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Should “open innovation” change innovation policy thinking in catching-up economies? Considerations for policy analyses

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GENERAL ARTICLE

Should “open innovation” change innovation policy thinking in catching-up economies? Considerations for policy analyses

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This paper provides a review of the current state of academic and policy-level debates on “open innovation” by elaborating on the relevance of the concept of open innovation for innovation policy-making in catching-up economies. The paper shows that paradoxes and contradictions exist between the “mainstream” innovation discourse and the development challenges of the catching-up countries that have led to “de-contextualization” of the innovation policy discourse. The paper argues that applying the concept of open innovation in its ideal-type form to the catching-up context is likely to reinforce these de-contextualization tendencies. This problem can be remedied by more conscious attention to the basic contradictions and paradoxes, which requires a more comprehensive and systemic analytical focus on innovation and technological development at the levels of firm, industry and policy.

Keywords: innovation theory; innovation policy; open innovation; catching-up economies; developing countries

Introduction

In recent years, the discourse on innovation has witnessed the emergence of new, by some accounts even paradigmatic, views on the processes of innovation and the relationship between firms, industries and the wider socio-economic context. The concepts of “open innovation”, “peer production” and “social production” claim to offer fundamentally different views on the theories and processes of innovation and propose reconfigurations of current innovation practices in firms and even across systems and policies.

One of the most prominent concepts seems to be “open innovation” (Chesbrough 2003, 2006, Chesbrough *et al.* 2008), which has also become one of the core components of the recent innovation policy discourse (e.g. EC 2007a, 2007b, EC 2010, OECD 2008a, 2008b, 2009). The novelty and popularity of the concept comes from its claim of paradigmatic change, which is reflected in some of the key statements and definitions of the approach. Consider the following statements:

Open innovation paradigm can be used as the antithesis of the traditional vertical integration model where internal R&D activities lead to internally developed products that are then distributed by the firm. (Chesbrough 2008a, p. 1)

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Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance their technology. (Chesbrough 2003, p. xxiv)

Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for the use of innovation, respectively. (Chesbrough 2008a, p. 1)

The origins of the approach lay in the managerial approach developed from firm-level analysis of leading US multinational firms (see Chesbrough 2003). Thus, originally it was a conceptual empirical approach, which has been given certain paradigmatic characteristics. As some of the leading companies at the world's technological frontier are changing business practices and models, it is assumed that this change will affect business and innovation processes in other places of the global production and innovation chains and networks. There are two potential avenues for analyzing this change:

- *Analytically* – this change can be interpreted as a contextual shift in the balance between different business models and practices (i.e. between hierarchical integrated modes and decentralized network-based modes of production and innovation). This raises the further question of whether this trend is functionally prevalent across the global economy (i.e. whether all companies and institutions should follow this shift) and what this implies for other institutional features, such as public policies.
- *Normatively* – this change can be interpreted as a symbolic change that mirrors the emergence of a new dominant approach to globalization-affected production and innovation networks. This raises further questions – how to spread the model across the global economy and how to change relevant institutions, such as public policies.

In the *economic analysis* of the open innovation concept we see both analytical and normative approaches, which we do not discuss in detail in this paper.¹ However, we argue that in the context of *policy analysis* and international policy learning we are more likely to witness the normative perspective, which fits well into the current post-crisis search for new models for socio-economic stability. For example the OECD has picked up the debate from firm-level analyses and extended it to policy debates, asking how public policies can support open innovation approaches:

As global competition intensifies and innovation becomes riskier and more costly, the business sector has been internationalising knowledge-intensive corporate functions, including R&D. At the same time, companies are increasingly opening their innovation processes and collaborating on innovation with external partners (suppliers, customers, universities, etc.). This clearly has important implications for policy-making, given the important role of innovation in OECD countries' economic growth. (OECD 2008a, p. 3)

In this paper we intend to contribute to the *analytical perspective of policy analysis* by discussing the concept of open innovation and its likely future extension to the innovation policy discourse of catching-up economies. We admit that this may be a step too soon as discussions of the impact of open innovation on innovation policy are still in their infancy. However, there are also academic attempts to discuss the

impact of open innovation on innovation policy-making and how public policies can foster open innovation (see De Jong *et al.* 2010, Vanhaverbeke *et al.* 2008).

We argue that over recent decades there has been a trend towards “de-contextualized” convergence of innovation discourses (both academic and policy) whereby catching-up economies are increasingly designing innovation policies in the context of theories and concepts derived from the “core economies” of the current technological frontier (see Karo and Kattel 2010a). Therefore, it is likely that policy-makers in catching-up economies will one day ask if and how to accommodate public policies with concepts like open innovation. In this context this paper discusses the following question: *does “open innovation” offer catching-up economies new opportunities and tools for successful catching-up strategies that also demand or prescribe re-thinking of innovation policies and strategies?*

The following discussion is divided into four sections. Firstly, we will discuss the problem of the “de-contextualization” of innovation policy discourses. For grounding our analysis in a theoretical frame, we will then show that the emerging theoretical consensus between evolutionary and neoclassical analysis of innovation in catching-up contexts (which emphasizes the targeting and development of organizational capabilities in the private sector through contextually embedded policy-making institutions and instruments) can be useful for discovering the most pressing institutional barriers or challenges of catching up. Then we will discuss both the economic and policy relevance of the concept of open innovation for catching-up economies. In the conclusions we discuss the relevance of the open innovation concept for policy analysis practices of catching-up economies.

De-contextualization of the innovation policy discourse

The late 1990s and 2000s have witnessed a growing literature and research on innovation as the key to catching up and development (OECD 2009, Radosevic 2009, UNIDO 2009, World Bank 2008a, 2008b, also Rodrik 2007). The academic research has largely looked into three catching-up regions – Eastern Europe (EE), Latin America (LA) and East Asia (EA) – with the former two being regarded as cases of relative failure² (e.g. Cassiolato and Vittorino 2009, Cimoli *et al.* 2005, 2009a, Kattel *et al.* 2009, Karo and Kattel 2010a, Karo and Kattel 2010b, Radosevic and Reid 2006, Tiits *et al.* 2008, Török 2007) and the latter as an almost unequivocal success story (e.g. Amsden 1989, 2007, Chang 2007, Haggard 1990, 2004, Wade 1990, 2004) of policies aimed at sustainable economic and technological catching up.

