

6. The role of policy space in technology evolution: Evidence from India and what Ghana can learn

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"The technological, environmental and regional distortions plaguing today's global economy demand customized, imaginative and adaptive solutions. This can only be achieved if local innovation systems can be preserved and expanded. Informed and responsible government policies are needed to enhance three pillars of sustainable development: social, economic and environmental" (Ayala & Gallagher, 2005)."

Abstract

It is incontrovertible that development is and has always been a function of public policy. The necessity for states to have enough space, to figure out in organic manner, which policy options work best for them, cannot be overemphasized. Using national policy tools effectively and freely to navigate a development path engenders sustainable and progressive development. It is without doubt that the sharp divide between developed and developing countries is partly, if not completely, attributable to the space developed countries had to navigate their path to development. Developing countries today are confronted with enormous challenges in their bid to use domestic policy tools—especially in trade and industrial development—effectively in the midst of a strong international and domestic environment of mass liberalization. These developments have constrained the policy space of most developing countries in their use of policy tools to direct their developments. This paper argues that for developing countries to amass adequate capabilities in science, technology and innovations (STI), they require adequate policy space through the use of policy tools such as subsidies, tax and non-tax measures to accentuate their progress. As a matter of fact, developing countries can see meaningful progress in capacity accumulation in technology for development, if they have the unrestrained opportunity to choose the best mix of policy options to drive the sectors of their economies that constitute the nucleus of growth. In this regard, 'business as usual' outward policies do not work at least in the interim. The paper dwells on the experiences of India in the software and pharmaceutical industries to argue for the need for policy space in technology evolution.

Keywords

Policy Space, Technology Evolution, India, Ghana, Pharmaceutical and Software

Vol. 4 No. 2 (2016)

Issue- June

ISSN 2347-6869 (E) & ISSN 2347-2146 (P)

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1. Introduction

The conversation on why some nations are more developed than others is almost converging. Perspectives appear to converge on the fact that to accelerate a nations' progress to development, there is the need to resort to improved ways of doing things—innovative ways. It is readily noticeable that the winners in today's competitive and yet interdependent world, are those who have been able to carve an enviable niche in science, technology and innovation (STI). This recognition presents Science, Technology and Innovation as a very important variable in the calculus of national development. Owing to this, possessing adequate capabilities in Science, Technology and Innovation—products and processes—cannot be derogated against in development discourse. While all nations seeking to develop accept the view that capabilities in STI is the game changer, most developing nations have not been agile in accepting the fact that capabilities in STI are not accidentally achieved. They require conscious and well thought-out public decisions or policies. Thus, well fashioned policies with great flexibility that focuses on STI capacity accumulation as a vector of development is important in developmental resolve.

It is against this backdrop that STI policy has become one of the most important strands of public policy in contemporary national and international development. There is a re-awakening of nations to the fact that in order to survive today's competitive international environment, they must develop their competitive edge. This is in recognition of the fact that innovation will largely—for a long time to come—become a defining factor in long term sustained economic growth. The validity of this claim is not in doubt when viewed within the arc of Robert Solow's growth model, which recognizes technological progress as a key variable for sustained productivity. Capacity accumulation in STI is thence imperative if nations can conveniently join the global value chain and derive maximum benefits from the world's economy.

Within this renaissance, this paper argues that in order to accumulate adequate capacity in science, technology and innovation—in process and product—business as usual outward policies will not bring the desired outcomes. There is the need to tailor make policies that respond to the unique demands and conditions of developing countries. Policies that uniquely respond to the demands of national development, firms and industries in an evolutionary manner to enable them develop enough capabilities to make them competitive. To be successful in this enterprise, there is the need for developing countries to have enough space to figure out organically, what strategies and policies best work. Policy space for national development strategies has thus been recognized as

indispensable to developing countries by recent events in the international development (Muchhala, 2007). This study explores the relevance of policy space for capacity accumulation in STI.

