Industry policy, technological change, and the state

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1. Introduction: Markets and scarcities-building productive capacities in LDCs through complementary institutions

Industrial Policies for LDCs

Industrial policy and innovation policies need to be strongly revitalized and focused on LDC development. Given the concentration of several LDCs in forestry, fisheries, mining, agricultural commodities, and oil, the task of these revitalized industrial policies is to support locally relevant development. Although much has been written about institutions and economic growth and development to date, the question is what aspects industrial policies should focus on in these economies. For several LDCs, even where growth is rapid, this trade-related growth has occurred without the benefits of diversification and structural change, private sector capital has been shy, and ODA continues to be a major source of financing but not necessarily directed at building productive capacities (UNCTAD, 2007; 2008). Of course, with changes in transportation or other costs, the extent of trade might diminish in the future. Nevertheless, many LDCs while enjoying elements of current growth rates of commodity exports, remain distinctly vulnerable as well. Directed industrial policies can therefore be a core instrument for developing economies that must build productive capabilities to compete in what is now a highly traded world economy (Rodrik, 2004, Haque 2007). Perhaps more importantly, industrial policies combined with ODA and social spending concerns, can form the basis of important new social compacts to improve domestic conditions. This paper attempts to lay out both a conceptual and practical approach to how these policies can be revitalized.

The paper begins with a discussion of scarcities and complementarities of institutions. It builds on this framework to study the state in industrial development. The task of the paper is not to critique market-led policies for the usual reasons , all of which are sound, but to highlight some additional considerations for how states can regulate markets, or use specific instruments to create and legitimize markets for particular purposes. In particular, the paper discusses scarcities and complementary institutions as prime considerations for state actions, and industrial policies as especially good instruments to do so.

Further, it will stress that the state's role in LDCs moving forward must focus on creating and supporting market structures, assisting enterprises, and building aggregate demand such that domestic markets can be built. But the state's roles in creating domestic market opportunities and building aggregate demand requires productive capacities and income redistributive strategies to be better aligned. To date, as the LDC report 2008 indicates, a sharp separation exemplified inward ODA to LDCs from institutional channels that might build productive capacity. LDC states and multilateral frameworks that ostensibly

assist LDCs should more fully utilize opportunities within the traded elements of the economy for building aggregate demand and agglomeration economies allowed within the WTO frameworks which hitherto have remained noticeably under-utilized. However, these must be linked more systematically to the untraded components of the economy. This should partially mitigate the large tilt in export focus and vulnerability to fluctuations in commodities trade that currently besets most LDCs.

Finally, it will extend a brief analysis to possible lessons for LDCs from the Nordic countries. They too came from resource-rich environments and were mostly small, open economies. Nevertheless, they have gone through immense structural and institutional change since. What might their trajectories tell us about state roles and market regulation on the one hand, and the deepening and diversification of industry on the other?

Scarcities and Complements: An institutional lens beyond Market Failure

A traditional industrial analysis of the past 100 years of industrial history shows that LDCs have distinct challenges in evening out their industrial inequalities relative to others and within their domestic economies. In LDCs whose manufacturing sectors are weak or absent, and whose industrial services and agricultural dynamism is low, there is urgent need for change and some important untapped industrial possibilities. The State is crucial in this task.

It is important to note that the contexts in which developmental processes take place many industrializing economies are embedded in scarcities not widely present in industrialized societies and lead to different technology incorporation and production (Srinivas and Sutz, 2008) Markets in these circumstances have not "failed" for the traditional reasons; markets themselves may not be the institution best equipped to address the peculiarities of building productive capacities and innovation necessary for LDC contexts. Economics analysis traditionally sees LDCs as having a static comparative advantage from their resource base. New comparative advantages have to be built, several deriving more appropriately from country resources, ownership of production and with newer institutional arrangements of benefits-sharing from reworked industrial organization. These coordination problems also depend on decisions of simultaneity and sequencing of investments, training, reward, and benefits-sharing and will require new attention to the political conditions for market viability and for the policy space to craft non-market instruments. Conventional understandings of comparative advantage must clearly be revisited in this new dramatically changed trading environment (Rodrik 2004, Haque 2007). However, besides traditional public goods-type failures, there are tensions within the roles of the state itself with respect to industrial policies and managing both the diffusion of harmonizing regulatory standards as well as employment realities (Srinivas, 2008a).

Scarcities are used here in their domestic and local contexts, not in the sense of comparative political

economy's more common "prerequisites for development" which lies at the heart of much development economics, some systems of innovation and catch-up approaches, as well as neoliberal prescriptions. In this sense, scarcities are not "missing factors" and "obstacles to development" approaches in the comparative sense that Hirschman deplores:

> "The traditional method of identifying an obstacle to development points immediately to the conceptual weaknesses we have in mind. The method consists in looking up the history of one or several economically advanced countries, noting certain situations that were present at about the same time when development was brought actively under way in one or several of these countries (a temperate climate, a population belonging to the white race, "primitive" accumulation of capital, coal deposits, law and order, widespread literacy, a group of Schumpeterian entrepreneurs, a fairly efficient and honest civil service, agrarian reform, the Protestant ethic, etc., etc.), and then constructing the *absence* of any of these situations as an obstacle to development. This procedure could lead one to conclude that the more countries develop, the more difficult does it appear for the remainder to do the same, for each successfully developing country does so under a set of special conditions, thus lengthening the list of obstacles (i.e. the absence of these conditions) which have to be "overcome". [1]

As we will discuss next, the 'market failure' approach hides more than it reveals. Scarcities instead can be defined as the basis of broader institutional change (not necessarily through markets alone) and seeks complementarities in domestic development. Hirschman for example argues that development is not so much about finding optimal combinations of productive factors and resources as on using—for development tasks—resources and capabilities that are hidden, scattered, or badly utilized. This hidden, scattered or badly utilized resources and capabilities can be thought of as scarcities within a society. These scarcities may include critical industrial challenges at the level of infrastructure that is missing or outdated, lack of access to materials and equipment of certain quality or accuracy, a scarcity of wider institutional support for the building of endogenous capacities, and in terms of the availability of those with ideas, capital, and project management skills (Srinivas and Sutz, 2008). The micro-details are important to flesh out.

The traditional market failures argument has limited relevance in dismissing industrial policy on two broad grounds: the first on the structure and detail of the markets themselves and how they are constituted; the second, on the very nature of technological change. In both cases, traditional arguments of market failure hold on grounds of imperfect information, incomplete markets, and uncertain contracts. If

[1] Hirschman, A.O. 1965. Obstacles to Development: A Classification and Quasi-Vanishing Act, Economic Development and Cultural Change, Vol. 13, No. 4, part 1 (Jul.), pp. 385-393.

market exchange is the only consideration, we may be on stable ground. However, in discussing production costs and learning, traditional market failures don't hold (Nelson and Winter, 1982; Amsden, 1997). Specifically, while traditional development economics can be seen as a move towards perfect markets or reducing market "imperfections" to zero, production provides different challenges. Here, the goal is to increase market "imperfections" so that P is not equal to MC. In other words, the state's role in building productive capacities, addressing systemic scarcities and institutional complementarities is far from a market failure argument for state intervention. On the contrary, the state's role is to build firm and extra-firm capabilities in order to maximize scale economies and other positive externalities. The institutional scarcities are much wider and pervasive in countries attempting to industrialize today and may have little recompense in market exchange alone (Srinivas and Sutz 2008). Some of these challenges of addressing scarcities may exist in demarcating the distinctions between the relevance of market and non-market activity in an economy and distinguishing those activities from which market exchange might be cordoned off (Nelson, 2003).

However, to enact industrial policies, states must engage in many roles at once. Traditional industrial policy was primarily seen by neoliberal prescriptions as correcting market failures and by 'development statists' as primarily focusing on the state's role in capital accumulation. While these roles might have been diverse in actual practice, the theoretical justification for the latter was the unitary goal of capital accumulation and in later studies, technological learning which defined the development state. Today, in the context of increasing inability of commodity trade or manufacturing to provide the employment growth rates necessary to redistribute any gains from trade, and from the urgent need to build aggregate demand, the singular goal of capital accumulation no longer holds. For example, industrial policies must now be seen more explicitly as instruments that best combine productive capacities by incorporating technological change and embedding employment growth. These engender several, sometimes conflicting roles of the state. In shaping industrial policies, different policies matter in thus shaping technological specialization.

Moreover, while traditional analyses of industrial policies has often created a sharp divide between state and market, the reality has been a wide range of market and non-market instruments that states have used over time. For example, although much of Korean success in building capacity in the memory chips industry has been explained as either state or market outcome, the reality is a complex mix of public and private actors. They participated in building production capabilities, project execution and innovation capabilities. In the case of microelectronics and semiconductors, different stages of growth took place in building the environment in which both public and private actors could participate. In the early stages, the institutional scarcities were associated with the business environment, associational relationships between workers, politicians and bureaucrats. In the growth phases of these sectors, entrepreneurs joined this mix,

with labor intensive work organizations and unions being more sidelined. In the maturing stages, a significant amount of attention by both public and private actors turned to building related industries and domestic demand, increasingly bringing into the fold entrepreneurs, professional managers, and engineers (see Cho, 1994, Heeks and Slamen-McCann 1996). Industrial policies needed to be dynamic and have the ability to address scarcities of different sorts.

2. Industrial policies as Co-evolutionary processes

To use a scarcity-complementarity framework can prove useful for thinking about industrial policies. This section offers a co-evolutionary framework for thinking about complementarity and how to apply it. This includes differentiating between industrial strategies more or less geared to domestic needs and traded versus untraded markets. During 2005–2006, more than 92 % of all exports from African LDCs were primary commodities, including fuels, while less than 44% for Asian LDCs, which grew much more rapidly in export of manufactures. However, LDC medium- and high-tech manufactures exports were still less than 10% (8.4) (UNCTAD, 2008). Much of the structural inertia of LDCs can be argued to rest in industrial policies and approaches to development that are unable to differentiate between varieties of innovations and industrial policies, some of which are much more difficult for LDCs to use as a growth path. At the same time, LDCs are high importers of essentials themselves, with oil and food constituting 30% of LDCs' merchandise imports in 2006 and food imports constituting 4.4% of collective GDP (pp 5-5 LDC Overview 2008). This elements point to the weak link between innovation and industrial policies geared to meeting basic needs and local demand. Some differentiation of institutional pathways out of this morass is necessary.

Co-evolutionary studies contribute to our understanding of dynamic economic systems and their institutional mix. Two elements that are important to industrial policies are (a) cooperation in addition to competitive frameworks to align different types of organizations within the economy other than competitive firms alone (b) the agency of individual actors *as well as* the environment in which they act. Both these elements of cooperation as well as selection environments provide us a way to understand how industrial development is made up of diverse actors, varied evolutionary pathways, and modes of *learning and adaptation*. Co-evolution can be said to take place if

> "…two or more agents and/or their environments influence each other's selection and/or retention processes and if a series of variations takes place in time in the respective agents. If the agent is merely responding to another agent's presence or activities by adaptation, that is not seen as coevolution". In other words, coevolution requires a series of responses and is thus "..a reciprocally induced evolutionary

> change between two or more agents and their environment in time.." ((Sotarauta and Srinivas, 2006, p. 319)

In such an evolutionary economy, industrial policies require policy spaces for dynamic learning, and constant adjustments and realignments to keep a competitive system of economic activity in place. It is a *continuous* planning process, and adaptation is a key element for successful actors. As we discuss here, market failures in the traditional sense have little place for dynamic states and learning processes. Moreover, mutualism and coordination so important to coordination functions of the state require attention to institutional scarcities and institutional complements.

Markets however are not necessarily the only or best instrument to address scarcities. Market failure arguments assume that there is a direct relationship between scarcities and their rectification, and that markets are the best institutions to do so. They do not directly account for the information and uncertainty problems associated with determining alternate governing mechanisms. Even in contexts of "incidental" scarcity (that of most industrialized economies), the reification of markets can arguably be over-emphasized because there is little consensus as to what activities should be cordoned off from the market and thus left to non-market systems of governance (Nelson, 2003), nor wider institutional scarcities within which a factor analysis holds limited sway. Moreover, firms are the primary institution and organization around which much of economic policy is built. Yet, many LDCs have weak firms, minimal scale capacity, and low productivity. The broader challenge is *systemic scarcities* (not just factor scarcities) outside the firm and a wide heterogeneity in institutional composition –including family work, micro-enterprises, a vast agricultural farm sector, and little non-farm rural employment or opportunities for technical change. Traditional actor scarcities may hide more than they reveal. Traditional factor ratios may be weak signaling devices for building productivity and productive capabilities for several reasons, thus requiring a more direct hand through industrial policies that galvanize indications of which yet-to-be identified resources need attention e.g. technology or skills, and influence specific types of investments necessary for the firm (Haque 2007). However, factor scarcity in the traditional sense hides a great deal more; focused on more is better, and that optimal resource allocation and profitability of those factor resources can be signaled by market activity, factor ratios fail on the above-mentioned issues that Haque lays out, but also in considering technological change and innovation in particular (Srinivas and Sutz, 2008). To address changing contexts for institutional and physical scarcities in the development process, we turn to a discussion of complementary institutions, and co-evolutionary dynamics.

Complementary institutions

In an ex-post analysis-as economic history is-seeking out which sets of institutions are complementary is

unhelpful. DCs and LDCs alike told to imitate the strategies of national innovation systems of those gone before are understandably likely to find the policy advice limiting (Arocena and Sutz, 2000). A strategy that instead identifies innovations and skills that are missing or absent in policy dialogues of *those* countries, (not in comparison to supposed prerequisites as earlier discussed), or that have arisen despite the lack of "correct" factor endowments or supporting policy frameworks, may better guide us to appropriate policy mixes in these environments. These scarcities, much as in the Hirschmanian sense, can provide us guides to what is working, and what less well. From a user-producer standpoint, the scarcity-induced 2X2 we will visit in the next section can provides us clues about why certain types of innovations might not arise.

Much of the evolutionary economic literature has focused far more specifically on firms and their technology than on the wider social and public contexts for institutional change, notable exceptions being the French regulationist school. From the standpoint of scarcity and its effects on cognition of innovators and the vastly differing landscapes of regulation and on the conditions under which institutions are complementary (Amable, 1999) there is much to be done.[21] In particular, scale-up processes and diffusion processes which are critical to development are often systemically scarce in LDCs and other industrializing contexts. Indeed, one of the common characteristics of LDC diasporas is how well they do in environments of industrialised countries, of "incidental" scarcities. Back home, however, they improvise, and this cognitive and economic characteristic of innovation is highly under-studied. These "non-canonical" solutions in response to scarcity are everywhere, but may neither scale-up nor diffuse widely. What kind of abilities, capacities, and cognition, are needed to solve problems in such an ambience? Can they be derived simply from the common learning matrix that every scientist and technologist has? Are they special in any way? (Ibid.) Importantly, North-South differences exist in what is learned and how it is learned; innovators may not always be able to conceptualize a solution for problems, recognized by a wide literature on user-producer relations, nor find new ways to reach common goals (see Lundvall, 1985) In this under-theorization of innovation relevant to LDCs, a process of real importance is being sidelined: the ability to innovate under 'scarcity' conditions. Here, idiosyncratic innovative paths are followed, which may provide solutions for urgent and otherwise unsolved problems.[1] Besides the cognitive, institutional and physical, and socio-economic elements of scarcity, the authors mention that scarcity-induced innovations are at particular risk. SIIs do not ''scale up" and can be

In differentiating the nature of scarcity, there are two variants: incidental and systemic. "While it is certainly the case that even today's industrialized countries face scarcities in the innovation environment, we suggest that these latter cases are ''incidental scarcities,'' where most other elements of the innovation environment are in place and the specific instance of scarcity can be remedied relatively systematically. Contrasting with this, industrializing countries witness more ''systemic scarcities'': this covers a whole range of issues, from material ones (some of which may be traditional factor scarcities) to the most diverse types of institutional ones (even, arguably, a scarcity of self-confidence). So, scarcity in actual industrializing countries, particularly regarding innovation, is more an ''ambience'' than an ''incident'' such as the lack of a specific input or the absence of a particular market at a point in time." (p. 132). In light of these characteristics, traditional factor input analysis can be particularly limiting in seeking a new analytical framework for innovation relevant to developing economies (Srinivas and Sutz, 2008).

‘‘locally strong’’ but isolated. Development planning and industrial policy are central to this re-formulation of how to scale-up SIIs and diffuse their practices through the economy. (Srinivas and Sutz 2008, Srinivas, 2008).

While most neoclassical economics reified markets as the primary institutuion, the reality is that any economy has several such possible institutions. These may include the state, families, universities, systems of land ownership or other types of property rights, labour governance, banking systems and so forth. Several of these institutions may in fact be antagonistic. For example, to circumvent certain types of scarcities, one might assume that building complementarities is a task of 2^n options. However, what the “varieties’ of capitalism, and the “national systems” literature hint is these may be viable options, or at least say little about antagonisms in terms of economic outcomes. From an evolutionary standpoint, the various organizations and institutions may have different selection effects (see Amable, 20000. Thus many of the potential 2^n simply lead to inefficient, nullifying, or other effects, resulting in a more limited set of mixed economies or capitalisms (Amable, 2000, Boyer, 2006). The example they provide is financial institutions that favour long-term relationships with industrial firms and banks may be more likely to reward firms that build industrial productive capabilities in-house. However, these may be antagonistic, or at least not complementary or supporting to labour market systems that are highly decentralized and ‘flexible’. (As we may imagine, the East Asian stories might have derived quite differently were these complementarities in place). More importantly, because even markets don’t emerge fully formed and functioning, but often need sustained regulation, states co-evolve with market and non-market environments alongside. In the Nordic cases complementarities had several common features across the countries, which allowed a set of economic and social institutions that supported ‘decommodification” of labour markets or lowered dependence on wages through extensive social supports, combined small-scale production alongside the growth of some large enterprises, and had financial systems in place that built up the exploitation of natural resources in ways that encouraged deepening and diversification of skills.