These differences and the (relative) failure of EE and LA are credited to the infusion of a specific “Western” discourse on economic development and innovation to the respective discourse of these regions. Namely, catching-up strategies of the EE and LA countries have been influenced by Washington Consensus (WC) based economic policies and a Western-biased conceptualization of innovation and understanding of the systems of innovation. In this context, the literature on EE (e.g. mainly by Radosevic 1998, 2006, 2009, also Piech and Radosevic 2006, Tiits *et al.* 2008) and LA (e.g. Cimoli *et al.* 2005, 2009a, Cimoli and Katz 2003, Sutz 2000) seems to agree that the innovation policies in EE and LA have largely failed because of peculiar mistakes in the policy process: mainly because of misconceptions of the initial problems of catching up and development.³

In the case of LA, the problems are usually pinpointed as misunderstanding the potential effects and timing of liberalization (resulting in a “foreignization” of the

economic structure, i.e. dominance of foreign companies in the critical nodes of innovation systems and erosion of local autonomous capacities and capabilities). In the case of EE, the challenges of liberalization have been magnified by a misinterpretation of the Soviet industrial R&D structure and capabilities (also resulting in a “*primitivization*” of the economic structure and disappearance of existing industrial capabilities). Both of these policy failures have led towards weakened capacities for economic restructuring and catching up that are paralleled by innovation thinking that lacks tools, methods and approaches to fully take into account these contextual problems.

Thus, while in both regions there have been cases of companies and countries being highly linked to what can be defined as global production and innovation networks (see Ernst 2002, 2009), in the current financial crisis, the high level of openness and exposure to and dependence on the globally hierarchical production and innovation networks has often backfired or revealed structural weaknesses. In the most extreme cases, as experienced by the Baltic States (see Kattel 2010), highly volatile markets and unstable global partnerships and networks have led to structural crises and unpredictable development and catching-up trajectories.

In the framework of evolutionary economics, these policy failures can be linked to the “mistiming” of catching-up strategies (see e.g. Reinert 2007, 2009). At the beginning of the 1990s, the developed world itself was largely facing a huge challenge in having to rethink policies and models for economic growth and technological development (see e.g. Sharif 2006, Soete 2007). At least part of it can be attributed to the techno-economic paradigm shift (see Perez 2002), which brought about new policy challenges, e.g. modularity in production processes and outsourcing, that changed the context of growth and development.⁴ In-depth discussions of the systems of innovation in developing countries are a more recent phenomenon (see e.g. Lundvall *et al.* 2009) and highlight the different levels of technological development and capabilities across regions within the dominant technological paradigm.

Overall, the general debate on innovation has moved towards an ever-increasing complexity of theories and models explaining innovation and economic growth/development; the academic discourse has moved from entrepreneurial and firm-level approaches to innovation (starting with Schumpeter 1939) towards a more systemic view of the influence of the socio-economic environment, i.e. the systems of innovation approach (for an overview, see Fagerberg 2004, Dodgson *et al.* 2008). Thus, the discourse on innovation and economic development can be largely divided into two broad levels of analysis: *entrepreneur- or firm-level* processes of innovation and *socio-economic conditions* (and policies) supporting innovation.⁵ Theories and perspectives from developed economies have dominated both of these levels of analysis.

Since the 2000s the firm-level academic research has increasingly started to debate the relevance of the past approaches and understanding of innovation (e.g. Chesbrough 2003, 2006, Chesbrough *et al.* 2008, also Benkler 2006). These new concepts, especially the concept of open innovation, are mainly firm-level discussions (based on firm-level and/or industry case studies) on innovation (e.g. about R&D processes, business models etc.), relying on certain assumptions of the system-level.⁶ Nevertheless, this debate seemingly lacks strong and coherent research on the system-level implications of the new concepts and links with the previous research

and policy discourse (with some exceptions, see e.g. Dahlander and Gann 2007, De Jong *et al.* 2008, Vanhaverbeke *et al.* 2008).⁷

Overall, we cannot witness any coherent research or theorizing on how these fundamental changes in the innovation discourse affect the catching-up perspectives and policy needs of lagging regions. Most of the above-made references to the empirical research on catching-up regions have placed some emphasis on the differences of policy needs and capacities between the catching-up regions and the original context from which most of the dominant policy discourse arises. The general policy-relevant claim is thus that a context-specific policy analysis is the key. This is also recognized in the most recent policy-level debates (OECD 2009, UNIDO 2009, also Box 2009) and in the analysis of the implications of open innovation on national innovation policies (see e.g. De Jong *et al.* 2008, De Jong *et al.* 2010, Vanhaverbeke 2008). Yet, the general tone of this claim at the policy level tends to remain rather vague or abstract, for example (OECD 2009, p. 53):

[L]ow income developing countries face greater difficulties in making innovation the engine of development. Not only are there objective barriers such as poor framework conditions, limited human and social capital for producing, disseminating and using knowledge, but there is also a low capacity in policy-making regarding innovation.

The policy recommendations that follow this are rather generic and inclined to be “one-size-fits-all”, departing more from the normative functional expectations than from analytical perspectives and present good practices of developed economies as suitable learning and emulation benchmarks. Without due attention to the local capabilities and capacities, to past causes of underdevelopment, to the international developments, these kinds of policy recommendations may continue to result in *de-contextualized* policies and strategies. Indeed, there is a growing stream of critical research arguing that global trends towards decentralized modes of innovation and production and emergence of global innovation and production networks reveal themselves quite differently once we move away from the technological frontier or down the ladder of techno-economic development.

Amsden and Chu (2004) offer an authoritative account of the techno-economic developments of the electronics industry (one of the traditional domains of network-based business models and theories) in Taiwan (a successful catching-up, or late developing economy). They argue that, because of the relative technological backwardness (the status of catching-up economies partly stems from the relative maturity of the technologies and technology-related processes that economies overall specialize into), the economic processes of innovation, production, marketing, etc. reveal themselves through different *capability structures* (i.e. contextualized production and project management capabilities based on the combination of lower production cost and less innovation-intensive skills) and *incentive structures* (i.e. less incentives for localized inter-firm cooperation, technology co-production and networking and higher dependence on the international sub-contracting and technology-import networks). Amsden and Chu claim that, in catching-up economies, the impacts of globalization (and expected impacts of more open innovation processes) reveal themselves differently and require contextualized policy responses (which they see as *state-led networking* where the state strategically steers both local and global innovation trends).

Also, Ernst (2009) argues that the relatively strong catching-up region of EA has managed to create sustainable links to global production and innovation networks through highly targeted and selective government policies that have created capabilities and steered the actions of actors participating in these global networks. It is so mainly because global networks remain hierarchical, and moving up the ladder (e.g. from “new frontier” locations to catching-up locations to advanced locations) requires high levels of policy efforts to invest in increasing absorptive capacities and innovative capabilities both at the firm level and across industry. Thus, the systemic catching-up challenges consist of at least two qualitative shifts:

- How to move from low(er) technological capabilities closer to higher technological capabilities needed for competing at the technological frontier.
- How to move from low(er) institutional capacities closer to higher institutional (entrepreneurial and policy) capacity and capability frontier.

In the evolutionary innovation literature this challenge has been conceptualized as “co-evolution” of institutions and technologies (Nelson 1994, Nelson and Sampat 2002). To put it simply, co-evolutionary characteristics of socio-economic development emphasize that the dual qualitative shift can only be achieved through a high level of coordination or embeddedness between technological and institutional development. The latter includes the development of institutions that create the underpinnings for both public- and private-sector capacities and capabilities. Therefore taking advantage of techno-economic developments is both an economic and a political process.