The paper precedes under three sections. The first section conceptualizes policy space and how it applies to STI policy making. The second part explores the current debate on policy space and how it has risen to the fore of developing countries' discourse at international platforms. The third section looks at how India and some other Asian economies have created or used policy space to amass capabilities in STI. The third section draws lessons for Ghana.

Conceptualizing Policy Space

There is no doubt that the issue of waning policy space is duly acknowledge by developed and developing countries as an issue in the growing interdependent and rule-based international system (see UNCTD, 1964). However, there exists a division on whether or not shrinking policy space has negative implications for developing countries to forge their development through national strategies. The argument for policy space as advanced by developing countries is based on the idea that they must be able to choose the best policy options to navigate their development within the interdependent world. That is, the trade-off made by being part of the global systems must be developmentally re-enforcing rather than inimical.

Conceptually therefore, policy space in the scheme of developing countries "is about their freedom to choose the best mix of policies possible for achieving sustainable and equitable economic development given their unique and individual social, political, economic, and environmental conditions" (South Centre, 2005).¹ Muchhala notes that policy space refers to the scope a nation has for building its own national development strategy and its relationships within the world economy and markets (Muchhala, 2007). The concept of policy space is derived from three established principles of international law namely; sovereign equality of states, the right to development and the special and differential treatment (S&DT) for developing countries.² These three principles place the onus on national governments to make and implement their own strategies for development. However, as noted earlier, the paradox remains that countries are primarily responsible for enacting their own policies, but are not afforded the policy tools within the interdependent international environment. The push for liberal economic orthodoxy that spins on the wheels of international capitalization, marketization and liberalization has greatly affected nations especially developing economies in their quest to progress and catch-up with their industrialized counterparts.

¹South Centre, "Policy Space for the Development of the South," No.1, November 2005, <http://www.southcentre.org/info/policybrief/01PolicySpace.pdf>

² These principles were affirmed in the General Principles 1, 3 and 15 of the treaty of UNCTD, 1964

In this regard, there is the need for a paradigm shift or to be more generous, a need to give practical heels to the rhetoric of S&DT for developing countries. Specifically, S&DT for developing countries should not be time-bound by creating limited transitional timelines in international agreements—especially those that bother on industrial development—instead they must make room for evolution. This requires transitional periods for adherence to multilateral rules to be a function of levels of development and technological need of the developing country.

Situating the concept of policy space within the framework of STI policy making, therefore, a critical question such as; what are the policy requirements for promoting learning and technical change, should drive discourse. Getting a practical answer to this nagging question is imperative, especially against the backdrop that STI policy remains a top policy itinerary today amongst developing countries. The paper suggests that conventional tools need to be modified and sharpened to deal with the practical needs of technology policy (Lall & Teubal, 1998). To be successful, a good balance must be achieved between the role of government and free market forces—an area of great controversy. The controversy revolves around how much government should intervene in and to what extent these interventions should go. The debate has also tended to focus on the role of *selectivity* in government intervention—selectivity being defined as the targeting of particular activities as opposed to their *functionality*—functional interventions are intended to improve markets, in particular functional markets without favouring particular activities (Ibid). Indeed '*jack of all trade master of none*' policy roads do not exude any significant promise when traversed in STI policy making and capacity accumulation. This argument is sacrosanct when viewed through the prism of the success stories of Asian economies of Taiwan, Hong Kong, South Korea and Singapore (collectively referred to as the Tigers), Japan and the newly Industrializing economies of Indonesia, Thailand and Malaysia. It is now accepted that most of these East Asian governments intervened widely and in many different ways, in their markets to foster development and in some cases the development of specific industries—some industries were promoted while others were not (World Bank, 1993). In contrast, Thailand is caught in the middle income trap due to its functional intervention with virtually no selective policy measures such as credit allocation and special tariff protection, targeting particular industries or clusters, as these were regarded as market distortions by mainstream economists (Intarakumnerd, 2015). And yet again, the need for targeted or selective government policies becomes more convincing when Thailand's relative success story in the automobile industry is reviewed. The relative success of Thailand in automobiles is due to targeted government intervention (Ibid).

