>
<td>Government signalling national demand; supporting organizational procurers’ procurement of newly developed domestic equipment (‘strategic procurement’)</td>
<td>Nurturing ‘lead markets’; encouraging public procurement as well as private consumption (‘strategic procurement’ and ‘state procurement in connection with private users’)</td>
</tr>
<tr>
<td><strong>Main instruments</strong></td>
<td>Innovation and PPI catalogues; pilot accreditation; raising public awareness; concrete measures regarding procurement management</td>
<td>Equipment catalogues; ‘experiment’ and ‘demonstration’ projects; user subsidies; risk compensation measures; user praises and awards</td>
<td>NEV: subsidies for public procurement and private consumption in selected cities; regulations and standards. LED: ex-post subsidies by MOST; public tendering by other ministries</td>
</tr>
<tr>
<td><strong>Designed implementation structures</strong></td>
<td>Inter-departmental mechanism engaging various levels and departments; S&amp;T departments in charge of accreditation and finance departments in charge of procurement</td>
<td>Projects conducted by all organizations can apply for the status of ‘experiment or demonstration projects’ to enjoy policy support from joint authorities</td>
<td>NEV: implement city-level programme plans designed by participants and approved by MIIT, MOST, MOF, NDRC. LED: implement city-level plans designed by participants; no unified national implementation structure until 2013</td>
</tr>
<tr>
<td><strong>Actual implementation processes</strong></td>
<td>National implementation came to standstill; regional autonomy in developing local mechanisms; actual processes featured flexible stakeholder interactions</td>
<td>National implementation was not investigated; some regions designed local approaches; Shanghai experience implying that proactive suppliers and intermediaries rather than policy incentives were key drivers to success</td>
<td>Participant cities implemented with high degrees of autonomy (particularly in the LED programme), divergent pathways followed; local governments proactively played the roles of ‘policy entrepreneurs’; pervasive regional protectionism</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td>Individual cases emerged; awareness raised but government procurers’ behaviour did not change much</td>
<td>Successful examples emerged in regions; moderate behavioural additionality and increased awareness; nationwide progress reported and praised annually</td>
<td>Accelerated the diffusion of NEV and LED lighting technologies; nurtured some local industries; caused ‘high fever’ in certain regions; duplicate investment; chaotic picture for LED programme</td>
</tr>
<tr>
<td><strong>Current statuses</strong></td>
<td>Terminated at all levels in end 2011 in response to international concerns</td>
<td>Still in force, faced by challenges as well as opportunities</td>
<td>Both programmes should have ended by end 2012; both were ‘updated’ in 2013</td>
</tr>
</tbody>
</table>

*Source: Author*
Policy channel 2 aims to accelerate the commercialization of MTE. SOE procurement of indigenous innovation equipment was heavily encouraged by the central government (State Council 2006c). The rationale of this channel was on the one hand, to signal the national demand to potential suppliers through equipment catalogues, and on the other, to conduct experimental or demonstration projects to use newly developed equipment. Regions featuring strong equipment industry bases followed this initiative and commenced their own approaches. Again, both compliance and autonomy were observed; while regions followed the national equipment catalogues, they utilized various instruments such as accrediting and supporting locally developed new equipment. This channel was met by international concerns as well, notably regarding the equipment catalogue’s explicit pursuit of import substitution when initially launched in 2009. Its later versions modified the wording and thus far it remains valid and seems promising in accelerating China’s catching-up pace (see MIIT et al. 2009; MIIT et al. 2012 for details of the catalogue).

Figure 3 Flowchart of PPI policy channel 1 designed by ministries

Source: Author

Policy channel 3 can be considered as systemic policies with various demand-side innovation policy instruments adopted, e.g. technological standards, consumer subsidies, capacity building and public procurement. As summarized in Table 3, although different programmes might share the same goals and rationales, their concrete policy instruments, implementation processes and outcomes are diverse. This study takes two Chinese programmes as examples, i.e. the ‘New Energy Vehicle’ (NEV)
Programme (also called ‘Ten cities, Thousands of NEVs’, see Zheng et al. 2012; Sun 2012), and the LED Lighting Programme (also called ‘Ten cities, Ten thousand of LED lights’, see ISA 2012). PPI elements associated with the two programmes were introduced by core ministries (MOST, MIIT and NDRC) in charge of innovation. They both to an extent accelerated the diffusion of NEV and LED lighting technologies and nurtured some local industries; both shared some common implementation patterns such as high autonomy and diversity of policy settings across regions, and were meanwhile faced with a tendency towards regional protectionism and duplicate investment. In particular, the development trajectory of LED lighting programme appeared to be a rather chaotic picture owing to the lack of centralized regulations or standards to shape the industry.