In the following section, we will provide a theoretical discussion arguing that, instead of making assumptions about institutional and firm-level capacities and capabilities, the emphasis must be on a “presumption-free” analysis of both endogenous and exogenous factors of the process of innovation. We will offer a theoretical framework that goes back to basics of innovation theories and thereafter use the proposed framework as a basis for a theoretical/conceptual discussion on open innovation in the context of development and catching up.

Emerging consensus in the theory of innovation and its discontents

Policy “talk” is always bound to be not only simply a watered-down version of theory but more importantly theory squeezed into sound bites fit for heated debates and condensed policy briefs and memos. In other words, policy talk can be expected to be in some ways contradictory and even shallow. However, in this section, we aim to show that the reasons why we see increasingly de-contextualized innovation policy in catching-up regions such as EE and LA lie in the incoherencies within the wider framework of innovation theory. We will argue here that, while there is in fact a somewhat surprising consensus emerging between economic analyses departing both from evolutionary and neoclassical perspectives on the role of innovation and more widely on industry in catching up, there are also serious discontents within this consensus. These discontents center on different understandings of the nature and role of technology in growth and make it relatively easy for policy advice and transfer to become de-contextualized. Describing the contents and discontents within innovation theory, we can later discuss the role and embeddedness of the new ideas about innovation such as open innovation in the broader innovation policy context.

Emerging consensus on innovation and industry

While evolutionary economic theory has always stressed the importance of and the pivotal role played by innovation in economic growth and in particular in catching up, the neoclassical perspectives have also increasingly viewed innovation as an indispensable if not fundamental driver of growth. Suffice it here to refer to Krugman's (1991) work on increasing returns and economic geography or Rodrik (2007) development economics, which both try to extend the neoclassical analysis to include innovation into the center of analysis. It is possible to create a common framework on innovation and development, or what we call emerging consensus in the theory of innovation. For this, the theoretical discussions of two perspectives and their core authors (Nelson and Winter 1982, Rodrik 2007) will be used here.⁸ The aim of the framework is to highlight theoretical foundations that should be seen behind the conceptual models and tools that are used to think about the complex issues of innovation. The framework traces these foundations back to specific assumptions on two levels which we have also emphasized above: *firm and industry and the socio-economic institutional context*. Table 1 summarizes the emerging consensus as a theoretical framework.

In the context of development and catching up, we can again detect a large overlap between evolutionary and neoclassical thinking. From the evolutionary viewpoint, any kind of economic growth is viewed as a disequilibrium process that involves a mix (changing over time) of firms employing different vintages of technology (i.e. differences in production functions). It is time-consuming and costly for a firm to learn about and learn to use technology significantly different from familiar ones. Also, firms will differ in their awareness, competence and judgments in choosing to adopt or not to adopt new techniques. The problem of economic development differs from the problem of general economic growth in the sense that the more productive technologies that the less developed country will adopt in the course of development/catching up are usually known and have been employed in more developed countries (i.e. borrowing, imitating, adopting; instead of inventing).

Rather similarly Rodrik (2007) argues that the growth strategies for economic development policy need to be based on three elements: *growth diagnostics; policy design; and institutionalization*. In essence, this provides a contextual analytical framework for bottom-up-based country-specific policy analysis (self-discovery of economic strengths and weaknesses). For Rodrik, the general "industrial policy" challenges to developing countries that reduce the incentives for productive diversification and more sustainable economic development can be summarized into key externalities: information externalities (self-discovery of an economy's cost structure, i.e. imitation/adaptation possibilities) and coordination externalities (coordinating simultaneous and large-scale investments and also prioritization of technologies).

In sum, despite different points of departure, both approaches come together at a specific *contextual understanding of the process of innovation and economic development* from the perspective of developing countries:

- engines of innovation can be found at the firm-level processes (i.e. innovations influence the market);
- developing countries face significant challenges in achieving economic restructuring and sustainable development because capabilities and behavioral models of firms and industries in these countries are more capable of imitating, rather than innovating;

Table 1. Emerging consensus for analyzing development and innovation.

	Nelson and Winter (1982) – relations and actions of firms (and industry) within the wider (institutional) context	Rodrik (2007) – influence of the institutional context on the firm-level processes
How do firms and entrepreneurs behave and innovate?	<p>The theoretical argument on firm behavior is based on two distinct concepts – <i>organizational routines</i> and <i>search</i>. Companies have built-in <i>patterns of action</i> and ways of determining future activities (regular and predictable skills based on “remember by doing”), i.e. including limited scope of capabilities, procedures and decision rules. This makes firms’ past experience increasingly important in predicting future actions – flexibility of routinized behavior is of limited scope and the changing environment increases the unpredictability and risks of survival where the firms opt to modify routines.</p> <p><i>Search</i> denotes the organizational activities (characterized by irreversibility, uncertainty and contingency – i.e. historically contextual) that are linked to the evaluation of the current routines that may lead to incremental or drastic changes or outright replacement of old routines; i.e. innovation is a deviation from/change of routine behavior. Innovation is viewed as carrying out new combinations – reliable routines of well-understood scope provide the best components for new combinations. Firms also have well-defined routines for innovating efforts, e.g. focusing first on pay-off factors vs. focusing first on new technological possibilities (cost and feasibility) and then on pay-off.</p>	<p>Rodrik’s approach does not place explicit attention on the firm or entrepreneurial level and is concerned rather with a higher and institutional level of analysis, i.e. getting the <i>institutions</i> (both market and nonmarket) in place for innovation and development.</p> <p>Yet, the argumentation is based on the assumption that there are two types of learning relevant to economic growth: (1) <i>adaptation of existing technologies</i>; and (2) <i>innovation to create new technologies</i>. Early in the development process, the type of learning that matters the most is the former one.</p> <p>In essence, the analysis is based on the idea that, without proper institutional support, the companies will not be able to pursue economic development and technological advance because of the possible negative impact of <i>learning externalities</i> and <i>coordination failures</i>.</p> <p>Thus, the entrepreneurial behavior is conditioned by existing capacities that, for economic development, have to be increased – this can be achieved by better institutions or institutional support.</p>

Table 1 (Continued)

	Nelson and Winter (1982) – relations and actions of firms (and industry) within the wider (institutional) context	Rodrik (2007) – influence of the institutional context on the firm-level processes
How does the socio-economic environment relate to entrepreneurship and innovation?	<p>The organizational routines and search are embedded in the <i>selection environment</i>, i.e. the ensemble of considerations which affect the well-being of the organization and hence the extent to which it expands or contracts. This is partly determined by conditions outside the firms in the industry or sector being considered but also by the characteristics and behavior of the other firms in the sector.</p> <p><i>Public policies</i> (including governmental and academic R&D) influence the search prospects of firms; in general, this influence steers the private R&D endeavors (towards socially more preferred innovation and routines, e.g. clustering). The firms evolve over time (through joint actions of search and selection), with the conditions of industry in each period bearing the seeds of its conditions in the following period.</p>	<p>One of the premises of the <i>getting-the-institution-right</i> principle is the increasing recognition that high-quality institutions can take several forms (i.e. function differs from form), and economic convergence does not necessarily have to be based on the convergence in institutional forms.</p> <p>Therefore, the impact of the socio-economic environment has to be studied in the mode of “<i>growth diagnostics</i>”, i.e. analyzing the differences of the “binding constraints” on economic activities that differ across contexts and focusing on the most binding constraints.</p>

- challenges are grounded in the historical experience and development context and have developed into peculiar paths and behavioral patterns of firms that cannot be changed from outside, but have to transform in the contextually logical pattern of entrepreneurship (learning of skills, discovering strengths and weaknesses, i.e. even imitating requires learning and the accumulation of knowledge);
- the role of wider socio-economic institutions is to create additional incentives and capacities to support the self-discovery/search for better ways and modes of entrepreneurial activity.