It is commonplace knowledge as noted earlier, both in economic theory and practice that markets are not always perfect. Imperfect markets necessarily warrant intervention—that is even when the market exists. In most developing and least developed countries, especially in Africa and some parts of Asia where vibrant allocative hands of markets do not exist, and even when they do

they are dysfunctional, government interventions are critical both to stimulate and create them. What is even more compelling for government interventions in capacity accumulation in STI is that “strict reliance on a market system will result in underinvestment in innovation, relative to the socially desirable level” (Martin & Scott, 2000). Market fundamentalists tend to treat all markets as the same and hence measure all market failures with the same yardstick. This is erroneous simply because some markets are stronger than others. This supposes that in developing countries where markets may be weaker, market failures will be greater and this warrant stronger government interventions—especially in risky ventures that require high investments. Besides, the market is not a disinterested entity as market fundamentalists would portray it. The invisible hands of the market are not disinterested forces, instead they respond to incentives. When STI capacity accumulation which requires Research and Development (R&D) and initial investments tend to be risky, the incentive to invest will be less. Hence the government must intervene and act as a risk taker. This may require deliberate policies that may not be market friendly initially.

In this sense, government interventions through targeting—using policy tools such as tax, subsidies etc.—do not contradict market principles, but complement them. Targeted interventions for STI development are market-stimulating policies and economically justifiable, even though in some circumstances they may require strong interventions in free markets for extended periods or doing without markets altogether (Intarakumnerd, 2015). Governmental policies should particularly target activities across sectors, clusters or industries which hold the key to spurring growth. It will suffice to say that in technological capacity accumulation, *laissez faire* approaches do not bring about the improvements sought when applied to STI policy. In most cases, laissez-faire policy by governments may leave the economy or some parts of it in a vicious cycle (Easterly, 2001). The situation may be particularly acute in developing economies. In this sense, the need arises for developing countries to tailor their policies to meet their technological needs. This suggests that development strategy should aim at achieving economic expansion via the accumulation of appropriate ingredients or capabilities to increase production capacity at the firm or project levels (Yanagihara, 1998). This requires governments or policy makers to act like venture capitalist rather than a Walrasian auctioneer (Lall & Teubal, 1998). Neo-classical innovation theorists argue that technology is readily available and will be cheaper to import so why the need to attempt growing local technology? Such arguments are simplistic and nothing more than a sheer assumption that technology diffuses and tends to create positive externality. It is a foregone conclusion that not all technologies are diffusive or create positive externalities. In cases where technology may be transferable, absorptive capacities are not the same and there is still the need to invest in absorptive capacities. This is true for most agriculture technologies which are mostly location specific (See Hayami, 1974). This projects the evolutionary approach to the forefront of STI capability building.

It is instructive to note that development is path-dependent—so is capacity accumulation—and the policy options and approaches adopted determine the path. It goes without saying that the tardy progress seen in most developing countries today is a reflection of the development path and the policy options that have prevailed over the past decades. The imperatives of the 21st century demands that a recalibration of this is done. Developing countries should target specific areas with their STI policies to spur growth. In so doing, the paper advocates an international environment that supports such policies rather than constrain them. Such an environment will mean giving development countries a significant niche within the interdependent world to manoeuvre their development especially in the area of STI and/or industrial policy.