5.4 Evaluative analysis

Evaluation criteria defined in Table 1, i.e. vertical and horizontal coherence, are employed here to appraise the appropriateness and implementation of China’s PPI policies. As characterized in Table 3, the first four rows of the table concern primarily policy design and articulation, while the bottom three rows are more about the ‘reality’ of policy implementation. The ‘designed’ vertical coherence (i.e. would the channels realize their goals if the implementation was carried out strictly according to the design?) can be evaluated through analysing the coherence between upper rows, while to evaluate the ‘actual’ vertical coherence all the rows need to be synthesized. As for horizontal coherence, Table 1 has defined ‘lack of coherence’ as a qualitative indicator in detail. As a policy phenomenon situated at the ‘intersection’ of innovation and procurement systems, PPI practices need to realize horizontal coherence with the circumstances of contextual domains. This means the design and implementation of the three PPI policy channels should be coherent with the settings of the domestic innovation and procurement systems, as well as with the contexts of the two systems, i.e. broader domestic and international circumstances. On the basis of the characterization outlined in Table 3, the coherence of each dimension is checked with that of the overall innovation and procurement policies/regulations as reviewed in Section 5.2; the dynamics of actors, institutions and interactions during the course of PPI cycles are also reflected on, to identify major tensions resulted from lack of coherence with contextual issues.

During its initial stage up to 2010, China’s PPI policy channel 1 which was based on innovation catalogues moderately realized its designed coherence between goals, rationales, instruments and designed implementation structures. A problem identified was its implementability since it adopted very rigid criteria and lengthy procedures to accredit innovation products. Time-consuming accreditation procedures and fragmented responsibilities for promoting innovation and conducting procurement across a wide range of agencies made the actual vertical coherence unlikely to be
achieved. The actual implementation process of channel 1 turned into one featuring low ambiguity yet high conflicts. Although some regions carried on implementing channel 1 and to some extent achieved outcomes coherent with the original design, the implementation processes were rather ad hoc and experimental, and the outcomes were individual PPI examples rather than systematic PPI activities. In terms of horizontal coherence, the ‘one-size-fits-all’ design counting on centrally-controlled coordination across multiple levels of government, and across innovation and procurement systems, was incompatible with the institutional fragmentation and regional autonomy of both systems. Horizontal lack of coherence with the international context (notably incompatibility of procurement regulations and goal conflicts with developed countries) was the fundamental cause leading to the termination of policies.

PPI policy channel 2 which was designed with the objective of promoting MTE commercialization realized a higher degree of vertical coherence. Empirical data collected from the context of Shanghai suggested that the implementation turned into an ‘administrative’ type for which both ambiguity and conflict were low, while the provision of resources, capacities and techniques might need to be enhanced. Vertical coherence was more or less realized in terms of both design and implementation. Higher horizontal coherence with the procurement system was realized since channel 2 is only targeted at the equipment sector. The ‘lack of coherence’ with the international context was diminished after the equipment catalogues removed the explicit requirements for ‘indigenousness’ and import substitution.

Unlike policy channels 1 and 2, PPI policy channel 3 has become an increasingly popular instrument promoting emerging technologies internationally, which implies that the appropriateness judged according to international ‘rules of the game’ is less controversial. The design of both programmes situated in policy channel 3 appeared to be more ambiguous compared with that of the other two channels. The implementation structure, i.e. selected cities implementing the programme according to their local plans, determined that regional autonomy played a key role in shaping the dynamics. The NEV programme realized more vertical coherence than the LED programme due to its greater national control over regions through a unified ministerial-level governance structure, larger amounts of subsidies and industrial regulations. The implementation type of both programmes was also an ‘experimental’ one, producing diversified outcomes as well as lessons for further policymaking. Domestically it was better supported by the procurement system owing to its sector- and region-specific characteristics which were in line with the institutional fragmentation. Horizontal coherence with the innovation system depended very much on the institutional settings of the specific programme.
Through comparing China’s PPI practices with that of OECD countries, this paper has found that substantial differences exist in terms of their respective institutional contexts, choice of PPI policy instruments, governance styles and implementation processes. Nevertheless, some signs of ‘policy convergence’ have been noticed. China has been converging both actively, e.g. through policy learning from developed countries (‘emulation’, Bennett 1991), and passively, e.g. through ‘harmonization’ (ibid.) by international commitments and ‘penetration’ (ibid.) by international stakeholders.