Similarly, co-evolutionary thinking on institutions describes how varied aspects of industrial development and institutions may better overlap and evolve. Traditional systems evolutionary thinking captures some of this institutional diversity and change, but co-evolution has broader antecedents of direct relevance to LDCs. First, traditional market failure arguments are let go. Instead, institutional gaps-of which scarcity is a category-are viewed as domains of interwoven institutions. A systems-evolutionary perspective recognizes that co-evolutionary policy domains that affect S&T and innovation are not fully developed in many countries because a certain complementarity of institutions (not necessarily absence of factor scarcities) does not exist. One the one hand, the institutional conditions necessary to generate VSR do not exist; on the other, agents and structures may be linked but they do not generate bidirectional causality

(See Dutrenit et al 2008). Co-evolutionary processes emerge into 'policy coherence' for industrial policies when certain forms of scarcity are addressed; Cimoli, Dosi and Stiglitz (2008) refer to the congruence conditions between institutional ingredients. These scarcities can be hypothesized to be the result of several gaps in VSR or bi-directional causalities remaining unfulfilled, and may not be best addressed through purely market mechanisms.

At the level of firms, choices have to be made about what problems to solve and the manner in which to do so. There are two characteristics of this search and satisficing behaviour that involve scarcity inducements: one the one hand the "what" and "how" aspects: Scarce resources induce firms to find alternative solutions that are appropriate for a local context and shapes the form of the solutions themselves; on the other, "Environment" aspects. Firms sit within a sea of selection choices. The regulatory policy landscape substantially directs the 'what" and "how" of firms.[3] Scarcity inducements can be taken beyond factor scarcities which have been argued to mislead in this context, to policy scarcities. How are firm-level productive investments, search, shaping of solutions affected by the lack of certain policies? How have firms adapted to cope with the absence of certain strategies, what do they lay claim as their cognitive and investment context for attacking a particular problem and shaping its solution? Firms may disproportionately put themselves at risk, or address problems that have limited local viability, disproportionately targeting export markets, or be unable to scale up solutions that remain unrecognized by policies. In other words, until complementary institutions are in place to assist firm-level learning, technological specializations may be awkwardly placed to either built domestic productive capacity for urgent domestic solutions, and/or disproportionately limit the domestic market size and chase firms to export markets. In both instances, market size and scope are limited through policy options. Policies –technology, innovation, and public finance, regional investment- can be built in complementary ways to limit the very wide set of potential priorities when resources are scarce and to signal social priorities for the country.

Traditional factor scarcity considerably misleads for innovation in DCs because in the sense of inputs, they disguise two basic realities in contexts of industrialization: first, that institutional scarcities do matter; second, and more importantly, that innovation may occur despite and sometimes because of, factor scarcities in the economic sense. Local search, a certain degree of imitation, "satisficing" behaviors emerge, in ''doing things differently'' (Srinivas and Sutz 2008, p. 132):

[3] "The ''defining'' part has to do with needs, wants, demands, and constraints; the ''solving'' part, with ways of addressing them. Searching and designing processes are influenced by ''input side'' and by ''demand side'' conditions. The latter include the spending capabilities of the prospective adopters of the outcomes to be achieved through those processes." (S&S, p. 135).

1. Searching for different solutions to problems that have been already solved because existing solutions are inappropriate or unaffordable, including the necessity of adaptation stemming from specificities of natural endowments.

2. Developing innovative efforts to respond to prospective users who face scarcities of some type.

3. Fostering specific ‘‘scarcity-driven’’ heuristics to deal with well identified but not yet solved problems.

Notably, adaptation efforts differ from the capacities to innovate in scarcity conditions. The latter are innovations in the strict technological sense of the term: new and different ways of solving problems, not only adapting pre-existing devices and procedures to a given context.

The 2X2 below captures the 4 quadrants associated with different technological specialization and industrial policy choices. AICs are advanced industrialized countries, DCs are developing economies, of which LDCs can be thought of as a distinct set. These innovations in the industrial sense particularly of scalability of manufacture, which are relevant for LDCs can be classified into (i) problems that have been identified as important worldwide but without actual solution(s) whatsoever; (ii) problems posed and identified in industrializing contexts that do not drive worldwide attention; (iii) problems that had already been solved but where the solution(s) found need changes if they are to be adopted as innovations in a given context;(iv) problems that had already been solved but where the solution(s) found are for different reasons of no use in the context in which the problem is present; (v) problems of replacement: how to build a known device replacing some of its components, or the machines used in its manufacturing, by other components or instruments, obtaining similar performance.

A core necessity is thus for industrial policies to build up hidden factors and those that have traditionally been sidelined, and to focus on scale-up and diffusion processes. The four quadrants differently incorporate policy options. In the first quadrant, minor modifications are made to existing technologies developed elsewhere, and can be an important galvanizing force for traditional “catch-up” and the building of productive capacities. However, quadrant I comes also with constraints on competition models for LDCs premised as it is on process innovations and the level of skills being on par with several other competing countries. In quadrant II, however, more opportunities present themselves for LDCs. Much of LDC development and industrial policies for this development have focused on (iii) and (v), while many of the scarcity questions from an institutional and technological standpoint in LDCs refer to challenges of (i) (ii) (iii) (iv) and (v).

	Problems for which solutions have been found in AICs	Problems for which solutions have not been searched or found in AICs
Problems for which solutions suitable for DCs conditions exist	The vast majority of solutions acquired through technology transfer	Solutions to problems mainly posed in DCs and developed locally
Problems for which solutions suitable for DCs conditions do not exist	"Canonical" solutions exist, but for different scarcity reasons they are not suitable for DCs conditions	No solutions (yet) Typically health issues like vaccines against cholera or AIDS

Srinivas and Sutz, 2008

Money alone is insufficient[4]. Although economics is often posed as a field which determines the allocation of scarce resources, monetary resources are not the only consideration in a scarcity and complementarity framework[5]. Rather, as Srinivas and Sutz (2008) and Sutz and Borgatay (2008) lay out, the issues are fragmentation of demand, lack of coordination and cooperation among policies[6]. Technocratic fixes alone cannot work. Economic planning in this regard is neither targeted policies alone,

[4] In this vein, innovation defined in the limiting sense of R&D inputs can considerably mislead the development frameworks for industrial policies (Adeboye 1997, Teubal 2008, Srinivas and Sutz 2008). "When analyzing the role of innovation policy in the economic growth of LDCs a major issue concerns the relevant definition of 'innovation' which should differ from that relevant to advanced economies and top tier industrializing economies namely the result of 'formal R&D activities in firms'. As mentioned in UNCTAD 2007, the relevant view of innovation here is far more encompassing: it should include not only other 'technological' functions that could be sources of innovation e.g. design and engineering; but other Schumpeterian functions such as the first instance of new form of organization, the first use of a new raw material, and the first penetration of a new market.." (Teubal, 2007). Scarcity relevant for industrial change is not measured in absolute but in comparative terms and includes missing or out-of-date infrastructure, no access to required materials and equipment, or of the necessary accuracy, missing institutional support for endogenous capacities, absence or paucity of skilled people to manage projects or discuss ideas, and finally (and more mundanely) lack of money when well-known solutions might be helpful. These have cognitive, economic and institutional impacts on building technological capabilities. (Ibid. p.131). Most notably, SIIs are not the opposite of modern, western, or ''high-tech'', nor are they relevant only to the poor, or less educated parts of the population.

[5] Economics' core is the study of scarce resources and their allocation. A society does not allocate resources to any innovation unless it has a means to value it and an institutional process by which to allocate subsequent resources. The irony is that most innovation metrics in use today –for example, R&D spending- measure resources allocated to the process, the very thing that needs to be studied. Much of industrial policy has derived from divergence of technological outputs between industrializing and advanced industrialized countries. However, scarcities that affect technical change at the micro-level affect *inputs*

[6] Under such conditions of scarcity, several strengths nevertheless do emerge and cognition and problem solving abilities that are highly innovative but unrewarded. Converting these to scalable, widespread diffusion of enterprises is necessary, but traditional approaches to industrial policy and innovation may not capture these innate strengths. Several approaches link capabilities and learning at firm-level to industrial-scale successes or failures (Katz [15], Bell and Pavitt [16],Lall and Teubal [17) However, attention to the scarcities contexts of LDCs may provide much wider ambit for industrial policies because it pays better attention to innovations that are not simple process or reverse-engineering examples , it may focus on the firm but also its much wider ecology of other organizations and it focuses on metrics other than input resources in assessing paths to productive capabilities. This focus on productive capacities and problem-solving can "(a) suggest solutions to urgent needs, (b) provide answers to why many problem solving and technological skills, visible in entrepreneurs and small and medium enterprises in industrializing countries, do not appear to ''scale up'' or lead to more robust economic development and locally relevant technologies, (c) push away from ''catch-up'' frameworks, suggesting different ways in which productive technological capabilities are embedded in society, or whether certain ''stages'' are even necessary or desirable in economic development, and (d) provide new insights for how theories of the firm relate to industrializing countries and the nature of path dependency in problem-solving varieties" (S&S 2008, p.138).

nor horizontal policies. Rather, industrial and innovation policies would explicitly link cognitive, sectoral, and structural elements in ways that are in concert. In building aggregate demand, there is a tremendous need for directed policies towards investment areas of education and training, housing, agriculture and food processing, and health sectors[7]. Matching problems to industrial policies is one way. Some elements are pervasive in ISI strategies, especially those such as India that retained national ownership to a large degree, and which explicitly focused away from consumer goods as was the ISI strategy of Brazil. However, as the later section notes, the Nordic countries provide examples of where innovation and industrial policies were closely aligned with social spending and the political philosophy (contested though they might have been at various times) of greater inclusion of diverse actors and attention to domestic social issues. This is a development example that has received far less attention than East Asia, and points to political economy goals for LDCs that address their troubling challenges of poverty, unemployment, and skewed income and asset inequalities. East Asian development examples may be less relevant than the Nordic countries in understanding how industrial and innovation priorities can be complementary to institutions of social equality.

The typology of scarcities and technological specializations of the 2X2 is important because as Katz (2008) indicates, it may let less developed countries off their restructuring processes that are primarily focused on static comparative advantages, and allow a better map from macro policy environments, to micro industrial policy instruments and firm-based realities. As far as industrial change is concerned, these would, from the standpoint of industrial policies, allow buttressing a more immature domestic institutional environment and creating greater coordination capabilities. Importantly, the framework provides us several menu options for consideration which we take up in the next section.

3. 'Many Roads to Heaven': The Role of the State in building complementary institutions

Conceptualizing the Role(s) of the State

The evolutionary and co-evolutionary perspectives emphasize that not all paths to industrial policy are the same. There are 'many roads to heaven' (Lall, 2003). This is emphasized by the 2X2 of different taxonomies of technological specialization. On the one hand at the economy-level, these specializations reflect structural elements; on the other at a more micro-level, they provide a way to understand why cognitive-institutional frameworks are so important to innovators, user communities and planning

[7] See also Lundvall and Borras (2005) for the coordinating role for certain Ministries that can be created to address this sort of issue. Again, bureaucracies have lives and politics of their own; yet, much industrial effort of several LDCs and DCs alike is antagonistic to the goals of other line ministries. Clearly, in the Hirschmanian sense, these scattered and hidden resources can be brought to the light and better coordinated as integral to industrial development goals.

processing. Ironically, changing trading environments and mutual co-evolution of country strategies has meant that industrial policies and pathways of development are converging at a time when greater diversity and scope is necessary.

While several institutional options are available on a menu of industrial options, there are limiting *structural* features of economic growth. While much attention has focused on global value chains, there are distinct institutional and technological challenges to this path, requiring many roles of the state; the development state has no single role. Insertion in value chains is not simple and power in value chains can disproportionately return gains to investment for some parties at the top (usually MNC retailers i.e. GVC "buyers"), rather than at the bottom. First-mover advantages are substantial, making these challenging, but not impossible options for LDCs. The need to look beyond GVCs as a strategy, thus, is urgent.

Here, more than ever, the state can act through industrial policy to even the playing field and ensure that retailers are less footloose with their LDC investment strategy. New economic geography, planning and regional economics offer various insights into alternates to perfect competition hypotheses and dynamic effects of key investments. For example, transportation infrastructure can be a determining factor in clustering, but also nudge towards consumption activity and the building of aggregate demand. Both labour income and land relationships can be factored in a manner to account for state policy that traditional market-failure arguments do not capture. Because land regulation and other labour-land institutions may have important effects in specific cultures, standard market failures are far from reality in understanding why the state's role can be so important. Naturally, states do not always get industrial policies correct, but neither need they be myopic nor absent. Thus, while industrial policy cannot presume a benevolent state, it can certainly take as it basis evolutionary and co-evolutionary forms of policy learning and change.

Indeed, a central assumption of enlarging policy space is that states can learn and evolve. Importantly, institutions and policies in particular will co-evolve (Teubal 1997; McKinley, 1999; Volderba and Lewin, 1999, Nelson, 1994, Murmann 2003, Sotarauta and Srinivas 2006) each with different units of industrial analysis and different scales of governance. Variation, selection, and retention, key elements for an evolutionary process of industrial transformation are not strong within LDCs, nor have the wide diversity of actors and organizations necessary for a healthy industrial ecology. Thus, industrial, socio-economic, and market elements may conspire to prevent co-evolution and learning from taking place. The relatively weak signals of domestic consumers and low aggregate demand and strong signals of international market activity make it more unlikely that technology policies relevant for industrial growth will

necessarily match local needs[8]. Similarly, other evidence indicates that evolutionary and learning processes of firms too, are compromised by their size and ability to mitigate external shocks. These selection environments can have dramatic consequences on firms, but eventually, for several reasons of bi-directional causality, affect the policy co-evolution process as well (see for example, Yoguel and Boscherini 2000).

In this 2X2 typology, innovations in quadrant I are often of the value chains category, building on several process and incremental improvements associated with *existing* technological opportunities signaled by outside markets-both 'low and higher-hanging fruit'. The 'market positioning' involved with LDCs entry into global value chains can be challenging (Lall, 2003). Not only does industrial policy in this regard have to be agile in sourcing key technologies, much of market positioning has to do with the state's ability to negotiate key market agreements on behalf of private actors. This is not only a traditional coordination problem, but a significant political question for state-business relations.[9] These linkages may be built on technological competence and skills, managerial issues and industrial organization, as well as infrastructure. These immobile assets have been the basis of advantage in trade, and critically important for domestic development even for non-traded or less-traded sectors (Lall, 2002). But here too, several paths may lead to the same developmental goal, and increasingly countries have mixed strategies-FDI-reliant strategies work alongside more indigenous/autarkic options. Countries that have been more self-reliant are increasingly using FDI, and those who have been much reliant on FDI are seeking to build indigenous capabilities, although they may disproportionately reliant on MNCs to do this for them (ibid.).

The state then has a critical role to play not only in producing the 'scaling up' necessary for economic development, but also in building complexity and size of enterprises (Srinivas and Sutz 2008). These may happen through the state's ability to extract reciprocity or exploit and sustain national ownership of key enterprises (Amsden, 1989); it may lie in systematically attracting back a diaspora and addressing important knowledge gaps and capital investment capabilities; it may equally be directed at 'evolutionary targeting' (Avnimelech and Teubal, 2008) where the state focuses on triggering, reinforcing and sustaining market-led processes of industrial change. The wider systems- co-evolutionary literature would

[8] In Mexico, for example Dutrenit et al 2008 highlight how these economic features can confound policy learning and co-evolution, including (i) low rates of growth in the last decades; (ii) export specialization in mid- and high tech industries of global chains, but with low domestic R&D activities (iii) reduced competitiveness (iv) industrial growth based on natural resources, but not on technological dynamism; and (v) high inequality and poverty.

[9] Indeed, a notable challenge comes from the development agenda itself, and the 'good governance' off-shoots of the Washington consensus. These have strong anti-corruption rhetoric, pushing the state away from big business, and increasingly to de-centralized mandates. However, the history of industrial successes came directly from state-business relations, and particularly the state's ability to negotiate large firms to build strong backward-forward linkages with smaller suppliers, thus increasing spillovers (Amsden 1989, Wade, 1990, Evans, 199X).

emphasize that given the uncertainties, neither the state nor private agents have full information, so the 'strong development state' is uncommon. Instead, a broad ground needs to be in place for experimentation, learning, and multiple simultaneous efforts to build productive capacities and economic development (Srinivas 2008, Sotarauta and Srinivas 2006, Moreau 2004). Importantly, co-evolutionary approaches imply that public policy and regulatory acts of state cannot be simply seen as states acting 'on' markets, but that policy itself emerges from prior market conditions and learning from these. Unlike the earlier state-led literature where considerable planning and foresight capabilities are assumed (as was in the case of analyses of Korea or Taiwan), the systems-evolutionary and regulationist literature recognizes a more nuanced role for the state as an actor without full information as well. This context of state activity for LDCs would emphasize that the state supports through reiterative, evolutionary targeting, the activities that some private actors may do well through market mechanisms (Avnimelech and Teubal, 2008, Srinivas, 2008b). However, it leaves space for policy learning and co-evolution of policy processes with economic change and very real political economy concerns, including local institutions of sub-national industrial and technology policies (Brazis and Krugman 1996; Coriat and Dosi 1998; Moreau 2004; Sotarauta and Srinivas 2006; Dutrenit et al 2008).