To this end policy space as used in this paper *connotes effective and free use of national policy tools to direct progress in order to accumulate capabilities in technology without undue constraints from the global environment*. This paper does not discount the fact that policy space can be constrained by domestic forces as well. For instance domestic interests that may benefit from large imports may kick-against import substitution industrialization. However, this paper focuses on exogenous factors that shrink domestic or national policy space with the reasoning that it is easier to legislate or adopt policies to control domestic factors than with global players. This is with the understanding that development is an endogenous concept. It ought to be that nations drive their own progress by choosing a combination of policy options that respond uniquely to the demands of their development. This does not also disdainfully discount exogenous factors like the role FDI plays in capacity accumulation through technology transfer. However, the paper argues that an existence of an FDI friendly environment may create just an open sesame which is a necessary condition but not sufficient requirement for the transfer of technology. A deliberate strategy that not only attracts but leverages investment while creating the right linkages between domestic industry and FDIs is crucial. Such strategies warrant a degree of domestic autonomy. However, the emergence of a rule-based and interdependent world has punctuated such domestic policy props needed to a large extent.

Technological or technical evolution is used in this paper to denote the gradual accumulation of capabilities in STI in an interactive manner within the framework of conscious policies and strategies. While this process may be part of a broader industrial policy, the paper is tilted toward science-based capacities accumulation. The paper conceives of this evolution as non-linear but rather interactive and yet organic. The process should effectively combine invention, imitation and innovation. The success is therefore based on some measure of organism at the policy level, allowing for experimentation and policy learning. This suggests that there is a link between policy space and technology evolution.

To fully provide a basis for the need for policy space in developing STI, the paper explores the Asian experience—focusing on India in the software and pharmaceuticals arena—in the use of

national policy tools to spur their development, through the accumulation of capabilities in the area of science, technology and innovation. It will be realized that, India's success in software and Pharmaceuticals got initiated endogenously at a time where international rules were less constraining. This also explains why India had the relative freedom to employ methods that contradict mainstream economic orthodoxy or strict market principles and thus may be difficult to replicate within the current international environment.

2. Exploring the Perspectives on Policy Space

In principle, global development discourse to all its intents and purposes has been about shared growth and development. A scan through post-war treaties and founding documents of the champions of global development such as the United Nations (UN) systems and neo-liberal institutions that emerged after the Second World War (WWII) conveys these intentions. The principal conveying belt of the post-WWII global development paradigm has been the principle of market liberalization. The pivotal rationale of the principle of market liberalization is that the unfettered movement of goods, services, finances and capital across national borders enhances global welfare, accelerates national development and eradicates poverty.

In the quest to realizing this feat, the ubiquitous idea of reducing the state into a facilitator—'*rolling back the state*'—and allowing the market to operate with little or no control became popular. This particular idea has been particularly pervasive in trade and industrial sectors following the formation of the GATT in 1947 and subsequently the WTO in 1995.³ However, after several decades of market liberalization, most developing countries are yet to realize meaningful benefits (Easterly, 2002; Moyo 2009; Collier, 2008)

Owing to this, the need for effective state—*developmental state*—involvement in not only creating the appropriate policies to regulate but lead the market has re-emerged on the agenda of developing countries' development discourse. This is particularly true given the fact that there are lots of market imperfections or failures in these countries. It is undoubted, both in economic theory and practice that market failures provide the basis for government roles or interventions in markets. However, the controversy, as noted earlier, has been how and to what extent governments should intervene and when they do, what policy tools are appropriate to correct market failures. The prevalence of neo-liberal economic principles expressed in the multilateral rules—especially multilateral trade rules—have shifted the post towards limited state intervention even in market failures. The international systems have constrained significantly the ability of states to use national policy tools to navigate their development. This is conspicuous when states attempt to lead

³For more analysis on how the GATT/WTO has shaped the issue of policy space see Keck, A., & Low, P. (2004). Special and Differential Treatment in the WTO: Why, When and How?

markets—*state capitalism*—rather than be just facilitators of markets. The shrinkage in policy space has been particularly striking in the area of trade and industrial policies (Chang, 2006). This has been recognizably so, especially in the 1980s when the World Bank and the IMF made trade liberalization—involving tariff cuts, tariffication of quantitative restrictions, and the reduction in non-tariff barriers (NTBs)—a key condition attached to their loans (Ibid). Chang observes that apart from aid and loan conditionality's, the policy space of the developing countries are further limited by the (real and imagined) threat of capital flight in the environment of open capital markets, leading to the adoption of pro-investor policies that may not inure to the benefit of these countries (Chang, 2006). (Chang, 2006)