6. Discussion and conclusion

The potential of public procurement for stimulating innovation and leveraging socioeconomic performance has been well recognized and documented by the literature. Yet existing research remains rather empirical and descriptive. Seeing the fact that there has been a severe lack of holistic approaches to analyzing or evaluating PPI policies, this paper has made an initial attempt to propose a conceptualization (a ‘system mix’ – ‘policy mix’ framework) which links the multiple levels and aspects of the PPI policy process.

PPI dynamics feature the characteristics of both innovation and public procurement. Concrete PPI processes are viewed as dynamics situated at the intersection of innovation and public procurement systems (‘system mix’), and shaped by the contexts, institutions, actors and interactions of the two systems. PPI policies are, on the one hand, horizontal mixes of innovation and public procurement related interventions, and on the other, vertical mixes of goals, rationales, instruments, designed implementation structures, actual implementation processes, and outcomes. PPI policies impact on concrete PPI processes through implementation, whilst PPI processes, shaped by various factors in the context, are manifestations of PPI policy implementation. One precondition for PPI policies to be appropriate is that, elements within the ‘horizontal mixes’ and the ‘vertical mixes’ should be coherent with each other. Therefore, ‘vertical’ and ‘horizontal coherence’ can be employed as qualitative criteria to evaluate the appropriateness and implementation of PPI policies.

The conceptualization and an operationalized evaluation framework have then been applied to the case of China to analyze and evaluate the appropriateness and implementation of China’s PPI policies up to 2011. The three PPI policy channels in China, namely ‘centralized, routine mechanisms for PPI’, ‘major technological equipment commercialization’, and ‘demonstration programmes for emerging technologies’, followed diverse trajectories and realized different degrees of appropriateness owing to their respective characteristics and institutional contexts. Neither horizontal nor vertical coherence could be said as having been fully achieved. The current
institutional setup of China’s innovation system appears to be too fragmented to deal with ‘systemic’ innovation policies, while China’s ‘government’ procurement system has too limited a scope to cover all types of ‘public’ procurement. An advantage of channels 2 and 3 over channel 1 has been attributed to their relative coherence with China’s institutional fragmentation, as they were both ‘fragmented’ policies, targeting specific sectors and levels of governance. Their horizontal coherence with international institutions was also better realized than that of channel 1, in the sense that the tendency of national protectionism was less explicit and fewer controversies were drawn. Lack of coherence with the international context can be largely considered as conflicts of interests between catching-up and leading countries in the domains of international trade and competition. A common problem identified, perhaps more for channels 1 and 3, less for channel 2, was local protectionism, which hindered the vertical coherence of policy implementation for the country as a whole.

The evaluation framework is not confined to the Chinese context as it draws upon established literature strands on innovation and public procurement in general. The notion of ‘designed vertical coherence’ can be used for ex ante evaluation of appropriateness, while ‘actual vertical coherence’ can contribute to ongoing or ex post evaluation by serving as a diagnostic tool to detect deficiencies. As discussed in Section 4.1, the institutional capacity for PPI policies in a given context is determined by the ‘intersection’ and ‘interaction’ of the two systems. For countries that have not adopted PPI policies, and especially those that are non-GPA members and are acceding to GPA (mostly developing countries), this framework can be applied as an ex ante evaluation tool to assess the institutional capacity and potential of PPI policies.

More broadly speaking, the ‘system mix – policy mix’ framework has also potential for adaptation to other cross-domain innovation policies besides PPI policies, to mitigate the difficulty of analysing cross-domain, multi-level and multi-actor dynamics.

As an initial attempt to conceptualize PPI, this framework is subject to conceptual ambiguity. Some important concepts and perspectives this study draws from the literature, including the notions of ‘policy mix’ and ‘appropriateness’, are still conceptually underdeveloped and/or ambiguous. The study has proposed definitions and delineation for these and has attempted to contribute to the field in addressing such gaps; nevertheless, this is only an initial effort, which should be considered open-ended rather than conclusive. Further refinement and characterization are needed to better guide analysis and evaluation.
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