Therefore, regardless of the analytical differences, neither of the approaches disregards the crucial interdependence of socio-economic and firm-level factors and behaviors. Thus, the problems are contextual; the end goal of policies and actions may be universal and consensual, but the path of development has to take into account the content and context of the problem and provide suitable solutions and development patterns. From the discussion of the theoretical consensus, we can see that the policy developments and debates discussed above in the catching-up context

often fail to follow the very basics of theory: *contextual understanding of problems and aiming policies at influencing dynamic firm-level capabilities.*

Discontents in innovation theory

The main point of discontent between evolutionary and neoclassical perspectives is the highly different understanding of technology and its role in catching up.⁹ More specifically, there are strong disagreements as to what causes and stimulates innovations in the private sector. On the one hand, the evolutionary tradition argues that innovations and economic growth in general take place because of knowledge and skill agglomeration and continuous upgrading and technological change that are engendered by highly embedded policy-making of increasing coordination, dialogue and cooperation managed by a highly capable state and administration. On the other hand, the neoclassical and also public-choice traditions argue that the main drivers behind innovations and growth are trade and competition: the former using the comparative advantage of nations to bring more, better and cheaper goods to consumers (higher efficiency); the latter creating pressures for companies to incessantly innovate and outcompete the competitors, and to push prices downwards in the process (higher efficiency, again).

While the differences in details are of course greater than described here, it is important to see that both traditions can be traced back to Adam Smith's theorem that the division of labor is limited by the size of the market (1904/1776). The difference lies in how one understands the theorem: the former school takes it to mean that *division of labor* is key (the creation of knowledge and technological diversity, and the producer with its capabilities are the main policy goals), the latter school thinks the *size of the market* is key (the extent of trade and competition, and lower prices for consumers are the main policy goals).

This difference goes back to understanding the nature of technological development and its impact on companies and economies. The evolutionary school argues that technological development is almost always path-dependent;¹⁰ neoclassical arguments assume that technology is essentially freely available to all, competitors and countries alike.¹¹ This view also assumes that technological development is more or less linear, towards ever more complex solutions yet with a rather clear path ahead. Thus, while neoclassical economists set out to rectify market failures that prevent the dissemination of technologies and skills, in the eyes of evolutionary economists, entrepreneurs seek technological innovation *in order* to create market failures. For evolutionary economists, technological development is anything but linear, and technology is anything but freely available. Path dependencies, linkages, spillovers, externalities, winner-takes-all markets and highly imperfect and dynamic competition make technology an unpredictable, high-risk and possibly high-return endeavor that drives on a tautological logic: technological development feeds on technological development¹² (see e.g. Arthur 1994, Perez 2002). These characteristics engender long-term structural changes in economies in the form of technology trajectories, paradigms and geographical agglomerations. In particular since the early 1980s, evolutionary economists have emphasized the latter, long-term characteristics of economic development that are directly related to technology and innovation.¹³

Thus, even if neoclassical or mainstream economists admit the existence and the importance of increasing returns to scale owing to technology and innovation (as, for

instance, Krugman and Rodrik do), from an evolutionary standpoint, this is not only not enough, but without understanding the paradigmatic and path-dependent nature of increasing returns and technological development, admitting the latter into growth models only obscures the issue.

In sum, while we are witnessing an important convergence between evolutionary and neoclassical perspectives on the role of innovation, there are key discontents between the two that go back to understanding the role of technology. De-contextualized innovation policy engenders partially from these discontents, especially as the neoclassical thinking has had an enormous influence on international organizations such as the World Bank. In essence, understanding technology as neutral to context and development level, innovation policies inspired by the neoclassical analyses in fact greatly underestimate the context-specific nature of development – even against their own theories.

In what follows, we show that the new “fashions” and proposed paradigms in innovation theory such as open innovation, first, create an even stronger misconception about the role of technology in development. Second, from the evolutionary perspective, these new ideas can be understood as part of the prevailing techno-economic paradigm that emphasizes networks and modularity in production. The techno-economic paradigm perspective would argue that cyclicalities and especially cumulativeness of techno-economic development creates more complex challenges on development than merely spreading the practices and developments of the techno-economic frontier (including technological, policy and business practices) to lower levels of the development ladder. This creates a demand for more complex policies and higher analytical capacities to provide potential for contextual policy analysis and emulation.

How does “open innovation” fit into the innovation-policy context of catching-up economies?

Previously we have noted that, similarly to the systems of innovation discourse, the concept of open innovation lacks a proper catching-up perspective, but also sufficient research on the systems level. In the theoretical discussion, we have shown that the debate on innovation – to be sensitive to catching-up development – has to be looked at from at least two perspectives, i.e. the firm level and the socio-economic environment. The discontents in these theories have also made it pivotal to take into account the issues of technology and techno-economic paradigms. In this section, we try to look into the core sources of open-innovation literature to dissect the core arguments and challenges that are related to advancing the concept from firm-level discourse to policy-level concept. Based on the theoretical frame, we will look for characteristics that are of relevance both at the firm level and in the socio-economic context and try to discuss how policy-makers in the catching-up context could contextualize the concept of open innovation.

Open innovation, business models and catching up

According to Chesbrough (2008a, 2008b; also 2003, 2006), the novelty of open innovation can be seen in the equal emphasis placed on external and internal knowledge in business models and strategies. According to this view, the need for changing the strategies is caused by the exhaustion of and lack of competitiveness of

the past business models and strategies of successful (mainly large and/or multinational) companies (e.g. fewer economies of scale found in internal R&D processes and therefore also resulting from internal R&D). The open innovation concept offers a tool for systemizing and explaining peculiar trajectories (and new complementary strategies) of development of these specific companies. As such, the concept looks at new trajectories found in business practices that influence the competitiveness of companies, such as coping with spillovers from industrial R&D and changes in intellectual property (IP) management (see Chesbrough 2008a).