The continuous expansion of the multilateral trade rules—following the conclusion of the Uruguay round under GATT in 1994 and the inception of the WTO in 1995—has brought areas that were hitherto controlled by national laws under international purview. Multilateral rules covering areas such as patents (through TRIPs), regulation of foreign investment (through TRIMs), and trade in services (through GATS) are notable. Beyond the circles of the WTO, developed countries have through bilateral agreements with developing countries further invaded the policy space of developing countries. Bilateral agreements are mostly used by developed countries to establish demands that could not be realized at the multi-lateral levels.⁴

It is worth noting that though far from practical, the multilateral trading systems have recognized the need for special and differential treatment for developing and least developed countries (LDCs). For instance the fifteenth General Principle of the United Nations Commission on Trade and Development (UNCTD) Charter (UNCTD, 1964) stipulates “The adoption of international policies and measures for the economic development of the developing countries shall take into account the individual characteristics and different stages of development of the developing countries, special attention being paid to the less developed among them, as an effective means of ensuring sustained growth with equitable opportunity for each developing country”(UNCTD, 1964).⁵

Affirmatively, paragraph 8 of the São Paulo Consensus⁶ notes “The increasing interdependence of national economies in a globalizing world and the emergence of rule-based regimes for international economic relations have meant that the space for national economic policy, i.e. the scope for domestic policies, especially in the areas of trade, investment and industrial development, is now often framed by international disciplines commitments and global market considerations. It is for each Government to evaluate the

⁴ For an example and further discussions on this matter, see the current Economic Partnership Agreement (EPAs) between the European Union (EU) and the African Caribbean and Pacific (ACP) group of countries.

⁵ United Nations Conference on Trade and Development (UNCTD, 1964). *Proceedings of the United Nations Conference on TRADE AND DEVELOPMENT*. Final Act and Report. E/CONF.46/141 Vol I http://unctad.org/en/Docs/econf46d141vol1_en.pdf

⁶ The São Paulo Consensus was adopted at the 11th Session of UNCTAD held in São Paulo, Brazil. At this meeting the issue of policy space strongly featured on the agenda.

trade-off between the benefits of accepting international rules and commitments and the constraints posed by the loss of policy space. It is particularly important for developing countries, bearing in mind development goals and objectives, that all countries take into account the need for appropriate balance between national policy space and international disciplines and commitments” (UNCTD, 2005.)

During the mid-term review (MTR) of the UNCTD in 2006, the issue of policy space took a center stage in the discussions. The developing countries reiterated the need to have space to drive their development. Particular reference was made to paragraph 8 of the São Paulo Consensus. The striking development worth noting is that, the discussion at the MTR was divided between developed and developing countries. Developed countries led by the United States argued that the concept of policy space is dubious which has become a negotiating tool and orthodoxy by developing countries without any demonstrable grounding in fact and that there is no persuasive empirical evidence proving that on balance developing countries have systematically suffered in the long term by giving up some policy space in exchange for a trade agreement or IMF loan (Khor, 2006). The US intimated that all countries are sovereign in policy making and it is by their own choice that they limit their policy options (Ibid).

The G77⁷ and China in stark contrast to the U.S position posited that, it is true in principle that countries are sovereign in policy making; however, it is paradoxical to note that countries are primarily responsible for enacting their own policies, but are not provided with the policy tools (Khor, 2006). China further observed that the failure of structural adjustment policies and the rejection of the one-size-fits-all approach also provide the rationale for the promotion of policy space (Ibid). The discussions on the matters have not been different within the WTO. The debate on the need for special and differential treatment (S&DT)⁸ for developing and least developed countries, has taken similar trends.⁹ While developed countries continue to push for more multilateral concessions, developing countries continue to ask for more domestic breathing space.