Complementarity can be used to analyse history as well. Traditional industrial policy of the East Asian countries was primarily focused on capital accumulation, and most other goals were subservient to this one. Indeed, much of the "development state" literature provided primacy to productive capacities in discussing industrial policies, even though most East Asian economies managed their social spending through a social productivist lens (Mkandawire 2000 and others). The current multilateral trading framework and the proliferation of harmonization instruments and the encroachment on "policy space" force us to enquire about several, often conflicting roles for LDC governments. In filling these institutional "scarcity" gaps and building productive capacities to support technological change in manufacturing, services, and agricultural sectors, LDC governments will have to be agile and international policies must be reoriented to be development policies. Capital accumulation concerns must be set against urgent concerns of employment growth and aggregate demand, and against the ability of the state to monitor and fulfill several other functions such as security, safety and standards, income redistribution etc.

A theoretical and empirical challenge has to be incorporate endogenous institutions and norms into technological change, instead of viewing policy/regulatory environments as acting exclusively on the selection of firms and capabilities, not the variation and retention.[10].

[10] "Problem solving surrounded by endemic scarcities showcases ingenuity at its best. It can be argued that every country faces the problem of not having a thorough understanding of the entire knowledge needed to solve problems. In this sense, ''developed'' and ''developing'' countries alike face an important type of scarcity. However, the tools that each type of country has to tackle with it are overwhelmingly disparate." (Srinivas and Sutz, 2008, p. 132).

Different types of industrial and macroeconomic policies can be used to crystallize this. Some would entail anticipating the market, others following (Wade, 1990). Further, in Wade's typology, some might assist decentralized producers do what they do, others to lead decentralized producers to do something other than what they would have done, or 'even creates new producers to undertake initiatives'. (p. 234). The quadrants would require much 'leading the market' with a vision to assist these decentralized producers do things differently and build domestic demand at the same time. As Wade argues, following the market (as much neoliberal policy would have it) simply gives a "seal of approval" on some, or all, of a firm's intentions or a sector's direction.

Instead, the quadrants evoke the need for leading the market:

> "A selective industrial policy that leads the market involves (1) government initiatives about what products or technologies should be encouraged; (2) public resources or influence over private resources to carry through these initiatives, and (3) a larger before-the-fact plan or strategy." (Wade, 1990, p.234).

Therefore, a politically sensitive analysis would recognize that the state has *several* critical roles to play in industrial policy-making and implementation, analysis and learning. One of these challenges is for the state's ex-ante roles to be clarified, and for sufficient information so that the state can act despite its several potential conflicts. The tradition market failure argument that states have no more information than private actors cannot hold here, since private agents have not stepped forward to fill this role (UNCTAD LDC report 2007). There are several theoretical issues that remain to buttress the need for state's interventions (Moreau 2004, Sercovich 2004?, Katz 2008, and Srinivas forthcoming). Building demand is one of these areas. In a dualistic labour market, and with significant wage dispersion, robust markets may not exist for enterprises. The state's role is thus not only in market creation and legitimization, but also in the employment guarantees and social protections necessary to build political consensus for these policies. This aspect of industrial policy-making is much more dynamic than a neo-classical market failures argument. Determining dynamically market-size in the face of large uncertainties is very different from traditional supply-side industrial policies. "Unlike the neoclassical market failures approach, the 'optimal' market size is mythical …The state here co-evolves, and learns. As in the Austrian models, it has no necessarily better information than do private agents, but it is (in North's sense as with several other political economists) the institution of last recourse that can most greatly minimise transaction costs. In an open-ended universe context, outcomes of policy and of several interactions with others cannot be known *ex-ante (*see Hodgson 1988, Moreau 2004, Sotarauta and Srinivas 2006)." (Srinivas, forthcoming)

Revisiting East Asian political economy

Countries have used diverse strategies to build aggregate demand. At critical periods of the growth of S. Korea, food consumption patterns were addressed through redistributive policies in ways that were not apparent in the more unequal Latin American strategies of Brazil and Mexico. Brazil compensated for declining oil terms of trade by boosting sugar cane production at the cost of basic staple cereals. Argentina performed better, but this was due to a vast natural resource base and the consumption patterns of a smaller percentage of the population. In S. Korea, on the other hand, food self-sufficiency and rising agricultural output had a growing aggregate demand over time in ways that sustained both agriculture as well as diversification of agriculture and the building of its capital-goods base. On average Latin American economies emulated the U.S. in terms of divergence of social spending and industrial production goals, while Japan and S. Korea adopted a pattern more conducive to linking the two (See Fajnzylber, 1990).

However, Cheng (1990) describes how the East Asian model-models in reality-reflect very different approaches to sociopolitical consolidation of industrial policy and the move out of agriculture, to early ISI, then EOI strategies. He describes how distinct patterns politically emerged in Korea and Taiwan in terms of party power, capitalist class formation, and thus decision or power to work with big business or disperse economic power. During decolonization, Korean political regimes were weakened, unlike Taiwan, and in large part due to U.S. influence, privatized the economy, which fostered'…first, a dependent, but later a powerful, capitalist class. The Rhee regime also introduced, yet took pains to violate, a democratic system. This postwar political structure remained intact despite efforts to transcend it by the subsequent military regimes." (Cheng, 1990, p.143). Taiwan had more explicit approaches of building up agriculture, receiving large agricultural subsidies, channeled foreign aid. Surpluses were then utilized through compulsory procurement, low grain prices, grain-fertilizer exchanges, and state controlled exports to industry (Cheng, p. 145). Using U.S. assistance, new grain markets were opened in Japan. Subsidies were selectively targeted at light industries. i.e. ."…one can identify ISI qua strategy in Taiwan" (p. 145). In Korea, the primary strategy was to maximize aid (Kuznets, 1980, p. 63) and although land reforms were enacted, agriculture was neglected. ISI strategies were largely ambivalent and contradictory between capital and consumer industries, driven by elites. Unlike the Korean government which was heavily dependent on business, the KMT regime in Taiwan was relatively financially and organizationally autonomous. The party elites also used the growing agricultural surplus to consolidate their hold on society and keep down demand for capital supply (Cheng, p. 154.)

In the shift to EOI between 1958-1960 for Taiwan, and 1963-1965 for S. Korea, Taiwan switched

priorities to industry, using agriculture primarily as a source for industrial labour, but with agricultural export revenues continuing to be important for the growing economy., There was no social conflict in Taiwan, while in S. Korea regime change came about through a 1961 military coup and ISI was consolidated. Eventually the KMT regime in Taiwan saw internal changes come about to party structure and reformist technocrats. Land reforms also created different social changes in Taiwan relative to Korea. Significant external changes occurred: in U.S. aid-giving, of Taiwanese economists allied with the IMF and their pressures, and several macroeconomic changes that followed that eventually supported the political move afoot.

The next sections focus on the roles of the state through two avenues: first, in realigning ODA and other social spending with building productive capacities; second, in building agglomeration and providing several shared public inputs to build standards capabilities and using research institutes. As we will see, this requires attention to sectoral policies and linking agriculture, natural resource industries, and manufacturing.

The challenge of aggregate demand: aligning ODA and social spending with productive capacities

While several LDCs have been growing quite rapidly due to recent favourable terms of trade for commodity exports, the lack of demand may pose the ultimate constraints to continued growth and underscore an especially messy political challenge. While in principle, aggregate demand growth can induce technological progress and heightened labour productivity and have a knock-on effect on reducing income or other inequalities, this cannot be done without a much stronger role for the state and for international frameworks that support such efforts. The political challenges to industrial policies arise primarily from the existing uneven income and asset distribution within several LDCs, and a looming unemployment crisis steadily worsening over several years of misguided 'market-led' strategies. Viewing the economy in market terms as artificially separate from its politics has resulted in international development policies that are myopic about government realities and compromises. While technically at least LDCs have potential for continued growth, aggregate demand can only be built with attention to its politics. While more exports may help, the sectoral and political implications of that growth need attention. Agricultural investments have been low as has attention to land distribution, viable employment opportunities outside of agriculture are low except in a few LDCs, and poverty has stayed stubbornly high. UNCTAD estimates that 21 LDCs are "food insecure ", 34 LDCs are "threatened" in FAO's estimates. Structural change has been slow or stagnant, and UNCTAD estimates that given current trends, the number of people living in conditions of poverty will increase in absolute numbers from 334

million (2000) to 471 million (2010).[11]. Low attention to agricultural productivity and redistribution has meant that access to food is precarious and malnutrition is on an increase. Migration and a loss of key important entrepreneurs, educated people, and investors are also increasing. Industrial policies are therefore vital political and economic instruments for affecting change, particularly in increasing agricultural productivity, spawning productive non-agricultural employment options, and building better links between agriculture, natural resource industries-including fisheries, and manufacturing where it exists. This supply-side push through directed industrial policies towards public investments is crucial. Indeed, it would be difficult to recall any instance of development where such policies were unimportant.

To build these complementarities between productive capacities and social spending, industrial policies must necessarily encompass strategies other than merely insertion of LDCs into global value chains. While global value chains have been important avenues of growth and income enhancements, they are not the only possibilities. In the latter strategy, what Nurske and Rodenstein Rodan saw as crucial elements of aggregate demand are not directly addressed (se Kregel, 2007). The export strategies of several East Asian, south Asian (including Bangladeshi) and African have been structured around GVCs. The challenge lies especially in those sectors where domestic aggregate demand is simply insufficient to galvanize domestic markets. For commodity exporters, commodity chains can hide troubling lack of domestic consumption. From fisheries to coffee, oil to grain, much of the GVC activity goes overseas. Over-emphasis of industrial policy towards the traded-end of exports disproportionately affects the priorities of exporters to meet technical standards or other criteria required by retailers elsewhere. This leads to a continuing spiral of divergence between 'harmonization-necessitated' and 'needs-necessitated' development (Srinivas, 2005). In the absence of domestic demand for primary or other products and in the relative absence of international capital to systematically build this end, there was no substitute for capital accumulation in building productive capabilities (Levy, 2007). In particular, there are several scale-related diffusion effects of technologies that pay a particularly important role. In line with Schumpeter's understanding of technology diffusion, Nurske emphasizes that Schumpeterian expansion of initial innovations outward into several other sectors and applications tends not to happen because of the lack of technical expertise, initial capitalization and the relative absence of entrepreneurs. In other words, the balanced expansion central to Rosenstein-Rodan and to the regional elements of Hirschman's backward-forward linkages rest on the technological capabilities of private and public actors, but especially on the capitalization and injections of technical change that spur further externalities and build aggregate demand (Kregel, 2007). In Nurske's view, no single market signal can achieve this build up of demand, and balanced growth would act across all sectors requiring capital investments in no single industry. This would sidestep the particular set of uncertainties and risk associated with single sectors and the shyness of

[11] See also discussion in Straam 2008

private capital, and would require the state as instrumental institution in achieving these goals. By differentiating the quadrants based on varied markets associated with income and relative purchasing power, we can craft a similar translation to innovation and industrial policies and opt out of the seemingly attractive but uneven strategies for LDCs offered by Quadrant I alone.[12]

Industrial development paths across Asia and Europe indicate that the complementarities of institutions- especially those that explicitly link aggregate demand to production- have more viable industrial policy options available. An important element of complementarity is addressing product and labour market policies relevant to the local economy. The different quadrants underscore how these may diverge. In quadrant 1 for example, where many global value chain strategies lie, several governments have made an attempt to align institutional forms, but aggregate demand is relatively weak. On the other hand, in other quadrants, where policy attention has been weak, the potential for building aggregate demand is strong.

In Amable (1999), and Srinivas and Sutz (2008) the type of regulation has significant impact on whether and under what conditions structural and sector specializations are aligned with domestic demand. The social democratic model (of the Nordic countries) sees definition of social needs as a time motivator for science policy, but also that technology policies work towards gradual movement out of natural resources exploitation to information technologies, deepening technologies in both. Srinivas and Wallin (2008) and Sutz (1990X) document how Nordic production challenges in key sectors in the 1970s evolved into diverse ways in which labour unions and community groups were brought into the design of key technologies at the onset and later stages of the microelectronics boom. Here too, strategies of social spending-to education and health were galvanized into (often) state-led collaborative ventures for work-place training and the development of vocational institutes with innovative private consortia and unions. Egalitarian ideas about the nature of society assisted this process of widespread skills and competence building, with considerable social spending being directed towards education and training. Nevertheless, there were some eventual limits. The meso-corporatist structures that assisted large firms in S. Korea for example were more likely to push for generalized skills and specialized in-house training. In Germany

[12] The fisheries sector in Namibia is another instance of how the state is attempting to more tightly wed industrial employment strategies with skills upgrading and infrastructure investments. This has not been without controversy; The Economist titled their coverage: "Govt wants foreigners out of fishing industry" http://www.economist.com.na/content/view/8105/70. This has pitted the state against foreign workers. In order to build on its productive capacity investments through fishing education and because of high unemployment rates, the government is under some pressure to persuade vessel owners to recruit Namibians. It also wants a clear and reasonable timeframe to replace foreign nationals with Namibians on board. Thus, the state has taken several steps to restructure contracts with foreign vessels in order to realign domestic investments and build channels for development. Illegal fishing has also been reined in order to regulate market conditions. http://www.economist.com.na/content/view/6524/70 .

In Thailand's auto, textiles and electronics sector, evidence indicates that national idiosyncrasy matters in industrial policy and two major variables- government policy and international conditions- are the biggest contributors to technology development (Vongpivat, 2002). Similarly, national policies limit the ability to regulate financial flows to business such that employment and work security prospects are not jeopardized.

and other countries, mobility of the labour force was external rather than internal through large firms (Amable 1999). The Nordic countries evolved into important competences in quality, differentiation and attention to services, while the "market-led" Anglo-Saxon model succeeded in high innovation rates, but dualistic labour markets. In every dominant model except the Anglo-American variety (were the state was nevertheless crucial in terms of public funds and critical built infrastructure such as roads, energy, transport, telecommunications, cutting-edge technologies) , the State has acted as an important provider of collective goods. Indeed, with the strongest constraints faced by the small Nordic countries in accommodating to their international regimes, their integration of domestic demand, and aligning of social spending with their productive structures, was most able to transform their industrial structures. Their industrial specializations reflected their specializations in social demand-health, security, or the environment, and exploiting their natural resources to the fullest. Export-strategies were not posed against social demands, but the latter set the base of the former. Quadrants II, III display these characteristics.

To conceptualize the 4 quadrants, the aggregate and effective demand-side needs special attention. The better able industrial policies are to distinguish strategies for the 4 quadrants, especially for I, II, and III, the better suited locally are the outputs of these strategies. For example, quadrants II and III may be best addressed by finding ISO certification support, metrology, and regional development planning such that backward-forward linkages can be established, and local demand and domestic markets are able to grow. In the Hirschmanian sense of regional development, a critical scarcity in LDCs is the separation of commodity, services, and manufactures within industrial policy frameworks. Non-farm rural employment that could have served this purpose of integration has thus far largely been ignored in national policy frameworks and multilateral assistance.

For LDCs, this approach to scarcity-induced innovation is useful because it places emphasis on the cognitive dimension of innovation, its scale-up and diffusion challenges, a wide variety of possible organizational forms beyond firms alone, and its recognition that policy matters. It has important planning and policy implications since its underscores not just outcomes, but development processes and consensual (or other) procedures for valuing and economically embedding certain types of innovations over others. These include recognition and value assigned to certain kinds of innovations and productive capacities in the economy, strong market and other signals provided by policy for participation in such activity, and the risk-mitigating assurances that industrial policy will help address scarcity by explicitly building networks and links to actors and organizations for such innovations.

To build productive capabilities and increase ownership of development, policy space is therefore especially relevant in technological specialization, diversification, and learning. This can happen with

particular emphasis on market creation and support, and both market and non-market paths to enterprise supports and income supports in order to build aggregate demand. While the creation and support of markets seems similar to older market-failure approaches, the attention here it to address the broader set of scarcities beyond those of markets as sole institutional instruments. In addition, income supports directed to dovetail with building productive capacities moves beyond traditional safety nets as well as social productivist approaches. The former, safety nets, sees aggregate demand questions outside its purview. Social assistance is dislocated from industrial growth strategies; in the latter social productivist approach, assumes a relatively linear relationship between social spending and economic productivity outcomes, requiring the former as instruments rather than broader entitlements. A focus on productive capacities allows for a wider understanding of how industrial policies can be used to build institutional capacity, address scarcities of various types, allow differential specialization in the four quadrants, and to build employment growth and income supports as a *shared, inter-linked* strategy for structural transformation. In an era of harmonized standards for IP, technical standards for food, health and safety, other export non-tariff barriers through standards such as TBT and SPS, these multiple state roles must accommodate the highly localized elements of sectors along with the highly globalized element of harmonization.

The absence of sizable domestic demand for tourism, fisheries, and manufactured goods are thus crucial questions for LDC industrial policy. Given the challenge of export oriented strategies that require insertion in GVCs, LDCs need to build aggregate demand at the same time that they build supply-side efforts. However small domestic demand is, it can be an important source of building technological capability and market size over time. In the traditional ISI-strategies, this same philosophy linked the consumption strategies of the 'elites' to production choices and capital goods investments. Prebisch's argument for ISI was also a demand-inducing strategy. The South African furniture industry is a good example., As with many other sectors, economic inequality and the absence of a middle class or buying class, is a limiting factor, making it even more economic sense to dovetail production strategies with ODA and other flows to social spending. The State's role can thus be to build the economies of scale that might otherwise be lacking from low consumption and which limit the development of domestically oriented manufacturing or other needs (see Keefer and Knack, 2003). Indeed, there is some evidence that if the state directed public spending towards traded goods and enhancing their productivity, that that would enhance macroeconomic impact and reduce inflation.[13] However, non-tradables could as well be the focus of these efforts since they have a similar effect.[14] In either case, the state would direct ODA towards productivity enhancing channels, on the one hand increasing demand, on the other 'leading the

[13] Rajan and Subramaniam, 2005. See also discussion in McKinley, 2005.