In this context, the main strategic challenge that open innovation tries to solve becomes that of finding proper strategies and business models (e.g. IPR systems and strategies; industrial R&D models and strategies; compatibility of the business model with those of suppliers, customers, competitors, complementors; cooperation with universities and other R&D institutions) to reap the benefits of ‘de-verticalization’ or vertical specialization (see Christensen 2008; for ideal-type models, see Chesbrough 2006, ch. 5). In principle, this becomes a strategic balancing act for firms between retaining existing competitive advantages and seeking new rents that the vertical specialization could offer. It is possible to dissect several issues where the concept of open innovation leaves firms with almost contradictory strategic choices (taken from Chesbrough *et al.* 2008):

- finding a balance between concentrating on core competencies vs. creating and maintaining capacities for technological foresight and adoption (e.g. searching the market for new ideas and technologies);
- balancing between competencies related to creating technological innovations vs. capacities related to sourcing or integrating such technological innovations;
- balancing the potential of gaining benefits from appropriability vs. benefiting from openness;
- balancing between the capabilities of value creation vs. value capture.

From this, we can see that much of the debate and strategic direction advocated by the open innovation is largely conditional, i.e. dependent on specific firm-level characteristics, but also more implicitly on the wider socio-economic context. Ernst (2009) has interpreted open innovation (in much the same way that most critical accounts perceive it) as a perspective to consciously de-emphasize the relevance of absorptive and technological capacities, conditioned by the sufficient existence of absorptive capacity in the very same firms that adopt this perspective.

Chesbrough (2006) has himself indicated that, depending on the characteristics of the firms, the strategic options may largely differ, e.g. larger firms are likely to have more IP “resources” to be utilized compared with small firms. This implies that the open-innovation-based business model of large firms could rely more on buying and selling IP while smaller firms are limited to collaborating and sharing strategies. The latter is more likely to threaten the core competencies of companies (see e.g. the example of the GO Corporation in Chesbrough 2006, pp. 35–37). This line of reasoning can also be extended to the differences in the level of technological development between companies, but also between regions, as is convincingly done by Amsden and Chu (2004) and Ernst (2009), who discuss the role of global production and innovation networks and its hierarchical characteristics in East Asia.

The diversity and partial ambiguity of strategies of open innovation is largely due to the fact that the original concept and theory itself is derived from empirical

observations of some and mostly leading companies and businesses that have changed their strategies and model of innovation or, more precisely and importantly, added new perspectives to their previous practices (that is, becoming “post-Chandlerian” – see Langlois 2003 and Chesbrough 2008b) by adding the external perspective to their R&D practices and business models.¹⁴ This has significant implications on how one should perceive this concept in the context of developing countries and companies coming from and doing business in these countries/regions.

We can view open innovation first as a conceptual strategy or generic conceptual model for specific companies for overcoming the discrepancies between R&D systems and business models and overcoming the problems of R&D spillovers by complementing internal R&D strategies with external strategies.¹⁵ This idea is strongly linked to the general understanding behind open innovation that “not the technology as such but the business model grafted upon technological innovations opens up new business opportunities” (Vanhaverbeke and Cloudt 2008, p. 264, also Chesbrough 2003, Chesbrough and Rosenbloom 2002); or

There is no inherent value in a technology per se. The value is determined instead by the business model used to bring it to market. The same technology taken to market through two different business models will yield different amounts of values. An inferior technology with a better business model will often trump a better technology commercialized through an inferior business model. (Chesbrough, 2006, p. 43; see also 2003)

Based on our theoretical framework for catching-up economies and the discontents between different innovation theories, we argue that, in the catching-up context, one should consciously emphasize the assumptions behind the concept of open innovation – firms retaining their (or having as a starting point a particular type of) core competencies and absorption capacity, whatever their specific strategies of openness.¹⁶ Therefore, the underlying principle of open innovation should be more in line with the following reasoning: *taking into account that technology and the level of technological development is sine qua non, not the technology as such but the business model grafted upon technological innovations opens up new business opportunities.* Through this extension, it is possible to link together the two levels of analysis, meaning that the capacities and capabilities of firms (for adopting R&D strategies, business models, etc.) are contingent on both firm-level characteristics and socio-economic and techno-economic characteristics. In fact, both levels are contingent on each other.

Moreover, in the context of the techno-economic paradigms and taking into account the nature of the current ICT-driven paradigm (for more details, see Perez 2002, 2006), it is relatively obvious that open innovation as a business model is mainly a strategy for established companies with already evolved capabilities and routines to “reinvent” and “align” themselves to the changing global technological and economic context. Policy analyses seeking to link the concept of open innovation with innovation policy-making of catching-up economies should depart from this position.

In the first section of the paper, we have argued that existing academic approaches depart from the assumption that the companies in the catching-up context have peculiar and, by definition, weakened capabilities for innovation and for the routinization of technological innovations into business models (i.e. the

companies tend to be imitators or adopters of external technologies – especially technologies already “known” in developed countries – as opposed to being innovators). On the one hand, this is due to the factors at the firm and industry levels, specifically often outdated core competencies, lack of experience and learning-by-doing, historical path-dependencies and legacies (e.g. the non-traditional structure of Soviet industry – see Radosevic 2009). In principle, the concept of open innovation is mute on how companies in catching-up countries should deal with these issues; the concept assumes that companies are able to assess their capacities and adjust strategies of openness and business models respective of their self-assessment. Therefore, we see that the concept does not overcome the discontents of “mainstream” innovation theories, at least at the firm level.

On the other hand, the problems in the context of catching-up development are also due to external or socio-economic factors, for instance factors related to policies of innovation and development (from education to trade). This will be elaborated upon in the next sub-section.

Open innovation, systems of innovation and catching up

On the systems level – systems of innovation – most of the research on open innovation has remained rather vague and conceptual. The emerging critique of the current open innovation literature (see Dahlander and Gann 2007) argues that the current approach has not been correctly placed within the earlier innovation literature (belonging to the closed innovation paradigm according to Chesbrough; for Chesbrough’s own account see 2008a, pp. 5–7) that also emphasized the benefits of exploiting the external environment. Most notably, it refers to arguments proposed by Marshall (1919) concerning external linkages and division of labor in innovation processes that require openness and collaboration between different stakeholders, to Kline and Rosenberg (1986), who deal with highly complex feedback loops and interaction in innovation, and also to Freeman (1991) (and also network literature), who argues that connectivity with external actors is crucial for maintaining the innovativeness of enterprises. Thus, it is argued (Dahlander and Gann 2007, p. 10) that “any criticism of the linear model of innovation ... can be construed as an argument for open innovation”.

Thus, there seems to be a lack of clarity as to what the open-innovation approach provides, once the analysis moves beyond the firm level and the managerial approach. The systems-of-innovation approach and the open-innovation paradigm have important similarities – the main one being the mutual recognition of the importance of knowledge spillovers that both the systems of innovation (e.g. Lundvall 1992) in general, and particular enterprises (Chesbrough 2006, 2003, 2008a) can benefit from. The difference between the two approaches stems from the level of analysis: systems of innovation has taken a macro- or a meso-economic level of analysis (national and regional systems of innovation), and open innovation has been constrained to the individual firm-level analysis (for more details, see de De Jong *et al.* 2008, pp. 28–30).

On the level of the systemic socio-economic and institutional context, we argue that the open innovation concept seems to offer a misconception rather similar to the discontents of the innovation theory that we have discussed above, i.e. the specific role of technology and its role in catching up. This misconception is likely to

contradict the capacities and capabilities found in the catching-up countries, or even to threaten the innovation logic of these economies.

Concerning this argument, one of the core assumptions of the open innovation concept and of openness-based business models is that companies can search the external and global environment for ideas, skills, new technologies and information that is embedded in the national or local innovation systems “all around the world” (see Vanhaverbeke 2008, also Cooke 2005b). The open innovation research exemplifies this with the experiences of the large multinational and global companies that can benefit from these search activities. Yet, the open innovation theorizing is contingent on the mutually reciprocal benefits of openness (achieved through trade regimes, intellectual property regimes models and inter-firm/academic/global networks), i.e. companies from different clusters or systems of innovation “open up” their capabilities and resources in order to get access to other agglomerations of knowledge, technologies and capabilities present in these very agglomerations or elsewhere.

On the one hand, this is once again dependent on the capabilities of the companies that we discussed in the previous sub-section (see also Amsden and Chu 2004 and Ernst 2009). On the other hand, we have shown in our theoretical framework that catching-up countries are usually seen as technology-takers/adaptors and that the socio-economic environment and the agglomerations of knowledge and capabilities by definition lag behind in the catching-up countries. The systemic barriers for catching up are enhanced by the current status of global intellectual property regimes that are dominated by the perspective of developed countries (e.g. Cimoli *et al.* 2009b, Deere 2009, Reichman 2009). This has reduced the policy arena for catching-up economies to create structures and systems for local technological and institutional learning and capability accumulation. Thus, for increasing socio-economic returns from private-sector activities, policy-makers need to be careful in choosing among policy alternatives. Creating a supporting framework for open-innovation-based strategies may result in a further reduction of the future policy space and the ability to create learning arenas and support socio-economic or systemic capacity and capability creation. Furthermore, Vanhaverbeke (2008, p. 216) has stressed that open innovation is fostered within particular institutional settings:

[T]here exist huge differences in the knowledge capabilities of regions depending on the presence and the level of global competitiveness of clusters and regional innovation systems. Since the effectiveness of open innovation strategies of companies is strongly related to the presence of regional innovation systems, these regional differences can also explain why some regions are much more successful in attracting multinationals ensuring a steady flow of workers and entrepreneurs.

In this context, Vanhaverbeke (2008, p. 217) refers to the works of Cooke (e.g. 2004, 2005a) and the concept of “regional knowledge capabilities” as drivers of globalization, as well as the claim that “instead of organization of industry determining spatial structure, the economic geography of public knowledge institutions determined industry organization”. The concept and ideas behind the “regionally asymmetric knowledge capabilities” of Cooke (2005b) offer a different level of perspective, but rather complementary ideas to the concept of “learned organizational capabilities” of Chandler (2005, also 1990). Complemented by the

relevance of technological capabilities and the level of technological development that we have argued is a pivotal variable in the context of developing/catching-up regions, we see that the open innovation concept faces two specific implications.

First, as the general socio-economic context of catching-up regions (national/regional innovation systems) is almost by definition characterized by the prevalence of mature or already utilized technologies, companies moving towards more open business models may have less to gain from the external strategies. When open innovation is used as a business model in highly developed regions/clusters, it is intended to lower entry barriers for new knowledge and linkages that can complement the core competencies; however, in lagging regions, this same business model is not likely to lower any of the most significant barriers as the main barriers are linked to the wider mix of institutional capabilities and absorption capacity.

Secondly, as the capabilities and capacities of companies are generally dependent on the level of development of their home markets to start with, companies from the catching-up regions may be inherently disadvantaged in competing, but also in collaborating on the global market because of incompatibilities of the R&D structures, business models and strategies. Therefore, this may lead to “cherry-picking” or selective “tapping-in” by large multi-national companies of limited and fragmented knowledge and capacities of catching-up regions. Of course, according to the counter-arguments to this claim, these kinds of contacts may act as one source for increasing the learning capabilities and accumulation of knowledge in catching-up countries.

Paradoxically, the experience of EE and LA has empirically shown that this problem has also been present in the context of openness in macro-economic policies (the WC policies), resulting in primitivization of industries and limited socio-economic appropriability of the positive implications/spillovers of these links. The problem remains that international/global companies are in general not interested in the entire local production chain or potential of the clusters of catching-up regions, but in specific aspects of these production chains that can be used for cost-reduction or for complementing the core processes of the firm (i.e. these companies are first looking to complement their core capabilities that are embedded in the much more developed socio-economic settings of the core country they reside in). This only reinforces the hierarchical structure of global production and innovation networks. Open innovation only seems to shift the emphasis from the discontents of innovation and catching-up development from the macro-level policies to the firm-level strategies. However, the solutions to these discontents remain a systems- or policy-level challenge.

Further, this also follows back to the characteristic claim of open innovation that not the technology *per se* but the business model grafted on technological innovations is at the root of new business opportunities. We argue that, from the socio-economic perspective, this argument falls into the same category of the de-contextualized line of reasoning prevalent in innovation discourses. The research on techno-economic paradigms and cycles of development from the evolutionary point of view has shown that differences in technological capacities and positioning in the international value-chain determine the competitiveness of industries/clusters/systems of innovation. The consensus on catching-up innovation theories seems to agree that catching-up countries are significantly disadvantaged from this perspective as they are more likely to be technology takers/imitators (the same tends to apply to institutional learning).

The logic of theories of de-verticalization, modularity and outsourcing (all basic principles of open innovation) implies that catching-up countries are largely influenced by what can be labeled “migration” or re-location of technologies and industries (see Hobday 2009, Nurse 2009), i.e. developing through technologies that have become obsolete or uncompetitive to be exploited in the cost structure of developed regions.¹⁷ In this context, Kalvet (2009, 2010) has also shown that the use and development of new business models by companies in these catching-up countries seem to be much more difficult challenges (and also linked to the general socio-economic capacities) than the de-contextualized discourses assume.

Therefore, we argue that, in the context of catching-up regions, the concept of open innovation and its implications both at the firm and the more systemic levels offer perspectives and potential for development which catching-up countries lack the systemic capacities and capabilities to take advantage of. Paradoxically, as open innovation is still based on the idea of first competition and only thereafter cooperation and openness, entering the environment of open-innovation-based R&D and business strategies, without sound policies for creating systemic absorption capacities across industries, would open up the catching-up regions to forces that are more likely to dominate or control these regions than to offer avenues for increasing capabilities and finding new business opportunities. Of course, research based on traditional firm-level case studies (i.e. successful companies acting in a global arena) would tend to contradict our claim. Yet we see that, based on the previous sections, there are at least two conceptual aspects of interpreting firm-level empirical evidence that policy-makers should be aware of.