[14] Adams and Bevan, 2004.

market' to increase supply of vital investments such as energy and transportation investments, telecommunications, agricultural R&D and irrigation, schools and vocational training[15].

This is important for several reasons, but because of the two causal relationships that industrial data seems to suggest: one the one hand, "that technological advance, through its effect on productivity, is a root cause of relatively high levels of (industrial) output. Conversely, economies with high activity levels are the ones that tend to specialize in the more technology-intensive portion of industrial production" (UNIDO 2005, p.150).

[15] Telecommunications policies are such a platform for national policy efforts. In particular the industrial policy of telecommunications deregulation needs to be an important element of building private sector capability in Africa. The base of installed PCs needs to be upgraded, and network interoperability and interconnection questions can be dealt with through standardization and procurement, a critical area for industrial policy. Public and private telecommunication operators are in the process or have competed full Internet service operability in Benin, Central African Republic, Djibouti, Mauritius, Madagascar and Senegal for example. Several nonprofits and the private sector providers could be better consolidated. An important platform for telecommunication policy could be to direct NGOs to work directly with line agencies in order to assist with the standardization and investment process. Several government and international companies have already established bases in several African and Asian countries in order to build future market opportunities. This could be leverage for governments through negotiation strategies with international or other assistance in order to get private sector actors to work more closely in providing essential services. Multilateral and public investments, such as through the Organization of American states assistance in Latin America and the Caribbean has resulted in some of the highest Internet usage growth rates in the world (Bourdeau et al. 1996).

In Colombia, a 1995 Telecommunications Development Plan addressed universal coverage, network investments, and serviced diversification. The period between 1991 and 1998 showed how effective some of these targeted industrial policies could be: a remarkable growth and private-sector investment occurred, and the long-distance operator, the public monopoly to date, invested in installing 3200 km of optical fiber connecting 26 cities, revitalizing urban industrial markets, and decreasing transportation and communication costs between industry and commerce urban and rural areas. Manufacturing centers and the bigger cities achieved the first phase of investments, and by the end of the century, a move had been made to establish a highly competitive market with international long-distance data communications services generating an ever increasing share of revenues. Regional cellular telephony territories were designated, resulting in geographically demarcated competitive market areas (see Mansell and Wehn 1998, p. 169-170, and Ministry of Communications Colombia, 1995.)

Telecommunications can have important direct and indirect consequences as well. For LDCs, diasporas can be a crucial source of national development. While remittances can be one vehicle to this goal, they have not always links themselves to direct industrial-policy maneuvering. However, increasingly digital diasporas can be important source of industrial policy consolidation. The Afghanistan case highlights how digital diasporas organized through Internet networks, again substantially affect not only NGO architecture, but FDI flows, technical assistance, an important sources of management or professional advice (Brinkerhoff 2004). many members of these digital diasporas have great interest in development work and simply write checks, and maybe an important source of professional and other expertise, investment advice, recruitment, and a source of external checks and monitoring of productive capacities. Information exchange and dissemination not only linked the diaspora members to each other, but also to organizations on the ground and shows a certain resilience and growth in attending to rapid response for earthquakes, and building banking and coordinated supply channels. In principle, many of these could leverage infrastructure development and industrial policies which would ordinarily bypass government-led development agendas, thus reducing national ownership and flexibility of policy instruments.

Beyond general telecommunications re-alignment to build markets and establish enterprise-friendly policies, actual electronic commerce and economic growth resulting from telecoms reform also have untapped industrial aspects. However, Lund and McGuire (2005) discussed that an important lack in e-commerce trade and growth strategies is the absence of any role for the state, the failure to distinguish between e-commerce of varieties, and an under estimation of social polarization and its effect on economic growth. This "last resort" approach to government activity in market structuring has substantially affected at the ways in which different societies utilize firm specific or other assets. Using UNCTAD (2002, 2004), the authors emphasize that lower transactions costs associated with e-commerce needs to be balanced by the cost of switching suppliers. Several "softer issues" (trust and familiarity) assist the switching to better suppliers. Moodley (2002) indicates that market mechanisms alone are insufficient, and investments in managerial expertise and supplier networks are also important. French speaking and Spanish-speaking LDCs lead specific industrial policies tailored to their integration needs, to not only speed up their access to particular types of markets, but also prevent internal social polarization from taking place within the economy.

In agriculture itself, there is sufficient worldwide evidence to push for industrial policies that emphasize greater productive capacities. These limit migration of people off-farms in search of sustainable wages, and build broader aggregate demand in the economy. Micro-macro linkages in agriculture should emphasize agricultural research, share infrastructure between non-farm rural employment growth and agriculture use, and build significant capability in extension services.[16] Improved agricultural technology diffusion, improved rural transport infrastructure, improved irrigation systems, and access to extension services can all be central elements of an industrial policy. In addition, education, land tenure, and maintenance of livestock herds are outside traditional industrial policies, but can form the basis of converging ODA and other social service spending with industrial goals to boost agricultural options for LDCs. "Green Revolution" strategies incorporated several, but not all of these elements. Again, the 2X2 can provide a guide as to where policy emphases lie in diversification and deepening of specific technological specializations, and how to link these to diminish income disparities. The cautionary tales from the green revolutions of several countries indicate that awhile a certain divergence of goal and outcome is inevitable, if much is not invested in policy experiments and in reducing inequalities, technological and other benefits might accrue to those who already have certain advantages. Industrial policies clearly need to be more than technology policies.

Thus, a potential virtual cycle potentially results from the associated S-shaped curve for income enhancements that can in turn create dynamic externalities to technological and industrial developments. How the complementary institutions can be developed can be studied in the next section at the level of sectors where links to employment, infrastructure, taxation, research, or other policies become more visible. To do this, a conceptual evolutionary look at structural change, and policy learning accommodating several roles for the developmental state; the ways in which productive capacities of enterprises have been built in the past, and the role of the state in addressing core concerns of the heterogeneity and weakness of enterprises. Emphasizes particular ways in which the state can craft market structure and build public-private mixed instruments. These may also be through "older" industrial options such as export strategies, public procurement and contracting, and wider public investment to boost tourism and other services, agriculture, and manufacturing.[1718] A wider ambit of policy options exists than have been exercised by LDC governments as we see in the next section.

[16] A study of Madagascar for example (Minten and Barrett, 2008) showed that controlling for geographical and physical characteristics, adoption of improved agricultural technologies has significant social benefits. Communes that have higher rates of adoption of improved technologies enjoy higher crop, lower food prices and, higher real incomes for unskilled workers, alongside overall better welfare indicators. The results can be differentiated by the ability of individual producers to have marketable surpluses, and by density of populations (worse outcomes).

[17] A slightly broader regional development cluster strategy premised on tourism is evident in Cambodia. Instead of more diffuse industrial strategies associated with simply generating larger number of tourists and spending amounts, the industrial strategies of

Full-utilization of WTO options for agglomeration: TRIMS, standardization and learning institutes

There is considerable evidence that productivity reflects country-wide features. While sector-specific disparities may well exist, they tend not to explain well any inter-country variations in productivity. In other words, high productivity countries are characterized by high-productivity in all sectors. Tendler and others have emphasized that while ISI policies have been largely dismantled with their emphasis on forward-backward linkages (although not always achieved in practice), there has been no subsequent replacement to date for policies aimed at a tightly linked domestic economy. Today's trading and industrial environments are characterized by a very loosely packaged set of requirements for industrialization and an international environment which is not conducive to countries trying to probe alternative paths. Current trading rules seem to assume development is relatively instantaneous, need no timelines for nurturing capabilities, nor means to agglomerate economies. Nevertheless, precisely because of this lack of cohesion, several studies have argued that in fact opportunity continues to exist for industrial development (Sercovich and Magarinos 2004?, Srinivas 2005). Certainly little prevents them from addressing non-traded segments where WTO rules are largely irrelevant. Therefore, even more reason to link traded and non-traded sectors more tightly together using several tools within the allowed WTO arsenal, and those for untraded segments where domestic industrial policies can hold free rein. In industrial policy, this state action is crucial because the state in its entirety may have strong effects. Even technical assistance is under-utilized by LDC governments in building public-private linkages.

As Amsden and Hikino (2000) correctly point out, the constraints on current development options within the multilateral trading system may be overemphasized. Srinivas (2005) and Sercovich (2004) emphasize that there is room in S&T policies, entrepreneurial development, social, regional and environmental areas where some considerable latitude continues to exist. For several LDCs, there continues to be flexibility on export subsidies and their use in linking them to social development goals. Clearly, LDCs could do much more with existing Agreements, their loopholes and inconsistencies. and non-agreements.[19] Moreover,

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the state were geared towards enhancing existing macroeconomic features that had attempted towards integrating anti-poverty features in development. Similarly, in the realm of natural resource use, technological upgrading can be intertwined with concerns for sustainability right at the outset and can be crucially linked to land and water availability and rights. Here, industrial strategies required substantial regional upgrading methods incorporating the cultural and eco-tourism aspects that most diminished poverty. Bolwell and Weinz, X). The state (the royal state in this case) worked closely to develop an explicit pro-poor strategy as the bulwark of developing industrial clusters around environmentally and culturally appropriate infrastructure. p.51, "Reducing poverty through tourism" by Dain Bolwell and Wolfgang Weinz (ILO Sectoral Activities Programmme paper

[18] South Africa and Chile have raised water to fundamental rights and 'floors of dignity' (see Barkin et al. 2008). Using market models first may not assist productive capacities. Mexico showcases how water management models that crucially depend on payment, fail on several counts. In the Latin American context, the integration of knowledge "…of 'extended peers" (people from outside the formal academic and research circles) in the evaluation of "the scientific inputs for decision making"" is crucial (Barkin 2008).

[19] Some absurdities exist. As Jensen (2002) explains, there is a certain peculiarity to the SPS harmonisation measures persuading, for instance, Tanzania, to deny access to fruit from Kenya citing international standards, if these standards in practice apply to neither country's actual development reality, but are required by a third, industrialised country elsewhere. These harmonization-

much of this could be accomplished o systematically addressing meeting standards and developing standards in specialization areas. To do this, WTO instruments for tradable sectors and non-tradable sector policies can be developed to improve education, training, working conditions, product and process quality and scientific and technical standardization and quality enforcement[20].

To date, most theories of the firm are limited in highly heterogeneous contexts. To utilize TRIMS and improve standardization within firms and to integrate formal and informal economic production will require sustained institutional and organizational efforts. For example, up to in sub-Saharan Africa, 70% of non-agricultural workers are in some form of self-employed informal employment; in Benin, this is as high as 95%[21]. Whether in fisheries, agriculture, or light industry, technical standards efforts will require ODA and government monies into standards training, laboratories, systematic efforts of industrial policies addressed at agglomeration economies, and ties to localizing research and development. The importance of combined policies that view both agro-based sectors and industrial manufacturing sectors alongside needs to be stressed. The table below shows the continuing importance of agro-based sectors.

Select LDCs, Structure and % share MVA approx. 1995-1997 in descending weight of agro-based sectors

Country	agro-based sectors	intermediate goods	capital goods
Burundi	93.0	4.1	2.8
Uganda	80.4	12.6	7.0
Yemen	74.7	24.1	0
Nepal	71.7	20.2	5.6
Bangladesh	65.4	24.7	7.9

(UNCTAD data, Chen, Vanek and Carr , 2004)

Much LDC effort is currently spent at the level of individual firms in systemically scarce situations, with each attempting to meet standards set elsewhere. No intermediate institutions (UN assistance programs are exceptions) exist to meeting standards and gradually developing the institutions of setting standards. i.e. increasing the overlap between needs-driven (adapting and gradually setting standards relevant

necessitated standards, should be considered for industrial policy to be distinct priorities from needs-necessitated standards that would build domestic productive capacities (Srinivas, 2005).

[20] In Taiwan, semi-conductor manufacturing and the subsequent explosive growth of original equipment suppliers, drew from shared pre-fabrication facilities partially developed by the state .

In fisheries, Colombia, Ecuador, Peru and Chile have all seen substantial investments –both private and public-in fisheries, and several international efforts to upgrade this sector. Chile has by far the best record of coping with challenges particularly in salmon farming.

[21] Chen, Vanek and Carr (2004)

locally) and harmonization-driven technical standards (meeting standards set elsewhere). Where standards can evolve such that 'needs-necessitated' and 'harmonisation-necessitated' technical standards shift closer together such as in the case of Nile perch, Darjeeling tea, India, or salmon in Chile, we might call this the 'highest common denominator'.[22] [23]

For traded goods and service sectors, simply meeting existing standards and being UR-compliant is no guarantor of development. LDCs should utilize trading rules and their open-endedness aggressively to map strategies for public investments and raising productive capacities. This can be better accomplished by systematically linking ODA to raising productive capacities and building agglomeration through several shared forms of public investments[24]. Non-actionable subsidies for S&T, playing with tariff rates, regional development programs are all potential vehicles. TRIMS have been under-utilized. LDCs should better exploit local content requirement clauses, and create conditional agreements (with external technical assistance where necessary) to shape the participation and agglomeration of domestic firms and multinational firms within and outside export zones.[25] Tariffs are by no means at their highest, and could

[22] A similar state strategy of market creation and sustenance, explicitly aligning employment goals with technology development, is seen in Brazil's furniture cluster (Morrison, 2007). In the initial period of industrialization, an acute shortage of trained workers in this sector forced the government to invest in foundations for technology, training, and research to provide inputs to the industry. The state's inability to regulate the market resulted in firms and brokers stepping in and being the primary agents of disseminating information and knowledge. However, the CTM (Centro de Tecnologia do Mobiliario) continues to act as a central; institution for technical assistance and training of local firms at subsidized rates and coordinating among a wide variety of private actors.

[23] In the construction sector of many developing economies, the state is not only an employer it also is regulator, procurer and contractor of construction services. In this largely un-traded sector, trading effects can nevertheless have considerable impact through technical standards in building practice and sub-contracting through global production networks of larger firms elsewhere. Ex. Construction industry and building standards: These may include building standards and ICBO for the construction sector which is overwhelmingly local (Werna 2008, Srinivas 2008, WTO XXX), with a small segment of design and engineering firms that are multinational. While larger design houses can anticipate the standards much better than the state in several respects, the potential positive spillovers in standards alignment and safe building practice is an important role for the state. In aligning its employment, procurement, and regulation functions, the state can potentially do much more with appropriate technical assistance than individual private firms. However, alongside private firms, the state can institutionalize professionalize industry associations that act as vehicles of standards diffusion. In turn, these can generate important effects in manufacturing-from pre-fabricated materials, to developing local standards for climate and energy-appropriate materials. However, this standards development, although crucial, has not easily developed. In Argentina for example, SENASA, the standards and metrology arm for industry, has been achieved through a significant organization and technical learning process.

[24] UNEP has worked closely on environmentally friendly integrated pest management services in cut flowers and technical know-how in several countries, using WTO and country policy options effectively. Methyl bromide's phase-put voluntarily or compulsorily as a soil fumigant, under the requirements of the Montreal protocol, has meant that horticulture, and agriculture sectors have needed greater technical inputs and broader trade and investment strategies to switch to other pest management practices. What were critical in this switching strategies and subsequent competitiveness, was the public universities and research institutes which acted as partners in the exercise with UNIDO and UNEP, and relied on a vast array of partnering business organizations. Physical infrastructure as revealed in the Kenya case, continued to be important for the dissemination of use.

[25] Oftentimes, the state's role in agglomeration can be straightforward. In Nigeria, the Otigba computer hardware cluster developed around coordinated infrastructure investments and market restructuring. The government approved two roads for cluster development, issued market directives via government procurement through directed agencies and ministries to buy firms' products, and explicitly linked cluster support to its employment potential of hitherto underemployed or unemployed science and engineering graduates (Oyeyinka, 2006). The state's role however is not relegated to the national government; far from it. Local government is a critical actor in industrial policy interpretation and implementation, especially in industrial land regulation, movement of workers, and their health, safety, and housing.. In the Nigerian case, through the Computer and Allied Products Dealers Association of Nigeria (CAPDAN) the Ikeja Local Government 'provided space for the new location of street traders within the cluster, an important aspect of land and labour politics needing alignment with new industrial policies. CAPDAN also worked with the police officials to monitor security on the streets. However, the state's relationship with business was not always smooth. The government was less willing or

still be used strategically to build certain capabilities. "Green" technology allowances have lain mostly unutilized. For LDCs such as the Comoros for instance, which depends on vanilla exports or for fisheries sectors in several LDCs, its ability to fully exploit existing opportunities is crucial. Greater policy coordination within these countries is required, but also between countries in ways that assist their economies.[26] One of the few that *have* been evoked is import surcharges, or emergency tariffs when imports have risen sharply and threatened local sectors, or for allowing some latitude in managing Balance of Payments problems. These are a vast minority in the range of potential options open that could affect the micro-climate for industrial development.

It is also clear that LDCs could be doing far more-from physical improvements, such as improving feeder roads and access roads. Concessionary lending from the World Bank and IMF and requires countries to formulate Poverty Reduction Strategy Papers (PRSPs). Without advocating for such PRSPs, there is evidence that sectors such as fisheries, which appear to have significant impact on improving livelihoods, are not incorporated in locally relevant ways into such PRSPs (Thorpe et al 2004). PSRPs and other ODA efforts could be directed by significance of sectoral presence within the economy and its impact for poor communities. This shift of the sector to the forefront of development debates and planning has occurred to some degree in Ghana and Guinea, but not in Cape Verde and Mozambique, where fisheries are highly relevant, yet quite absent in the planning on trade, development and poverty (Ibid.)

For non-traded goods and services, much more can be done outside the rubric of the WTO Agreements in skills development subsidies, educational programs, private sector R&D, incubation or other services for start-ups. Moreover, considerably wide latitude exists to match S&T policies to regional ones, building public R&D systems to assist agriculture and SMEs in manufacturing, the use of public procurement instruments, and other institutional supports for cluster development.[27] In the case of export standards and

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able to regulate the quality of computer components needed to improve product quality and that would have helped restructure the market in favor of local producers. The cluster currently needs more government support in infrastructure in order to upgrade further.

[26] In such regions of the world like Sub-Saharan Africa, a different approach to policy coherence is necessary. As Jensen (2002) suggests, there is a certain peculiarity to the SPS harmonisation measures persuading, for instance, Tanzania, to deny access to fruit from Kenya citing international standards, if these standards in practice apply to neither country's actual development reality, but are required by a third, industrialised country elsewhere.(See Srinivas, 2005 on policy coherence in standards).

[27] There are other more challenging industrial policy tasks to reduce volatility and more firmly embed clusters in formalized institutions; to realign formal and informal institutions especially in post-colonial contexts where trade and industrial strategies may be unable to successfully incorporate local practice and institutional variety. For example, while many analysts have written off African clusters based on perceived lack of social capital and collective efficiencies that have characterised the industrial surge of Northern Italy, Pakistan, and other regions of the world, Meagher (2007) points to the economic dynamism of several clusters in Nigeria. "Despite dynamic growth in the 1980s and 1990s, all three clusters were in a state of precipitous decline by the early years of the new millennium" (p.477)..There is a need for deliberate state action and attention to 'informal governance' in destabilising and undermining what might have been three dynamic manufacturing clusters of shoes, garments, and weaving in two different Nigerian regions. Severe state neglect in response to neoliberal pressures on utilizing market instruments crippled the sectors in several ways. At the same time, pressures to be "lawful" under a misplaced good governance agenda, pitted the formal apparatus of the state against several alternate institutional and more culturally embedded models of networks. The clusters were not only culturally dynamic, but globally linked until the state effectively undermined their clustering activity and trust networks. There was a breakdown of apprenticeship ties, sourcing networks, and trading paths. Efficient clusters need the state (Ibid.)

technical standards, the trade debates and supposed constraints are red herrings. Standards can be built in and diffused through the economy through a range of directed policies and efforts geared towards *both* trade-related and non-trade-related activities.[28] Furthermore, there is some evidence that negotiating extended timelines for compliance is possible in several sectors for particular TBT/SPS standards.[29]

A thrust for industrial policies that focus on industrial organization, efficient links to suppliers, transportation will result in better quality control, workforce training in continuous improvement activity, and improved delivery times[30]. Government policies with ODA and technical assistance inputs can be directed towards ,management training, building rapid responses to private queries on breakdown of malfunctioning of transport, electricity or water services, and important investments in inspectorates which can often be a significant bottleneck for accreditation and standards. These prioritized industrial policies can result in cutting costs and increasing efficiency in both public and private firms, but not through lowering wages. Just-in-time, and factory layout changes made in Zimbabwean agricultural cart producers showed a 35% cost reduction and higher quality and reliability in delivery (Kaplinsky, 1994)[31]. Similarly, Humphreys et al (1998) show how Indian producers of low-tension electric switching gear concentrated on links to suppliers. Much of this was in-house management changes, which shifted downward order processing time, manufacturing lead time, waiting time for dispatch, and transportation itself[32]. In the same manner, the public's role in building Internet accessibility and lowering the cost of basic information services is critical to leveraging industrial capacities.

Another crucial element of productive capacity, implementation, and institution-building is to focus on the State's line agents in industrial labour inspection, industrial upgrading and technical training in the

[28] The Mexican standards and environmental capabilities of SEMARNA (Secretariat for the Environment and National Resources and Fisheries – SEMARNA has shown the importance of resilient, early investments in good public agencies and how these can enable private actors' adaptability to external market conditions.

[29] For instance, UNIDO's efforts in technology forecasting and building or productive capacities in Uruguay has focused on shared infrastructure needs in energy and transportation and logistics, and shared facilities, inputs, and channels for growth in biotechnologies.

[30] While much has been written about the Indian success in information technology services, Jamaican business has also grown. However, the state in the 1990s was not as active in building the industrial policies necessary for expanding markets, providing loans, and developing a pipeline of educated workers. Continued high costs of access to the Internet and the relative lack of public sector institutions for the development of ICTs were considerable hindrances in the Jamaica instance relative to India. Nevertheless several value-added services have since been established (also see Dennett 1995, Patterson 1995 and Girvan 1994)

[31] These involved relatively low-hanging fruit in industrial processing such as time taken to pass the product through the factory, distance traveled by work-in-progress, and a dramatic reduction in labour input per item.

[32] Addressing scarcities includes tapping often less visible capabilities. The State may not have full information any more than private actors, but it may unduly sideline others. Using case studies from Pakistan's export-oriented textile-garment and sports goods sectors, Anwar (2007) argues that economic agents, such as SMEs, often have the requisite 'know how' to resolve infrastructure constraints, such as poor quality roads and transport networks, but are overlooked in conventional prescriptions for industrial development. Moreover, when local institutions, e.g. business associations, facilitate SME-government connectivity for learning novel approaches, these generate benefits for industrial performance. (Personal communications, N. Anwar Dec 2008).

larger LDCs, agricultural extension programs, infrastructure supervision, health and labour standards services. For example, technical standards and the inspectorate can have far –reaching sectoral impacts. Productive capacities can be built with the bureaucracy (through higher levels of staffing and engagement), setting accreditation councils, building line-agent expertise (with the inspectorates) and enabling a wide agricultural extension program relevant also to horticulture, fisheries and other sub0sectors. These would be considerably assisted by key public investments into a National Standards Institute to formulate, harmonize and disseminate standards.[33] These might include ISO/IEC standards, market analysis, consumer production. A National certification capacity crucial for ISO standards, and trained audit staff, several physical and chemical testing staff and laboratories, and metrology expertise and infrastructure for establishing appropriate measurement units, traceability measurements, and actual enterprise testing in early and later stages of manufacture. Crucially, the State's primary roles can be to build this sustainable accreditation infrastructure to reduce collective compliance costs while building extension and line-agent expertise and accessibility.

With the onslaught against industrial policy, came also a parallel, related steam of discourse of the new public managerialism. State agents were contrasted to private agents, state bureaucracies to private corporations on the basis of efficiency, accountability and other criteria. The upshot of this two decade period, was a significant erosion in public management capabilities, significant erosion of morale, privatization of key state assets in public sector production and delivery, and a notable lack of attention to state line agent performance. [34] The investments in this arena of industrial policy can be coupled with ODA that emphasizes governance, and with under-utilized TRIMS agreements. The roll-out is quite straightforward and can substantially use technical aid and assistance already available under the directives of the WTO, and the expertise of organizations such as UNIDO and UNEP. Several industrial cluster studies do point to the importance of standards-setting, adaptation, and standards-taking in middle- and low-income developing countries. This is an area of potential research for industrial policies for LDCs.[35]

[33] see UNIDO, http://www.unido.org/fileadmin/media/documents/pdf/tcb_sps_compliance.pdf

[34] Since then, research on labour inspection and governance and the U.S. and Europe, has heralded a regulatory renaissance in industrial flexibility in Latin America (of the Franco-Iberian variety)with very different features in the Anglo-American systems (see Piore and Schrank, 2007). Their and other studies (Pires, 2008 on Brazil) show important characteristics of how flexibility and industrial upgrading can evolve so as to uphold "decent work" practice while at the same time supporting technological dynamism, spread of efficient business practice, and the upholding of norms of industrial upgrading.

[35] For example, since 1998, the Sultanate of Oman has targeted investments and training of fish inspectors and the adoption of HAACP standards in seafood processing operations, leading to approx. 24 seafood fish processing facilities that are HACCP certified. (**Source:** INFOFISH *International* 2/2006: 52) Fisheries inspectors and staff training has also been essential in the case of gains made by NAFIQAVED (*National Fisheries Quality Assurance Veterinary Directorate*) in Vietnam. It dealt with challenges to isolation and identification of various fish borne parasites and impacts on food safety standards. Similarly, in Thailand, strategic use of existing options under WTO for technical assistance led to the deployment of FISHTRADENET, dedicated to seafood trade and

Similarly, traceability in trade of specific food-related items allows for considerably opportunities for productive capacities in essential commodities relevant to LDCs and to SIDS.[36] These types of policies building inspectorates with extension services and standardization is critical to the competitiveness of the long-standing vanilla industry in the Comoros, for example. This sector is facing increased competition from Uganda, India, and Indonesia which have entered the market. The Comoros challenges has come paradoxically from its very success and the high vanilla prices of recent years, causing over-supply. Curing vanilla is a highly labour-intensive process, providing the basis for employment diffusion. Two strategies were potentially open in an industrial policy for this sector: first, industrial policies could have foreseen excess supply. On the one hand, better suppliers could have been supported with standardization, extension services and credit linkages, and several micro-macro policy linkages put in place to support the sector. Second, those international buyers who shied away from high vanilla prices and who switched to synthetics could have been dissuaded with pro-active Comoroan and international assistance policies to emphasize product quality, authenticity and value in ways similar to campaigns for coffee, basmati rice or champagne. Comoran bourbon vanilla has several industrial users and unique qualities but was never at the centre of concerted national or international efforts to build productive capacities and leverage quality.[37]

Similarly, in Burundi, where coffee, bananas and mining designate the sectoral bounds of this land-locked and historically embargoed nation, industrial policy must be pragmatic. The banana and coffee sectors lend themselves to considerable standardization and extension service improvements even without the benefit of sea-trade. Lake Tanganyika's presence continues to be important but use of feeder roads complicated by civil war and poverty. An industrial strategy here would focus on diversification of agriculture while building cash-crop markets. Infrastructure investments must be an essential part of ODA, and donors should be required to show how their investments are building supply and demand. Measurable increases in income close to feeder roads and new transport infrastructure should be part of

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technical information. This was generated through collaboration with the FAO for strengthening national capabilities in trade policy and seafood safety assurance. This required training of inspectors and other staff, In other countries, the training of inspectorates has also coincided with building industrial expertise in logistics and facilities management.

[36] The "Farm-to-Fork" program of UNIDO was adopted in horticulture in Egypt and fisheries in Pakistan. Compliance costs are sizable, which is where the State continues to play a vital role, and technical assistance is crucial as part of a broader development strategy. The importance of metrology, testing, and accreditation can extend well beyond agriculture, to building capacity of a distinct sectoral kind, in Pakistani fisheries to textiles for examples, to build capacity in the latter which increasingly must jump several accreditation and certification hurdles. The same holds true of leather.

[37] In a manner similar to the notable success of Darjeeling tea as a setter, not just taker of standards (see Srinivas 2005), Comoran bourbon vanilla could be the basis of international standards setting of its own. Similarly, the Comorian tourism and fisheries sectors could have built on shared strategies with vanilla bean production to showcase the island's best. Furthermore, industrial policies can be geared towards building links with food and beverage firms, as well as pharmaceutical firms, all large users of natural vanilla. As part of a future platform of Indian and Chinese pharmaceutical and food firms in Africa, this may be a viable longer-term development strategy for this sector.

industrial strategy, and its main European and Asian trading partners (Belgium, France, Italy and Japan) for example, should have to emphasize how their bi-lateral trading relationship assists the building of Burundi's productive capacities.[38] Industrial policies could have directly addressed fundamental problems of the sector including storage infrastructure needs, cassava pellet processing and special equipment, need for cassava processing speed, and poor roads and transport in delaying collection.

In Mauritania, under-utilized fisheries zones and under-recognized quality of stock need urgent road and air transport infrastructure. A broader industrial strategy here would link rewards of industrial capacity development to technical or other expertise to develop the country's complementary but problematic judicial system.

Food processing alone is the single largest component of the manufacturing sector in most African countries and comprises medium-to-large-scale activities, "artisan" and small-scale activities, which have complex, interlinked activities. This production heterogeneity requires industrial strategies in all 4 quadrants of the 2X2.

SSA Region	Agriculture
% Employment	70
% Merchandise Exports	40
% GDP	32
% MVA based on agricultural raw materials24	33-67%

Standardization has been important in recent economic history. However, much of the data we have hides some of the standardization within it. In East Asia the structural shift from nature resource-intensive products and unskilled labour intensive products to both technology intensive and human capital intensive products. Standardisation is subsumed within this broader move. Standardisation is collapsed within this broader move.

[38] The diversification of food crops is an essential part of this industrial strategy, to minimize volatility in cash crops; the FAO's successful strategy of reintroducing cassava on a large scale is an example of how cassava-related food industry can be built ensuring both food security as well as sectoral expertise for export. Disease-free varieties developed with the FAO's International Institute of Tropical Agriculture in Nigeria have combated Cassava Mosaic Disease which had depleted stocks in the region.

Export category change

Export category Change % exports 1988-% exports 1979)	Japan	Korea	Taiwan	Hong Kong	Singapore
Nature resource-intensive	0	-4	-2	0	-3
Unskilled labour- intensive	-5	-10	-8	-14	-8
Technology- intensive	14	8	7	14	14
Human capital- intensive	-9	6	3	-1	-3

From source: Adapted from Hobday (1995b)

There exist some instructive lessons on the link between technical standards and industrial development can be gleaned from the East Asian and Nordic examples we know (example, see Hobday 1995b, Srinivas 2005, Srinivas and Viljamaa 2007):

1. Semiconductor and electronics firms first responded to and then themselves created increasing standardization. This change took place over nearly a 40 year period, from firms with significant dependence on external buyers to those with significant in-house capabilities (sometimes, these were not the same firms, but reflected an industry-wide shift).
2. Firms moved into these standardized (although rapidly changing) sectors from *already* standardized sectors such as bicycle manufacture (Anam Industrial in South Korea) and other 'old' electronics sub-sectors such as vacuum tube manufacture. i.e. they were already exposed to production with some standardization.
3. IPR rules were little or non-existent at the time relative to the situation today. However, even so, significant advances in both east Asian and Nordic economies occurred with the state framing rules for sharing information, facilities, platform technologies and links to research institutes and universities (think of the Taiwanese semi-conductor fabrication efforts, or Finnish centres for excellence, or state supports for shared technologies in Tampere's mechanical engineering and automation sectors, or Turku's biotech cluster
4. To achieve basic levels of standardization, the state has been important in explicit or de-facto industrial policies in a variety of ways. The variety is important to emphasize because the country examples from East Asia and the Nordic countries used a vast array of instruments and institutional rules to achieve standardization. These included building sub-contracting relationships, FDI, technology transfers, procurement and building local content. Some (as in

Norway) built "goodwill" compacts with companies that required demonstrations against clear guidelines that domestic capabilities were being built.

5. Quite distinctly, industrial complementarities were built that incorporated standardization into local use as well. This is best exemplified by the Nordic examples, where social development and productive capabilities were seen as two sides of the same coin. Here, not surprisingly perhaps, innovation/S&T/technology investments were also directed at solving local problems and best leveraging local resources[39]. Natural resources became not just commodity export sources, but were built by the state and private firms into high-tech sectors that services other intermediate sectors with wide diversification in several cases.

Standardization required a wide diversity of market and non-market instruments, and a variety of organizational actors. An important function of this fell in the domain of close links of firms with universities and research centres, extension programs and vocational training institutes. We turn to this next.

Research institutes, training, and extension programs

A further opportunity for LDCs is to use educational and research institutes with much greater latitude under the WTO rubric. Here too, international assistance either through ODA or through assisting frameworks must be considered for support and exchange. Universities and research can be important but highly underutilized platforms for industrial strategy and can showcase how quadrants II and III strategies can be used. Other related under-utilized options may include ICT-related investments and open-source incentives for export upgrading and tracking, transport, vocational institutes, tech training programs etc. These under-utilized instruments may include building domestic and partnerships overseas other than through global commodity chain retailers which has often been the primary source of know-how for LDCs. These are areas where the WTO rules allow "non-actionable subsidies" since S&T, environmental and regional development, for example, are exempt if they can be shown to promote competitive practices.