First, these companies have already succeeded in the existing socio-economic context – that is, in the context without explicit attention to the open innovation paradigm. Thus, these companies can be seen as a rare exception rather than a rule, at least according to the innovation theories that are specifically devoted to catching up and technological development.

Second, the success of single companies in catching-up economies does not automatically imply that these successes bring about a positive impact on socio-economic development and catching-up processes on their home turf. What matters in catching-up development are the socio-economic outcomes and effects of innovation, competition and cooperation. Assessment of these outcomes is a matter of systemic studies at the level of industries, economies and global production and innovation networks as a whole. In addition to studying single success stories, policy analyses should also seek to clarify whether one can witness a change in the hierarchical set-up of these networks, or whether there is systemic movement up the ladder of development because of changing business models. Furthermore, at the level of innovation-system studies, policy analyses need to analyze if the changing business models are signaling the emergence of systemic qualitative shifts of both technological and institutional capacities and capabilities.

In the current state of research, the open innovation perspective seems to lack sufficient tools and capacities to support these kinds of policy analyses. Therefore, owing to the lack of a better alternative, the system-of-innovation perspective still seems to be sufficiently equipped for providing basic tools for policy analysis and in-depth research, at least as a starting point.

Conclusion

In this article we have discussed whether the concept of open innovation offers new solutions and potential avenues for the development and innovation processes of catching-up economies. We have looked into this question taking into account the needs of the catching-up context both from the perspective of firms (i.e. will open innovation help companies to increase their competitiveness) and even more importantly from the perspective of socio-economic development (i.e. will business practices and policies based on the concept of open innovation lead towards sustainable socio-economic development and catching up). Our analysis has been based on three levels of reasoning.

First, we have argued that, from the perspective of the catching-up context, most of the innovation discourse has been de-contextualized, i.e. both academic and policy-level discourse on innovation has been developed based on the experience of the developed countries and context. There is convincing literature that argues that the Eastern European and Latin American countries have already largely failed once in their innovation policies because of this de-contextualization (i.e. using Washington Consensus-based policies for development).

Second, we have argued that, despite the seemingly emerging consensus in theories of innovation – both evolutionary and neoclassical perspectives emphasizing *contextual understanding of problems and aiming policies at influencing dynamic firm-level capabilities* – the domination of the policy discourse by the neoclassical discourse (Washington Consensus-based policies and understanding of innovation and technological development) has resulted in the very same de-contextualization of innovation discourse. We argue that the reason for this stems from the misunderstanding of the role of technology and technological development by the neoclassical school of thought. That is, by understanding technology as neutral to context and development level, innovation policies inspired by the neoclassical theories in fact greatly underestimate the context-specific nature of development – even against their own theories.

Third, taking the above into account, we have discussed whether open innovation offers new avenues for developing policies and business models in catching-up contexts. In this context, we have argued that the concept of open innovation is based (similarly to previous innovation discourse) on rather explicit and contextual assumptions: it is based on the experience and research in the context of large/multinational companies of highly developed countries and specific technological markets; it is a firm-level approach that currently lacks systemic contribution to and analysis at the systems/socio-economic level. Therefore, the debate and strategic direction advocated by open innovation is largely conditional, i.e. dependent on specific characteristics of the firm level and the wider socio-economic context. Thus, we argue that the critique of de-contextualization applies for open-innovation thinking as well.

We have indicated that assumptions or conditionalities of the concept of open innovation do not take into account the peculiarities and differences that characterize both the firms and the socio-economic context of catching-up regions. We have also argued that the assumption of the open-innovation paradigm – that *not the technology as such but the business model grafted upon technological innovations opens up new business opportunities* – does not adequately capture the context of catching up because of the fundamental differences and implications of the level of

technological and institutional development and inherent catching-up logic. This underlying difference between contexts makes the open-innovation-based arguments over strategic business choices, and even more importantly over public policies, less plausible.

While the current policy debates on open innovation tend to concentrate on how to design policies that foster open innovation practices and businesses across industries and innovation systems, we argue that catching-up innovation policies need to be more centered on a task of creating a framework for developing institutional capacities and capabilities across the innovation system. Therefore, the open-innovation paradigm cannot provide prescriptive innovation policies or policy frameworks for catching-up economies. Rather, open innovation practices are likely to remain only a part of the innovation policy context.

In sum, in our view, the open-innovation concept lacks proper attention to the underlying principle of the emerging consensus in innovation theory – *contextual understanding of problems and aiming policies at influencing dynamic firm-level capabilities*. In catching-up countries, the challenges of technological development cannot be seen as only technological or business-model-based or emanating from the policy level. Achieving the dual and interlinked qualitative shift in technological development and institutional learning has been historically a highly complex, systemic and contextual challenge. Most approaches to innovation that study the success stories of economies, regions and firms explicitly or implicitly take into account the relevance of historical variables (of time and context) and the cumulateness of technological development.

In this context, it is surprising that the discussions of catching-up development are based on the transfer of either academic concepts (such as systems of innovation and open innovation) or policy discourse (all kinds of best practices and benchmarks) from the developed countries to catching-up regions often without “due diligence” to the contextuality of the concepts and discourses. The cumulateness of technological development brings out the very same qualitative differences that are the basis for making a difference between developed and less-developed economies.

Based on our analysis, we argue that transferring the concept of open innovation from the developed context to catching-up economies makes the concept qualitatively less relevant (in the specific time and context of development that defines economies as catching-up economies). Therefore, policy analyses in catching-up economies should not only center on how to enhance the use of open-innovation-based business models through policy reforms, but should first start with critical contextual analysis that places the systemic catching-up challenges at the center of policy concerns and recognizes that staying globally competitive and becoming globally competitive are qualitatively different challenges.