In Rwanda, the Kigali Institute for Science and Technology Institute at through a UNDP project in 1997, with the executive agency name the German GTZ, has been an important organization in leveraging public investments in building management, science and engineering, computer technologies, food sciences,

[39] See also Amable, B. & P. Petit. 2001. The Diversity of Social Systems of Innovation and Production during the 1990s. In *Paper prepared for the second Conference of the Centre Saint-Gobain pour la Recherche en Economie*. Paris.

electronics, and various process technologies[40]. Similarly, existing international efforts towards the MDGs can be other springboards for action. [41]

In terms of the State's role, much more can be done to build knowledge use and dissemination, by the use of research institutes and extension programs, the use of universities' 'Third roles' and so-called 'developmental universities' (see Coleman, 1984; Brundenius, Lundvall and Sutz 2008). The U.S., Europe, and East Asian countries have all used public investments in research strategically to build agglomeration, seed industries, and leverage capital investments. University, technical schools, and training programs can do a substantial amount towards this goal to address the needs of LDCs. Universities and researched institutes can be crucial elements of industrial policies directed at regional development and specific innovations. For example, they can build complementary institutions between local applications and intermediate goods for future technological deepening. Examples of quadrant III are of solutions which exist but are not adequate to full scale up and manufacture. A crucial latent demand may exist, but be underserved for several reasons. The synthetic skin example of Uruguay is a good example where state had led market creation through several directed, but incremental measures.[42] Similarly, the state is a critical factor in co-financing research

[40] Its center for continuing education, business incubation, career guidance and counseling, information technologies, have network effects. The faculty of business administration has seen a surge in part-time students, indicating how much continuous education plays a role in professional management expertise. A consulting report by the conclusion of the Project indicated significant gains have been made through the establishment of KIST[40] and *"The achievement so far is impressive* and even *exceed the forecast".* These gains have included full-time student enrollment exceeding original plans, a wide range of vocational training, short-term courses, and a strong technology research and dissemination focus, which has already demonstrated some success in the industrial technologies of *e*nergy saving public cookers, energy saving bread making ovens and bio-gas energy technologies. These have significant capacity for scale-up and industrial manufacture, and it remains to be seen whether capabilities through the Rwandan line ministries and the technical expertise of KIST can achieve the broadening of industrial capabilities in Rwanda. Linkages between German science and technology, private and public sector capabilities, have been an important part of this by bilateral strategy for building productive capacity. A crucial component in leveraging technical assistance and past development investments has occurred through the joint collaboration aimed curriculum development as well as offerings through KIST; this is occurred in conjunction with universities from Europe and Africa with strong reputations for technology-intensive courses such as the Kenya's Jomo Kenyatha University of Agriculture and Technology Tanzania's University of Dar Es Salam, Uganda's Makerere University, and the Netherlands' Delft University of Technology. KIST's Technology and Business Incubation facility (TBIF) recently won the World Bank infoDev award of $50,000 and was selected from a numerous entrants; its focus is ICT investments to diversify and upgrade rural productive capacity. KIST's departments have also won the Ashden Awards for Sustainable Energy by scaling up biogas plants for uses in prisons to treat toilet wastes and generate biogas for cooking. The bio-effluent which can then be used as fertilizer for production of crops and fuel wood (see also http://www.ashdenawards.org/winners/kist05)

[41] The Millennium Village Project, hosted through the Earth Institute of Columbia University in New York, is also strategically leveraging applications in IT, speech and other technologies, and the use of community health worker training as a platform to both systematic links to the Ministry of health and regional infrastructure of several small towns. Decent forms of educational/research/development projects can have potentially important private sector, and open source and other implications in Africa. In several of these countries, important private sector actors, and especially African entrepreneurs are already present in the IT sector. There are severe shortages of information sources, skilled workers, and inadequate infrastructure. Ethiopia for example provides a case which Alemu (1996) describes with several opportunities, but missing investments and important negative repercussions in health, airlines, or other applications.

[42] Personal communication, J. Sutz. 2008. In Uruguay for example, the state, through university-based programs is attempting, as in the Rwanda case, to work more closely with researchers, private firms, and public agencies (such as hospitals) to utilize new technologies at low cost. Synthetic skin is one of these advances. It can be extremely expensive without the necessary industrial policy supports, to use regenerated skin which can cost (for a burned arm) approximately U$S 10.000. Instead, relying on bovine collagen, Uruguayan researchers specialized in new materials and nanotech and are now developing a methodology to be transferred to industry to manufacture cheap synthetic skin. Eventual problem: poor people receive expensive treatments if such treatments are included in a public health policy called National Resources Funds. Only those health situations prioritized to be covered by the Fund "open a market" for non canonical solutions. It is not sure yet that synthetic skin will be provided to poor

with non-university actors. Without appropriate funding and funding signals, markets cannot be created for quadrant III elements. The "Neuro-navigator" is a joint project already approved and begun between the Institute for Electrical engineering and a public hospital in the countryside, Tacuarembó.[43]

Equally, examples of Quadrant II exist where problems that have not been researched in the developed countries but where solutions have been found or are searched in developing countries. In these instances, industrial policy can be critical for scale-up, manufacture and procurement. Here, international financing through venture capital, prizes, or procurement funds can be a vital part of a global compact[44].

Negotiations are underway between the metal-mechanic trade unions in Uruguay and Brazil for joint production ventures that would produce the APWU in adequate volumes, as a way to revitalize the metal-working industry and create new jobs in both countries.[45] Similarly, the state is a critical element of assisting private technological capabilities. In recent years, Brazilian public policies in science and technology have built more entrepreneurial businesses. The emergence of a large array of medical devices applying biophotonics technologies in São Carlos came from collaboration between different research groups working to overcome the costs of imported medical equipments (Plonski and Pereira, forthcoming).[46][47]

In India, the National Innovation Foundation, and grassroots groups such as Shristi and Honeybee, travel far and wide to help grassroots innovators document, apply for, and receive patent protection. The foundation also works on awards for innovators, and to help them receive research assistance, managerial expertise from

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people with severe burns. This is therefore a critical element of health and industrial policies that requires scale-up and manufacture and several process manufacturing innovations.

[43] The device captures images of the brain during neuro-surgery, which would normally cost U$S 500,000. The proposal is to develop locally a similar devise which would cost more than ten times less, using cheaper TV cameras and using a different approach to the control system of the devise. What is important for LDCs is that many of these expensive inputs can now be obtained from other publicly funded or procured agencies in other DCs. Thus, Uruguay or India's gains are now potentially gains for several LDCs.

[44] Autonomous Unit for Potable Water, developed for Uruguayan soldiers in Congo, is an example of 'endogenous' technology fitted to urgent needs: small, cheap and mobile plants for potable water in Uruguay. It has important industrial policy elements for financing, scale-up, manufacture, and process improvements. The Autonomous Potable Water Unit (APWU), like its name suggests, is a device able to transform "dirty" water into potable water. It can rapidly provide acceptable and stable sanitary solutions for small and medium towns –typically less than 20.000 inhabitants- in poor landscapes that do not have access to the major water supply systems, and can potentially be an important element of industrial infrastructure services itself. The first unit was installed in Congo, in 1993. After its operational success, the Uruguayan government financed until 1996 the building of 120 APWU that are installed in the whole territory, serving scattered small towns and villages (the smaller units) and also medium towns (the bigger ones). Uruguay is the only South American country reported to have not suffered from any case of cholera. Again, for LDCs, these gains can be substantial. Some APWUs were donated to Central American countries after the sequels of the hurricane Mitch (Nicaragua and El Salvador); another one was donated to Venezuela after mud avalanches. A small unit was also donated to the small village of Talwandi Sabo, in Punjab, India (2002). After that, it was said that India would have a demand of 1000 APWU in five years. The public water supply enterprise made contacts also with Hungary and South Africa, where high interest in buying or making joint-ventures for production was expressed. United Nations was contacted as well as a possible procurer of such units.

[45] Personal communications, J. Sutz. Dec-Jan 2009-'09.

[46] personal communications, L. Pereira. Dec 2008.

[47] However, the state's role in structuring market conditions is not without difficulty. The Brazilian patent system for example is characterized by significant institutional lumpiness and lack of neutrality. Application of the intellectual property law is influenced by knowledge and power in the market place as seen by the position of the economic agents such as business sector, technology involved, origin of capital, and technological capabilities and scientific competence of the researchers involved. To the degree that IP can be an instrument market restructuring and to galvanize technological investments in certain sectors, industrial policy can further disseminate intellectual property information, rights, and language to a wider set of actors (Ibid.)

private and public sectors, as well as venture capital to scale-up their innovations. Many of these innovations fall in quadrants II and III of the 2X2. Similarly, the ability of states to link industrial policy with basic needs technologies, can spur significant economic and political benefits. Quadrants II and III have high likelihood of achieving these goals, but need explicit industrial policy attention and recognition of innovations.

In Brazil, these quadrants have been linked to Quadrant IV, where no solutions as yet exist technologically and institutionally, the quadrant of 'ultimate scarcity'. This is the quadrant where no existing solutions exist, nor research yet in neither developed countries nor developing countries). Here industrial policy dovetails with various employment, health, and other policy goals.[48] [49]

Similarly, shared international strategies can re-orient industrial development and regional inequality simultaneously. For example, several policies now exist in Mercosur to diminish economic disparities among Argentina, Brazil, Paraguay and Uruguay through the Fund for the Mercosul Structural Convergence (Focem). The Fund aims to reduce existing asymmetries of various types between these countries and promote the growth of Paraguay and Uruguay.

Micro-macro linkages and cumulative effects

Another way to emphasize this point of scarcity and how complementarity can address it, while building agglomeration economies, is to discuss the relationship between macro and micro policies as several scholars have recently done (see Sercovich 2008, Dosi 2008, Teitel 2008, and Katz 2008, Cimoli et al. 2008). For LDCs, much effort is focused on quadrant I strategies where institutional complementarities and aggregate demand strategies are weakest. This approach to a wider classification of innovations relevant to LDCs continues to allow them traditional avenues (quadrant I) of pursuing industrial policy, but significantly widens the opportunities for micro and macro policy spaces to pursue strategies that more tightly intersect with pressing issues of domestic demand, and the institutional links between traded and non-traded elements of the economy.

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[48] For example, CNPq (the Brazilian National Research Council) and other public agencies have pushed strongly in this direction. Fiocruz, the biggest centre for health research in Brazil and in Latin America, will begin a very significant project on neglected diseases, "Innovation Management for Neglected Diseases" (2008) that will address issues such as intellectual property rights; technology foresighting; health industrial-economic complex; technological platforms; social networks visualization and analysis. This has linked several key elements of industrial policy directly.

Similarly, S&T for social inclusion through the building of vital technological capabilities is now central to the Ministry of Science and Technology. It is estimated that 2% of the S&T Brazilian budget is devoted to social inclusion items, which given the amount of money spent in Brazil (1% of the GDP) is a significant quantity.
http://www.mct.gov.br/index.php/content/view/42301.html There have been many efforts from Brazilian government to spur sustainability poor regions according to local resources and competences. These have specific industrial clustering outcomes, from the cluster of textile firms in Jardim das Piranhas – Rio Grande do Norte, the cluster of sport shoes production in Nova Serrana – Minas Gerais, ecotourism in Bonito – Mato Grosso do Sul, Production of biodiesel with social inclusion in the Northeast, and production of urban biodiesel in Indaiatuba – São Paulo.

[49] Personal communication, L Pereira., Dec, 2008.

From a co-evolutionary standpoint, it becomes important to buttress the efforts of micro-level industrial policies with macroeconomic approaches in terms of public financing, labour market governance, fiscal policies and exchange rates[50]. While at the micro-level, the industrial policy and capabilities building mistakes made by Latin American countries relative to their East Asian peers have been emphasized considerably, more discerning commentators have emphasized the manner in which macroeconomic policies undermined several industrial policies in place to address learning and productive capabilities (see Katz 2008, Tietel 2008). For example, 'virtuous co-evolutionary processes' are challenging in Mexico because of broader economic and social problems, including an export specialization in mid and high-tech industries which have poor domestic links to R&D even if they are tightly coupled to global value chains, resource industries that do not complete on the basis of technology upgrading, high inequality and poverty i.e. income distribution problems, and an industrial trend towards lowered competition (Dutrenit et al. 2008). If the assumption is that agglomeration's scale and network economies can be best harnessed by firms and workers, then macro-policies that assist industrial policy implementation may be most useful that allow agglomeration economies to emerge. These may include monetary or fiscal policies that encourage national firm ownership and investments, relatively late opening of capital controls, investments even in periods of exchange rate instability, or explicit incentives for foreign diaspora to invest in the home country LDC.

A national micro-macro set of cross-sectoral linkages could have extended credit and insurance, established line-agents of standards, monitoring, and infrastructure provision, and reduced volatility and intense competition that eroded the viability of the clusters even during periods of considerable economic dynamism. The culturally embedded and economically vital activities also showcase how ODA spending in social services, education, income-generation, or health, could be tied in to revitalize these and other clusters. Decades of state neglect however complicate this provision, making even more urgent the task of placing productive capacities at the centre of state strategies going forward.

Insurance services and re-insurance markets are another source of national supports and will more tightly wed industrial manufacturing and agricultural sectors together. For SIDs, climate-linked insurance products are an important element of industrial policies, and a diversification base for new employment options.

[50] In Thailand, the State through its Board of Investments was instrumental in setting up the initial market conditions in the 1970s and 1980s for the highly successful jewelry sector by progressively eliminating all import duties on inputs for export-oriented jewelry (Scott, XX). . The Board also approved 5-year tax holidays for more than 100 approved gem and jewelry firms in the late 1980s, while the Department of Export Promotion acted as a vital facilitator and service provider linking retailers and export buyers with local firms. These agglomeration effects of state activity had far-reaching consequences on the sector. Again, the central and regional and local states acted in concert, building significant agglomerations. The local government was vital in enacting industrial policies through provision of health, housing, and land use regulation. Today the local government assists with the *Gemopolis project, a* 258 acre space for new factories including housing for workers. (Ibid.)

To build agglomeration, these public investments could leverage unutilized and under-utilized standardization-related policies, and associated network infrastructure, utilizing laboratories, metrology, roads, transportation hubs, and R&D investments. Firms and workers that seek benefits from co-location should be guaranteed lowered production costs, and better suppliers. Where oil extraction or other large capital investments already exists, public investments must be leveraged against the ability to shape private participation into building domestic capacity, especially in the case of foreign companies involved in extraction. Some of these profit monies emerging from the extraction or concessions can be set aside in infrastructure or investment pools to further leverage these investments. If we expect these large investments to have a lock-in effect on some forms of building, moving, extracting, and processing technologies, the state's role is to invest in horizontal and diversification channels to optimize these resources to other-related sectors.

Policies favouring global value chain development have tended to sideline diversification and limit inter-sectoral linkages, and exacerbate commodity dependence. Therefore, a set of policies to more robustly build complementarity and address systemic policy gaps is necessary. These would include assessing whether GVC development could potentially straddle several quadrants. After all, a dependence on commodity exports is not by itself an indicator of lag or inability of future technological evolution. Countries such as Finland and Sweden have moved from such histories to extremely technology and skills-intensive sectors over time, and while retaining and building on much of their extracting, processing, production, and automation experience in commodity and natural resources.

As Bell and Albu 1997 point out, clustering data points to the benefits of external sources of knowledge-such as global buyers for standards 'taking'. It is less clear what pathways exist within GVC clusters regarding under what conditions domestic, and internal sources of knowledge can be used although these are clearly quite important. If one of the goals of industrial policy is also to build complementary institutions for greater absorption and building of firm-level capacity, but also capacity within industry associations or other institutions. These would require public investments and technical assistance in metrics, longitudinal data collection, and the use of diverse Ministries to come together to support technology and skills improvements. The heterogeneity of technical efforts in many developing countries remains under recognized in policy debates (Abadeyo XXX, Srinivas and Sutz 2009). These come about because of the vast diversity of production typologies and the large numbers of people working in conditions far removed from some ideal fir m.

4. Learning from Nordic history: forests to pharmaceuticals

In keeping with the Hirschmanian emphasis on learning and uneven development, his emphasis is equally

on hidden resources and scarcities that need to be reconfigured into productive abilities. The states roles can be thought of as building complementary institutions and addressing any severe imbalances between the four quadrants (diversification) and making each quadrant's strategies more domestically embedded (deepening). This is echoed in Srinivas and Sutz (2008) which discuss the links between structural shifts and differentiation in technology specialization within the economy, and those of Reinert (2005) and Taylor (2005) that discuss investing in those sectors that exhibit dynamic increasing returns and shifting labour out of those sectors that are exhibiting decreasing returns.[51] In this section, I lay out some elements of Nordic history. While East Asian development has been taken to be the prime example for development trajectories, I argue that there are important political economy differences and insights to be gained from Nordic economic history of the 20th century about the role of the state and the building of productive capacities. These are not useful seen as "prerequisites" but rather lessons in the diverse roles of the state, how complementary institutions were used to address scarcities, how technology and innovation policies were constantly reworked to be sensitive to domestic needs as well as external markets. There are some similarities as well. As open economies, and some small, the Nordic countries provide interesting natural-resource based examples of how deepening and diversification of technological capabilities occurred, and how the state managed market structure and its domestic political economy in a manner that led to extremely rapid sectoral and national sophistication.

Why the Nordic countries perhaps pose a useful lesson for LDCs is because the international climate undoubtedly mattered for these countries to build productive capacities. As several commentators have argued, they mattered enormously to the East Asian NICs as well; without geo-political stars being in alignment, the NICs could also not have had access to key markets for their exports, nor supports for directed aid from allies. In my estimation, while the social and cultural contexts for Nordic countries are far removed from several LDCs, their industrial history as 'early latecomers' (especially Finland), provide some important clues to the State's roles. This requires both the international climate to be relatively favourable –which the current multilateral framework does not entirely accommodate, and perhaps more importantly of local, regional, and national government policies being aligned. In the smaller Nordic countries-Denmark, Norway, Finland, political systems and social cohesion were built through gradually evolving complementary institutions in labour governance, technology policies, social supports, and education. This gradual move to aggregate demand was a crucial element (and complement) of building productive capabilities. In the East Asian cases, the development states described by several researchers have focused on productive capabilities and state-business compacts, but have downplayed considerably the tensions in the roles of the state, or the pressures and complexities in building aggregate demand. The

[51] Taylor, L. (2005). Development Questions for 25 Years, WIDER paper

Storm, S. 2008. Building Productive Capacities and Technological Capabilities in LDCs, Development and Change, 39 (6), pp. 1203-1221

shift from agriculture to manufacturing through ISI, then export-oriented industrial policies in the NICs provided aggregate demand primarily through the growth of the manufacturing force, a path that may be conceivable in only some LDCs. For the remainder with significant export concentration in minerals, oil, other natural resources, and agricultural commodities, the Nordic countries may have some useful lessons.

More particularly, Nordic histories of building productive capabilities show case how we can more widely take lessons of addressing scarcities through complementarities to LDCs. As Amable's table (2000) indicates, industrial complementarities need be much wider than innovation or technology policy narrowly defined around firms. For LDCs and many other developing countries, these scarcities refer not only to firms, but to several *broader organizational contexts* within which productive capabilities are developed. For example, complementary institution building is necessary outside firms, such as unions, public universities, or labour market links between family and work, many of which may not depend directly on market mechanisms.