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Notes

1. For the role of open innovation in small and medium-sized firms, see Van de Vrande *et al.* (2009). For the role of open innovation outside high-tech sector, see Chesbrough and

- Crowther (2006) and Chesbrough (2011). For the relevance of open innovation strategies outside the core technology economies, i.e. China, see Liu (2008).
2. The failure of EE and LA innovation and development policy is recognized at least in the academic debates, while the public and policy discourse has usually followed a perception that the development of LA has been a failure and the development of EE more of a success story, see also Kattel *et al.* (2009), Tiits *et al.* (2008).
 3. For a comparison between EE and LA, see Kattel and Primi (2010) and Karo and Kattel (2010b).
 4. Further, Mowery (2009) has argued that the recent debate on innovation (i.e. changes in industrial R&D processes and strategies and the emergence of open innovation debates) is a historically recurrent process that in the late nineteenth and early twentieth centuries revealed itself in traditional industries and in the late twentieth and early twenty-first centuries in the new industries based on ICT and biotech, for example. Therefore, it cannot be seen as a paradigmatic change, but rather as a path-dependent development that according to Mowery has also been heavily dependent on public policies.
 5. Methodologically this has been paralleled by a concentration on either firm-level case studies (of mainly successful/innovative firms) or more systemic studies of industries and systems of innovation to encompass the dynamic inter-linkages between firm-level capabilities and socio-economic capacities. Concepts of clustering, agglomerations, linkages and others highlight the mutually reinforcing effects of these levels. Analytically and for the sake of policy analysis, though, the different implications of these levels are of importance as the impacts of one on the other are, as this paper argues, contextual.
 6. The concept of open innovation in brief argues that, in addition to the traditional modes of innovation relying on the firm-level capacities, the new modes of innovation that seek to benefit from the external capacities (and internally underutilized internal capacities by putting them on the market) are becoming an integral and equally important part of the business and R&D strategies of companies. Thus, open innovation does not fully replace the old, but complements it with something new.
 7. The open innovation concept has been linked (Chesbrough *et al.* 2008) to several levels of analysis: firm level; inter-firm level; level of institutional set-up. In the same line, Vanhaverbeke (2008) has offered a five-level distinction: intra-organizational networks; firm level; dyad level; inter-organizational networks; and national/regional innovation systems. However, a literature overview on open innovation by Fredberg *et al.* (2008) has suggested that, so far, the topic of open innovation has mainly been analyzed as a pure innovation issue, and other related aspects and consequences of organizing open innovation have not been included in the open innovation literature. Therefore the overview indicates that there are only few attempts to look at the industrial dynamics and beyond the firm level in discussing open innovation (see e.g. Berkhout *et al.* 2006, Bromley 2004, Christensen *et al.* 2005, Cooke 2005a, Vanhaverbeke 2008). Works by de Jong *et al.* (2008) and Vanhaverbeke *et al.* (2008) are the first comprehensive attempts to look at the public policies fostering open innovation. Yet both of these accounts are sensitive to the need to look further into the developing country specificities.
 8. We use here Nelson and Winter (1982), and Rodrik (2007), respectively, as perhaps the most succinct and well-known expressions of both evolutionary and neoclassical thinking and analysis on innovation and development. While neither exhausts the possibilities of evolutionary or neoclassical thinking, both can be viewed as canonical for each tradition, at least in the catching-up context.
 9. For excellent summaries on the differences between the two schools, see Cimoli *et al.* (2006) and Drechsler (2004).
 10. As expressed by Dosi and Soete (1988, p. 418): “Technology ... cannot be reduced to freely available information or to a set of ‘blueprints’: on the contrary, each ‘technological paradigm’ with its forms of specific knowledge yields relatively ordered cumulative and irreversible patterns of technical change”.
 11. See e.g. Sachs (2008, p. 205), who argues that “the very science and technology that underpin prosperity in the rich world are potentially available to the rest of the world as well”. Similarly, the World Bank asks (2008b, p. 3; see also World Bank 2008a, p. 18): “[w]hy is it that existing proven technologies are frequently not adopted by people who presumably would benefit most from these technologies?”.

12. As importantly, in evolutionary understanding, technology is a man-made comparative advantage that creates havoc in the Ricardian comparative advantage model (for a brilliant case study, see Murmann and Landau 1998). What technological development shows is that the key is not trade as such but *what kind of trade and with whom* (see Gomory and Baumol 2004 and Palley 2006 for excellent discussions).
13. Key figures in this tradition are Freeman (1974, 1987), Freeman *et al.* (1982), Freeman and Louçã (2001), Dosi (1982) and Perez (1983, 2002).
14. Also, Chesbrough's original work and theorizing (2003, 2006, 2008a, 2008b) is closely linked to observed practical problems that modern companies have been facing, some being firm-level (e.g. problems of discrepancies between motivation and reward systems of R&D units vs business units, resulting in the underutilization of internal patents, the shelving of ideas and therefore the creation of corporate costs), others being caused by developments at the socio-economic level (e.g. the increasing practice of university patenting of public research, resulting in further barriers to the diffusion of knowledge and slowing down the speed of innovations). The research so far has concentrated mainly upon *what particular firms can do* in a generic environment that is influenced by both internal and external factors, but the variables found in the generic environment are largely taken as given or exogenous to the strategies of firms.
15. Chesbrough (2003, Figures 1-1 and 1-3, 2008b) has argued that the open-innovation approach provides a solution to the perceived problems of rising costs of innovation (increasing costs) and shorter product life on the market (decreasing revenues) by transforming R&D and IP strategies so that the increasing costs of innovation are avoided through the leveraging of external development, and decreasing revenues are re-established by creating new revenues through licensing, spin-offs, sales/divestiture, etc. Therefore, the argument advocates supplementing the basic/core business model or core competencies, based on internal investments in development and revenues from their "own market".
16. This argument is also linked to the discussions of asymmetric knowledge capabilities of Cooke (2005a, 2005b) or learned organizational capabilities of Chandler (1990, 2005), but also more generally to the consensus of innovation theories that we have analyzed above. Also, this would support an argument that open innovation strategies seem to be particularly useful for increasing the competitiveness or technological advantages – by accommodating business models to the changing external conditions – of companies that have already achieved a considerable first-mover advantage and have accumulated significant technological and organizational capabilities through cumulative learning. Suffice it here to mention the description by Chandler (2005) of the foundations of development of RCA in consumer electronics and IBM in computer industry, but also the description by Mowery (2009) of the development of US industry at the beginning of the twentieth century. In understanding these developments, the key factor is the importance placed on the initial starting position – the level of learned organizational capabilities; the existence of barriers to entry; the potential to benefit from economies of scale and scope, i.e. first movers creating their industries by establishing integrated learning bases that embody their technical and functional capabilities (Chandler 2005) – compared with existing but also emerging competitors. We would argue that the open innovation approach does not explicitly emphasize these factors, but clearly takes them into account. At the same time, Amsden and Chu (2004) recognize that the innovation theory coming closest to understanding the context of catching-up economies is the theory of first mover advantage, but it still needs to be refined (they propose the theory of second mover advantage) to understand the contextual differences, which are reflected in capability and incentives differences and policy needs.
17. Chesbrough (2006) argues that the openness of business models results in two types of benefits: *outside-in processes* and overcoming the problem of "not invented here" would enable the companies to "purchase-in" technologies, patents and knowledge needed for increasing the value-added of the core processes of companies; *inside-out processes* and overcoming the problem of "not sold here" (which can be seen to be a more fundamental transformation in the business model proposed by the open innovation concept) would enable companies to create extra value from their core processes and technologies (through licensing, etc.) and from selling the redundant technologies and knowledge that

have resulted from the loose coupling between the R&D processes and business models. Companies in catching-up countries are by definition dependent on the outside-in processes, but their core problem is the challenge of moving up the value-chain in production and technological development.

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