Indeed Lall (1992, 2000) emphasizes that the State's role in active and selective interventions requires a more macroeconomic incentives regime for trade policy and industrial policies, intervention in various markets of labour, capital investments and information, and the investments and institutional supports necessary for revitalizing industrial technology such as education, standards and metrology, various types of technical extension and R&D. Addressing institutional scarcities or building complementary institutions, requires much wider institution-building by the state beyond R&D. Lessons from East Asia or from European or U.S. histories must be interpreted keeping these scarcities and complementarities in mind.

Small country industrial policies must emphasize not only increasing the ability to withstand selection 'shocks' or gradual changes, but also the ability to build Nation-state, city complementarities. For example, in harnessing expertise and retention in Finland's industrial history, the nation-state was crucially important to directing policies, but equally buttressed the efforts of capabilities and expertise concentrated in specific regions[52]. Moreover, the Nordic states in both the pre and post 1990 recession years have been examples of interventionist policy across R&D investments, tax policies, technology development, regional economic planning, science investment areas, key cluster and center of excellence initiatives for platform technologies, and more recently an active debate about how to bring in capabilities they do not possess.

Furthermore, the shifts to domestic productive capabilities and diversification have been important elements of several Nordic countries. Within the industrial histories of North Sea oil that has affected both Norway and Scotland, for example, oil exploration and processing was conducted under rather

[52] Kostiainen and Sotarauta (2003)

different policy and institutional environments in Norway. The state took a decisive role early on and in the 1960s was already beginning to deliberately mitigate over-rapid exploitation by private actors and unregulated markets. The government established Statoil, a national company, and rewarded operators who could demonstrate a move to building domestic capabilities. This practice continued well into the 1990s[53] In addition, in notable contrast to the UK, the Norwegian policies emphasized agglomeration economies, which together with building domestic capabilities, ensured the transformation of Stavanger, to a "knowledge-intensive" region.

Income and asset inequalities can create limits on growth on the one hand, and relevant technologies and sector adaptability on the other. From a structural standpoint, aggregate demand may simply not grow fast enough to fuel to need for productivity rises and opportunities in new sectors; from an institutional and cognitive standpoint, severe income disparities can exacerbate institutional scarcities and prevent complementarities from emerging.[54]

In the East Asian economies, these complementarities were less studied. In Western Europe, the institutional contradictions seem more harsh[55]. Much of the attention on industrial policies has had the benefit of effectively ignoring the realm of (a) labour market policies since most East Asian economies had fairly high levels of labour repression; where they didn't, a corporatist compact effectively managed labour relations in a manner that would be more politically and internationally complex today (b) centre-state relations and local government roles in industrial policies. In many East Asian economies, the central state held sway over local jurisdictions and industrial planning in a manner that is unusual today. i.e. institutional divergence is the norm across countries. However, not all institutional bundles are the same with respect to implications for LDCs.

[53] Hatakenaka, S., P. Westnes, M. Gjelsvik, R. K. Lester, MIT LIS Working paper 06-002, 2006.

[54] See Storm (2008), Srinivas and Sutz (2008), Taylor (2005) and older writers on structural limits to growth such as Prebisch.

[55] Benner 2006

Key features of diversification, deepening and industrial policies in the Nordic countries

Country (region/city)	Older sectors	Current Sector	Noteworthy elements	Industrial policy/national policy strategy
Norway (Stavanger)	Oil	Oil[56]	Deliberate wedding of industrial and regional economic plans, links from micro to macro policies, links between sector, tax, and regional economic development plans.	State-ownership Concessions to operators who good demonstrate investments in capacity building. Use of "goodwill points" to persuade international oil companies to contract out oil and gas research to Norwegian research institutions. "goodwill" ensured that these companies would then be considered for offshore exploration concessions. Clear guidelines for evaluating operator contributions to domestic capabilities. During the late 1980s, private oil and gas funded approx. 12% of Norway's total R&D expenditures (public and private[57]).. Drilling facilities and technologies developed with close ties to universities and public research institutes. Deliberate agglomeration strategies-strong and coordinated roles for national and local governments Tax policies to promote R&D spending by classifying R&D-related costs as immediately deductible. Significant supports to embedding universities in industrial sector research and development Macroeconomic policies aligned with industrial priorities No notable degree of diversification, but significant technology deepening.
Finland (Tampere)	Paper, stone crushing/quarrying, forestry products, construction, textiles, clothing, footwear	Overall sector today builds on cumulative and shared capabilities and labour pools, thus locational and scale advantages. including	State instituting of war-time aircraft factory and significant metal-working investments. State investments continue in some sectors, large investments in platform technologies to service all sectors in mechanical engineering and automation, cutting-edge	Diversification into machine automation, mobile hydraulics, control of dynamic systems, thermal and laser coating, flexible manufacturing and production Automation, process control systems in the pulp and paper industry. Key sector-specific and platform

[56] Hatakenaka et al. (2006)

[57] Ended in 1990s because of conflict with EU guidelines. When the goodwill policies were terminated, a systematica decline in private sector investment in R&D can also be seen.

[58] Martinez-Vela and Viljamaa (2004).

	and leather	textiles, paper, rubber, medical equipment, media, etc. Most production in turn depends on local machinery and telecommunications. Also still has 'old' sectors, textiles, clothing, footwear, and leather but with considerable sophistication. Mechanical Engineering cluster [58](process automation and machinery, variety of mobile working machines, also some glass processing machinery and stone crushing machinery) Intermediate sector process inputs to forestry, paper, electronics, mining, transport, rubber and plastics industries	R&D in universities and close alignment with firms. In some sub-sectors, state role more visible than others. Post-war reparations to the Soviet union required continued investments and diversification in metal industries, including investments by state and private firms in technical, production, and design skills of local engineers and technicians especially n machinery state-privet cooperation and investments meant that many private companies continued in these specialization areas Huge post-war shortages meant that new markets for intermediate production goods and consumption goods opened in the domestic economy Soviet union continued until 1990s as largest market for many of these suppliers. Two large companies in airplane devices and paper manufacturing, Valmet and Tampella, became large diversified industrial companies with common platform in mechanical engineering and automation Diversified companies include industrial sectors in railways, lifts, logging, container handling, air systems, terminal systems, logging, crushing, boilers, processing and chemicals, hydraulic drills, mobile mining machinery, and more recently entrants in virtual technologies, electronics, telecommunications, mobile phones, forest logging etc.	technologies: hydraulics, automation, electronics and wireless technologies. Automation is a central competitive factor in many sub-sector. Drop in traditional manufacturing, but significant intra-sectoral shifts in industrial employment, not to services employment. Despite change in several instances to foreign ownership, investments and concentration seem to have increased, not decreased. Tampere is clearly 'sticky'. Co-location uses agglomeration economies drawing from shared technologies, suppliers, process platforms. Niche market strategies by private firms, large diversified business groups, use of platform technology development in mechanical engineering and automation, Despite high labour costs, transport costs and , and delivery times, the huge agglomeration and specialization attracts world-class companies, workers, and researchers to the area., Challenges include aging workforce, ownership of foreign multinationals, mature demand and need to find new markets, increasing trend towards logistics sectors and customized services Significant efforts since the 1960s to invest in infrastructure, university ties, engineering workers, , relatively low role for national policies, but highly active private sector and local public officials.
Finland (Turku) [59]	Food, shipping, transportation	Biotech, biopharmaceuticals, diagnostics, polymer systems,	State and private sector regrouping around a broadly defined set of food, pharmaceutical and agricultural	**Significant diversification from generic drugs to therapeutics,** functional food/neutriceuticals,

[59] BioTurku: "Newly" innovative?
The rise of bio-pharmaceuticals and the biotech concentration in southwest Finland, Srinivas and Viljamaa, MIT IPC Working Paper 03-006

	equipment, chemicals, pharmaceuticals (late 19th century onwards, construction, metal work, textile and shoe manufacturing	drug delivery technologies, nutriceuticals, or functional foods, animal and human health R&D areas, biomaterials, , food processing, chemistry,	expertise. Relative absence of ICT expertise meant further investments in food, agriculture, chemicals. State strategies initiated after extreme recession of early 1990s which disproportionately hit Turku and immense unemployment. In addition, localisation of capability and the focusing on a life science identity has also played out through experiments with information technology through "Data City" in Turku between 1986-'89, a dedicated area for IT, was followed by "Bio City" in 1992. Furthermore, the national Centres of Excellence Program created further impetus for local initiatives, and concentrated resources and gave recognition to local lead researchers. National programs through TEKES also forced a greater localisation through bringing local industry and researchers together through financial and market incentives of various kinds. The *combin*ed effects were productive; more Finns abroad returned to Finland, and many from Turku were only too glad to be able to return home and find R&D opportunities available after stints in the best foreign laboratories.[60]	biomaterials, and diagnostics. Several shared platforms, and agglomeration induced by local economic planning and clustering policies, new spatial architecture to induce interactions among key research groups for inter-disciplinary areas. Significant efforts of private actors and local government, and national policies in place to recover from serious recession. universities followed relatively late. Active policies and efforts to increase spatial and organizational proximity has meant perceived spillovers in new knowledge, increase knowledge exchange, and build and attract highly skilled workforce. State –led efforts to boost private venture capital through initial public venture capital fund. Negative external economic impacts and national industrial and S&T policies strategically re-oriented by local actors and national and regional governments to city's advantage in re-amassing and revitalizing existing capability in older industrial sectors.

[60] Srinivas and Viljamaa (2003, 2007): Turning points for the Turku pharmaceutical industry:
1889-1925 Start of Finnish pharma industry, Generics manufacturing, mass production, 1940s Farmos and Leiras start bases in Turku, 1925-1980s Companies mostly acquiring foreign licenses to sell domestically. 1970s Move to greater trade. More R&D investments but greater generics sales to USSR Late 1980s product patents adopted in many other countries. Anticipation of EU membership 1989-1994 Recession, loss of USSR generics markets, M&A in pharma in global pharma industry, joining EU, shift to EU product patent regime, Turku starts BioCity 1994-2002 EU entry, further focus on R&D, consolidation of drug development R&D projects in Turku firms, layoffs, biotech start-ups and spin-offs arise, Turku pushes to develop a nationally recognises biotech base.

The Nordic countries enjoyed, it appears, these institution al complementarities that allowed labour arrangements and industrial organization to emerge that also stayed innovative (Benner, 2006). In other words, institutional complementarities of interest are those that assisted productive capabilities and the move out of natural-resource commodity exports into processing, metal and machinery specializations.

However, the social democratic Nordic model, very different from the East Asian NICs, showcase how the state's s controls with other actors over the economy can deliver productive capabilities in a nature resource economy undergoing structural transformation. The institutional complementarities can deliver benefits through shared understanding and institutions on wage restraints, public goods, goals and coordination of local economic development, labour-firm compacts to boost international competitiveness, and explicit investments in technology investments and using innovations to deliver on domestically necessary innovations, even while exporting. Many of these were unavailable in the East Asian NICs, and strong national compacts, with significant wage and labour repressions were necessary by the state to institute industrial development policies. Even where corporatist policies have been in place in the Nordic countries, there has been continued state support for infrastructure and productive investments.

The table below indicates the relative rank of different types of exports to a region's profile. In the Nordic case, natural resource processing and high-tech manufacturing are very closely linked. In the East Asian case, natural resources are relatively few, which many have argued prompted the manufacturing push of the NICs (see Haggard.)

The relative rank of different types of exports to a region's profile

World Region export rank	Natural Resource processing	Foodstuffs and primary commodities	Low-tech manufacturing	Mid-tech manufacturing	High-tech manufacturing
Latin America	2	3		1 (primarily automotive)	4
East Asia	N/A	3		2	1
Nordic countries	1	3	4 (shoes, clothing etc.)	2	1
LDCs (Africa)	1 (**Oil**-Angola, Cha Equatorial Guinea, Sudan, Tomor-Lest Yemen; **Mineral**- Burundi, Central African republic, Dem. Rep. Congo, Guea, Mali, Mauritania, Mozambique, Niger Sierra Leone, Zambia)	1 (Benin, Burkir Faso, Guinea Bissau, Kribati, Liberia, Malawi Solomon Islands Somalia, Tuvalu Uganda)	1 Haiti, Lesotho		N/A
LDCs (Asia)			1 (low and mid-tech in e.g. Bangladesh, Bhutan, Cambodia, Nepal)		N/A

UNDTAD secretariat estimates, LDC report 2008; Shapiro, 2007; various studies on Nordic economies and Eurostat various years.

Furthermore, the manner in which several Nordic countries balanced the growth of big business with the needs of smaller, decentralized production sites is instructive. As in the East Asian cases, state-big business compacts were managed in ways as to ensure that domestic productive capacities were built.

Norway's strategies were considerably later than many Nordic countries, and quite distinctive. Their efforts were directed by the state to solving specific crises and addressed to national interests.[61] Prior WWII takeover of German industrial property left significant state industrial growth in Norway. In the 1930s, the state Labour party was critical to the growth of industry, including the strategic building up of industries in new fields. In `1945, he country was only semi-industrialized relying largely on supply of raw materials or semi-processed goods. At that time, the economy relied less on mineral ore and energy sources. Domestic capital was scarce and many production technologies were incipient. The state was critical in establishing single factories to deal with particular industrial challenges. In the earlier part of the 20th century, foreign involvement in Norwegian mining and forestry was high, creating considerable worries for the state and citizenry alike. In 1906-1909, three sets of concession laws came into being to limit foreign exploitation in three core areas-waterfalls, mines, forests. [62] What is revealing is that at the time, widespread opinion was that concession laws by limiting foreign capital and involvement would

[61] Gronlie, T. 1992. Establishment of state-owned industrial-enterprises: Noway in a West Euorpean context, Scandinavian Journal of History, 17, pp.209-225.

[62] Lange, E. 1977. Scandinavian Journal of History, 2, pp. 311-330.

retard industrial development and wider economic progress in Norway. It was seen, by limiting the private use of water power, to also further support the development of more socialist institutions within the economy. In the language of complementary institutions, the right of reversion and control of property rights were important elements of the new laws. Despite political party and private sector opposition, the concession laws stayed and do not appear to have impeded industrial development. On the contrary, this led to a pathway of development through to the 1960s unlike the other Nordic countries, but which transformed Norway to an industrial nation status by the 1970s.[63]

According to the typology based on Norway's relatively late 20th century role of the state, the state has five primary functions: as entrepreneur (expanding industrial base and production activities), director (building monopolies, directing industrial activity and form of organization, controlling natural resources), champion of national values and interests (including preventing the exploitation and control of key national assets by foreign companies, increasing self-sufficiency and balance of payments), social reformer (management of benefits, social inclusion and inclusion of workers in problem-solving and decision-making) and solver of crises (taking over ailing companies or branches to prevent unemployment, retaining key production and product bases, updating organizational strategies or technologies, maintaining national prestige and political power)..[64] In other words, the state not simply as economic agent, but as political institution, with multiple roles.[65] Norway's *composite* of these five roles makes in and Finland quite unique in Western European history. While other European countries had some of these state traits, rarely did they have all five, thus making these two underscore some important lessons for LDC governments as well as international development agencies and multilateral lending and trade institutions.

The Nordic country examples therefore showcase the following elements:

1. As small, open economies, they have moved rapidly from natural resource bases to high-technology economies in export-orientation while still retaining strong ties to their natural resource base. This is *not* the story of the east Asian NICs and provides an important alternative set of lessons in industrialization.
2. Their states have been heavily influential in national and sub-national, and regional policies in the realms of productive capabilities, state investments, public employment, and R&D and manufacturing compacts with business. War-time and Post WW II state investments and the need

[63] See also Bergh, T., T. Hanisch, E. Lange, and H. Pharo. 1983. Growth and Development: The Norwegian Experience, 1830-1980, Norwegian Foreign Policy Studies, No. 3, Oslo. In Norwegian, see also Gronlie, T. 1989. Statsdrift som industrieier I Norge 1945-1963 (state enterprise: The state as an Industrial ownedr in Norway 1945-1963).

[64] Gronlie (1992) develops this in full drawing on Gronlie, (1989)

[65] The same themes are developed in Srinivas (2008), Moreau (2004).

to pay reparations were very important to the industrial histories in countries such as Finland. In all countries, however, the state has remained influential in setting parameters for congruence/complementarity through the labour market, industrial policies, and regional(sub-national) economic policies.

3. By and large, big business has been an important element to the Nordic 20th century story, but this built on several centuries of small producers who produced metal work, pulp or other outputs for distant markets. It would be erroneous to draw the big business-state relationship to sharply; in the Nordic countries, 'proto-industrialization' took root over many decades, an 'industrialization before industrialization' through varied craft industries.[66]

4. The Nordic countries have all systematically built institutional complementarities through state and non-state actors to systematically develop and transform their economies structurally. In so doing, they have invested sizably in education, healthcare, and pensions, but in ways that build a social productivist model. Unlike the east Asian NICs, Nordic countries built institutions that complemented each other in the industrial policy and regulatory domain: labour productivity and capabilities went alongside longer term compacts for social cohesion, something unusual in the east Asian stories.

5. The institutional complementarities that we can hypothesize in the historical Nordic record points to localized agglomeration in 'old' industries such as weaving, iron, steel, textile, cotton, timber, many of which have continued to be core competencies alongside 'new' industries such as biotechnology, automation engineering, hydraulics and deepening in 'old' sectors and their merger.[67]

6. The state was possibly most active when crises hit these economies, and complementarities most pursued to accommodate domestic needs and social cohesion.

The Nordic countries also show how it was possible to contemplate committing to both economic and social cohesion in the 20th century. This was done in full force in the mid-war and post-war years, and accomplished while building industrial renewal and invigorating regions through innovation, technology

[66] See Isacson and Magnusson (1987). Indeed, even in earlier periods, not only were state investments important, but also state procurement initiatives and the creation of "freetowns" , areas relatively free of guild interference, but using state procurement and government investment funds. These were important in established regions of fishing, ship-building, craft work, shoemaking, scythe forging. Moreover, these early industries evolved from basic processing to much greater sophistication in saw mills, spinning and weaving, pig and rod iron, and other semi-manufactures; gradually in a select few private foundries with state monies as well, the use of steam power. (Ibid. p. 47, 100-103).

[67] For example, in 1850 sawmill production comprised ½ of all Finnish exports; today, forestry products continue to be an important, and technologically sophisticated element of Finland's economy. Diversification has not meant abandoning its resource base into other types of manufacture; on the contrary, there is great path-dependency to Nordic economic history. Skilled work was always important, and further honed by state investments and private activity, and matched to needs in society and inputs into intermediate sectors.

development, scientific infrastructure, strong public universities, and regional/local policies that were aligned with national development. This was done while upgrading in commodities and moving into higher technology areas. However, they differ amongst themselves in their ability to keep these complementarities in place. This reflects their variations in tax and incentive policies for R&D, emphasis on extractive versus other industries, and the role of the continued *dirigiste* state in the post-EU membership phase.

Those Nordic countries hit hardest by the recession and loss of markets such as Finland (perhaps a lesson for LDCs considering how to respond to losses in commodity trade), have been most active in using the state to rebuild the domestic industrial base, find diversification routes, invest in public infrastructures and shared platform technologies. They have aggressively used universities and private research centres, and built agglomeration strategies with a wide variety of instruments. Their main challenges today lie in the change in ownership of leading firms during recession (from domestic to foreign owned) as well as global mergers and acquisitions in their various sectors.

5. Conclusion: Industrial Policies for the 21st century

It should be evident that there are several possible future policies and compacts that could set the stage for building productive capabilities in LDCs and numerous current options several of which have remained heavily under-utilized. Both the domestic and international policy environments should be revisited in light of this various current and future options to rework the financial and investment architecture within and outside these countries.

New industrial policies would at the minimum from an evolutionary and political economy perspective:

1. Systematically address scarcities of technology and institutions, including streamlining national ownership strategies with international assistance. These would require market creation and supports, building enterprise capabilities, and strategies to build aggregate demand. From an evolutionary perspective, this would require building diversity and number of actors and processes able to participate in a variation, selection, and retention perspective. It would include co-evolution dynamics and learning for innovation as core elements of future industrial policy and approaches to the state.
2. The increase in diversity and coordination activities for the state can also increase the number of

business opportunities for investment and commercial innovations, while at the same time prioritizing core areas for public investment especially in infrastructure. This would thus include the clear prioritization of ODA investment flows to these priority areas, and a planning strategy for industrial development that galvanizes employment, technology, and basic needs.

3. Include the prioritization of central and local government coordination mechanisms to boost cooperation between private actors, reduce information asymmetries and uncertainties, and minimize insurance failures associated with private investments. These might include providing literal insurance and credit buffering to reduce adverse selection and moral hazard problems for private actors in order to recoup their investments, but also opens up possibilities for stakeholder participation from cooperatives, industry associations, NGOs and others. This coordination between public and private actors, and between central and local government can be an important trigger for land-capital-labour links that build the domestic economy.
4. Build technical assistance and ODA alongside with appropriate benchmarks in order to build productive capacity in industry sectors. PRSP and other strategies should make central the specification of practical ways forward for developing anti-poverty strategies in tandem with productive strategies. These might include industrial and technological features with land regulation strategies, education and training goals for the economy. Industrial diversification within and out of primary commodities must receive first prominence in these strategies.
5. Use public procurement as a paramount tool in linking ODA, State investments in industry, to employability and development Goals. This procurement can be a critical element of inducing innovation, meeting technical standards and galvanizing investments in crucial LDC sectors with industrial effects in energy, health, education, IT infrastructure, and agriculture.
6. Induce and reward commercial innovations arising from the several strategies above through grants, prizes and other recognitions. These are likely to build Quadrant IV type innovations, but have overall impacts in the other 3 quadrants as well.

To build this new domestic and international architecture, national policy instruments that build "upstream" productive capacities and augment ownership deserve special note. As indicated in this paper, increasingly the state's essential national policy role is to build balanced strategies that galvanize multiple sectors at once. These national policy instruments must be directed to evening out the 'harmonization-necessitated' and 'needs-necessitated' challenges where "upstream", less traded productive capacities have tended to be sidelined and under-supported. While WTO-linked trade instruments have indeed narrowed, several tools continue to be notably under-utilized in dramatic fashion by LDCs. First,

most have unnecessarily low tariff barriers; second, all under-utilize technical assistance and institutional infrastructure in crucial areas of technical standards which today should be considered low-hanging fruit in industrial policy; all under-utilize the full range of trade-related options available with respect to TRIMS, TRIPS, TBT and SPS technical standards in building enterprise capacities, linking domestic economic and trade policies, and building infrastructure. Third, all have under-utilized building on links to the 'Third Role' of universities, research institutes, and extension programs. The WTO's bark is indeed worse than its bite and the LDCs have under-utilized critical options that would help them in diversification and structural change.

Another important focus of the state is to use these instruments to build domestic markets, aggregate demand, and micro-macro linkages . For smaller LDCs, the domestic market will remain a small element of the share of total trade. However the demand-side has important characteristics for broader development. Building domestic markets and bringing in private activity is a critical role for the state. The State's role in industrial policy will have to incorporate demand-side scarcity challenges and supply-side issues e.g. surplus labour and excess capacity in some sectors. For LDCs such as Bangladesh for example, this challenge is very real. Traditional fiscal instruments within industrial policy have been put to good use in inviting in FDI flows and providing credit to investors in the garments sector that has seen very rapid growth rates.

This institutional and financial architecture would involve global compacts for reorienting ODA and minimizing ODA-dependence, to increase investments in productive capacities and linking social policy/services funding to productive channels where pertinent. Instead of simply registering funds to support upgrading associated with export standards, a series of alternate investment instruments can be explored. In light of the shaky world financial context currently, these alternate investments instruments are geared to greater accountability, not less, regarding productive investments. These might include diverse tools such as angel investor pools, rewards and prizes, agreement to lowering of trade barriers for those countries which show demonstrable increases in productive capabilities, strategic infrastructure investment instruments such as metrology centres, transport. This new financial architecture would boost aid monies and could reorient industrial benchmarks and measurable impacts on the following: diversification out of commodities or deepening where relevant; strengthening links between service economies within LDCs to their existing manufacturing bases, however nascent (esp. in fisheries, agribusiness etc); increasing agricultural productivity and agricultural extension programs for food access and security and commercialization where relevant.

Accordingly, the new financial architecture would (a) rework technical assistance, agglomeration and standardization through new policies and channeled ODA (b) through global compacts to assess productive capacities and their links to ODA and social spending. For example, instead of technical assistance being ad-hoc and on country requests, aid and ODA conditionality should to the degree possible, build technical assistance in conjunction with expert assistance to LDCs for developing customized industrial policies. Similarly, the technical assistance, ODA, and expertise (technical, legal, financial, sectoral) would build the relationship between LDC industrial policies and their regional (inter-country) and national agreements. An important element of this global compact would revisit conditional bilateral agreements. Instead of bilateral agreements that undermine the credibility of LDC trade options, a global compact to assist the productive capacities of LDCs would require donors and industrialized nation partners to be signatories to ensure cohesive bilateral frameworks in their partnerships with LDCs. Regional and nation agreements can also build in special benefits for promoting sub-national jurisdictions in larger LDCs, especially in sectors such as tourism and product and place branding, which can directly exercise several trade-related options.

Overall, the ability to meet the MDGs is pivotally positioned on the ability to build industrial capacity, including the infrastructure necessary for these countries. One important element to envisioning a future financial and institutional architecture for industrial policies geared towards LDCs it to therefore galvanize financial instruments and policy links between different Millennium Goals e.g. between TF 10 (Science, Technology, Innovation) with the TF on urbanization and infrastructure upgrading, those on gender and economic development, with training and trade, environment protection opportunities with tech transfer and local innovation. To the extent that Official Development Assistance circumvents these vital channels, we can call it a significant failure of development aid, and a deliberate dissipation of energies by key donors in keeping LDCs in perpetual uneven, un-integrated, and subservient positions of trade and development. Building productive capacities can be argued to be not only entirely in line with MDG goals, but at its core although as yet rarely articulated in this manner.

For example, Targets 13 and 14 of Goal 8 need a global partnership for development for the East Developed Countries and particularly for the special needs of landlocked developing countries and small island developing states. Target 18 emphasizes benefited new technologies, especially ICTs, and particularly cooperation with the private sector in order for this to happen. These dovetail particularly well with Recommendation tool of the MDGs-particularly on the need to increase rural and urban productivity, provide a basic infrastructure services-especially water, sanitation, transportation, and energy networks, and the need for development policies to have at their center income generation and private-sector promotion strategies. Recommendations 5 and 6 require developing country governments

to link with regional initiatives and common market programs, and Recommendation 4 recognizes the need to "fast track" countries through ODA especially those requiring massive scale up on the basis of both good governance and absorptive capacity. Recommendation five also emphasizes the vital need for building training, public-sector management and community worker expertise in key areas including water supply and sanitation, infrastructure, health, education, agriculture, environmental management and nutrition. Particularly as it links to Recommendation six, these emphasize the vital industrial components of cross-border infrastructure projects including roads, railways and watershed management. These should have a galvanizing impact on the linkages between agricultural and industrial development, and the utilization of key services capacity of relevance to LDCs, especially in tourism, fisheries, and ICTs. Recommendation 8 emphasizes the importance of export competitiveness for LDCs, especially through key investments in trade-related infrastructure, especially electricity, roads, and ports. This directly complements Recommendation 9 which emphasizes the need for scientific and engineering R&D to build capacity for addressing health, energy, agriculture, and natural resource use an adaptation. What the MDG considers essential infrastructure investments are those essential to industrial policy and capacity.

Global benchmarks are therefore a necessary element of any compact to estimate the effectiveness of Overseas Development Assistance and national policies. These relate to investments in urban and rural infrastructure, the building of public sector investments and filling of technical and institutional scarcities. This is especially the case in public sector investments and upgrading, particularly the training of personnel, the links between technical training and bureaucracies, the training and recognition off inspectorates, standardization agencies, and monitoring personnel, the development of metrology and testing laboratories, and the use of large firms where available to build backward and forward linkages with small firms and suppliers. These can potentially build on the existing Heavily Indented Poor countries initiative, combined with existing benchmarks off the Millennium Challenge Corp., or the African Peer Review Mechanism of NEPAD, along with the PRSP process of the UN and World Bank. The MCC benchmarks have their own challenges for evaluation, but it is clear how several productive capacity issues in infrastructure, agriculture, industry, and services can be systematically evaluated if they should be placed at the center, not at the periphery of a development strategy.[68] The time dimension for compliance for standards must be part of this changed architecture.

Global benchmarks for the new compact would have at their core the existing industrial scoreboard indices developed within the UN agencies and used also in the Industrial Development Reports. These would include a "graduation index" for tracking not simply MVA per capita or mid- and high-tech % of exports over time, but more systematically track industrial indicators of deepening within and diversification out of commodities and the relationship between industrial policies, ODA flows and

[68] Personal communication with J. Bhatt, MCC, D.C.

aggregate demand measures. Much of this data is currently available; what is needed is the construction of composite indices that reflect the goals of building productive capacity over time. These benchmarks would set the stage not only for measuring the performance and successes of LDCs themselves, but of donors and the quality of bi-lateral agreements that may otherwise undermine gains made by LDCs on these axes. Several environmental/climate change benchmarks that have attempted innovative composite indices that blend technological, economic and socio-political indicators can be emulated in this regard. The Competitive Industrial Performance Index would need only slight modularity added to its existing features. Currently, several of its elements disproportionately focus on Quadrant I measures such as R&D spending and patents; however, measures of other quadrants II and II especially can also be built in. For example, an index that captures grassroots innovations are already being developed by several groups in India. These could be adapted for use in studying LDCs. Similarly, a composite that captures that aspect of industrial performance that best builds on changing agricultural productivity can measure path-dependencies and inter-sectoral linkages.

Furthermore, today's economic and political map is changing. A key element to the success of this new financial and institutional architecture must build on the experiences and capacities of countries that have recently industrialized and which have their own interests in expanding trade with LDCs. Thus, involving the Lower and Middle-Income Economies in Special Compact is a critical element and centers not on traditional donor countries, but those that have seen firsthand in recent years the ways in which to build productive capacity: Brazil, China, India, Indonesia, and others. This truly global compact for the new century could provide a critical role for many of these countries which already have significant and growing FDI in several African countries[69]. While to date many of these investments are in faster growing, non-LDC environments, several Indian, Chinese and other companies are building critical infrastructures for industrial capacity in several LDCs in both Asia and Africa (see OECD Report 2007). Australia, which already has several investments in Africa can be another important player in galvanizing investments from private companies, and straddling its investments in both Asia and Africa. The nature of these involvements must reflect the type of industrial investments and potential benefits for LDCs, not merely the investors. There are several considerations. For example, unlike China, the Indian diaspora in

[69] A critical element of this relationship of between India and African countries is the diplomatic push by the Indian government, with considerable African support to ensure that India obtains a permanent seat on the Security Council. India's leadership of the Non-Aligned Movement of which many African countries were important participants, India's historic anti-apartheid ties and politics , Gandhi's presence in South Africa, and various political involvements in the subcontinent of politicians and businessmen of Indian origin, plays India's long-term future and are in a different light. However whether or not these translate into linking existing productive capacities in state and private owned businesses in India remains to be seen. Indian entrepreneurs and the government remember well the backlash against the success of Indians, mass expulsion of Indians from Uganda under the Amin regime, destroying several decades of family ties, investment, and country experience. Black-Indian politics have not always been smooth, but Indian private enterprise in Africa over the last century has been a much more diversified, more deeply penetrating into the continent's life, and today, and may seem to be less threatening and perhaps less exploitative than Chinese state owned investment in Africa. Growth sectors are likely to be oil, pharmaceuticals, IT, and textiles. The Tatas a company known for extensive history and investments in Africa is substantially increasing its stake, and is known for leveraging productive capacities in skills, labour standards and infrastructure investments into sustainable wages, health, and housing.

Africa which is extensive can play and has played a vital role in building the business-state relationships necessary for building productive capacities. The entrepreneurial classes of the Indian diaspora already have substantial presences in several African countries.[7071]

Whomever the investors, to avoid a natural resource curse and to emphasize domestic ownership and to channel foreign investments into productive capacities, governments and conditional lending should insist on re-orienting a percentage of revenues from mineral and natural resource profits. While this is politically challenging, a new financial and institutional architecture and states would leverage these resources. For example, oil revenues can be required by the new architecture to be re-allocated to macroeconomic funds and microeconomic diversification strategies to prevent a resource curse. This has both macro- and micro-implications for the success of industrial policy and economic development on the one hand, and political and social cohesion on the other. If economics comprises political realities, then any new compact and architecture for LDCs must be politically astute. This is especially true for small, open economies and the ability of the state to communicate the importance of new strategies to its own population.

This is the time to reemphasize the urgency of industrial policies as a vital element of broader domestic development. In some instances, “older” policy approaches continue to be adopted, with a primarily defensive posture with respect to market instruments. The urgent task for LDCs states is to differentiate different forms of institutional scarcities and prospective complementarities when designing and implementing industrial policies. Chapter 3 provided many practical pathways and country and regional examples. The task is both deepening and diversification and the use of many instruments currently lying

[70]From small entrepreneurs to very large mining and steel investments, Indian companies have been going global aggressively, many building on the knowledge and contacts, and substantial demand from Indian-origin and other African customers. For example, in mining key investments have been made already by Indian mining giant Vedanta Resources PLC which runs Zambia's largest copper mine. Zambia's commerce minister in strategic talks, promised to build various incentive packages and investments zones especially to attract Indian companies. China has already benefited from such incentives in Zambia. Thus, part of this relationship great Africa is competitive, with the Indian government and Indian firms attempting to follow China's investment example, and perhaps likely disappointed that their own century old relationship with Africa has not been fully institutionalized in industrial investments. The experience of several successful Indian investors in Africa is one that the Indian government is attempting to highlight class distinctions in its industrial policy and FDI strategies in Africa: "The first principle of India's involvement in Africa is unlike that of China. China says go out and exploit the natural resources; our strategy is to add value," says India's minister of state for Commerce, Jairam Ramesh” (Christian Science Monitor May 2008, http://www.csmonitor.com/2008/0505/p01s04-woaf.html).

[71] A fundamental difference however, is that while most Chinese investments are state led and state owned, Indian investments are private, with the state increasingly attempting to build an industrial promotion strategy and leverage the best options for Indian firms. Indian firms are more diversified and private-public partnerships that are evolving in India to trade with Africa, may eventually be more agileThe Indian government is acting as a facilitator for future Indian business expansion in Africa. In the last five years, US$2 billion (increase in line accredit to $5.4 billion, and aid to US$500 million in the next five year) have been extended by the Indian government is credited to African countries, with the promise of preferential market access for LDC exports into India, with 34 of those being in Africa. In the instance of oil, India and China are increasingly competitive. Nigerian oil as an important source of Indian oil imports, and the Indian state owned oil and natural gas Corporation ONGC invested $720 million in Sudan for oilfield share, and pipeline investments, a move that has caught much less international scrutiny than the corresponding investments of China. (Christian Science Monitor May 2008, http://www.csmonitor.com/2008/0505/p01s04-woaf.html).

under-utilized. Ultimately however, no matter how virtuous and visionary the national and local states are, several international instruments and potential new compacts for LDC development are necessary. A new institutional and financial architecture is urgently needed for these tasks.

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