One thing is clear in the policy space debate. None of the countries on either side of the divide denies the fact that the increasingly interdependent and rule-based world has waned off some policy space of developing countries. As noted above, the general principle 5 of the UNCTD treaty of 1964 and the paragraph 8 of the Sao Paulo Consensus places the onus of policy making on individual countries. However to argue that it is nations’ choice that they limit their own policy options amounts

⁷ The G77 refers to a group of 77 developing countries mostly from Africa, Caribbean and Pacific

⁸ See the Special and Differential Treatment Provisions in WTO Agreements and Decisions. WT/COMTD/W/196 14 June 2013 Committee on Trade and Development

⁹ For instance the division between the developed and developing countries on the so called Singapore Issues (Competition policy, trade facilitation, transparency in government procurement and new Investment rules) is a case in point. While developed countries sought further concessions and multilateral rules on these areas, the developing countries argued that their policy space will be eroded. This division led to the collapse of the Cancun ministerial in 2000.

to oversimplification of how the world has become—interdependent. It is within this kind of reasoning that this paper argues that when applied to STI policy, conventional policy options would not bring about the expected outcomes. Therefore, if developing nations choose policy measures that may in the short term contravene market principles, there should be an international environment within multi-lateral trade rules that support them rather than tag such measures as market distortions. This, situated within the concept of this paper would demand S&DT for developing countries to amass capabilities in STI through their industrial and trade policies.

3. The experiences of India in Amassing Capabilities in STI

The transfiguration of some Asian countries from ‘rags’ to ‘riches’ remains a myth when measured against the standard indicators in neo-liberal economic orthodoxy. India presents an impressive case of the need for policy space for capacity accumulation in technology and innovation. With a GDP per capita income of US\$1,587 and real GDP growth of 7.6% as of February 2016 up from 7.2% in 2015 (EXIM Bank of India, 2016), India is still a middle income country according to the World Bank’s classification, albeit with high prospects for sustained growth. A couple of decades ago, Indian like many economies in Africa today, conveyed an image of poverty and destitution. Today, the dramatic growth of Indian software and pharmaceutical industries has projected its image as techno-savvy (Bhatnagar, 2006). As had been highlighted earlier, this impressive feat attained in the technological frontier in these sectors did not occur by accident. They are a result of well-calculated steps at individual firm levels combined with supportively targeted government interventions. The specific government interventions or policy tools will be discussed in turn.

3.1 The use of Tariff and non-tariff measures

It is a recognized fact that taxation remains one of the oldest, if not the oldest policy tool for nations. Tax policies, depending on the intentions of government, can be used to encourage or discourage economic activities within national borders. India in her drive to position herself on the path of development used this policy tool effectively, especially in amassing technological capabilities in software and pharmaceuticals. After independence, India recognized that foreign know-how would be required for development; however, India wanted to derive maximum benefits from such investments. To this end, the nation’s first economic plan regulated foreign investments in India through strict controls and conditions (Sampat, 2010). India’s industrial policy during this era, like many developing countries, was based on import-substitution industrialization which aimed at self-sufficiency. For examples in the 1950s and 1960s India enacted the Foreign Exchange Regulation Act (FERA) to regulate foreign capital in India. Among other provisions, the Act required firms to reduce

foreign equity holding to 40 percent if they wished to be treated on equal terms with Indian companies (Ibid).

One sector that saw evolutionary supportive government policy was the software industry. After the introduction of the FERA, IBM exited the Indian market since it could not abide by the provisions. Indian government and software firms saw this as a great opportunity to give practical meaning to the Indian government's self-sufficiency drive through import-substitution industrialization. Athreye (2005) reckons that from the early 1970s to late 1990s series of policy measures—such as tax incentives, import restrictions, conditional imports, tax differentiation and direct subsidies—which met the specific needs of the software industry were enforced (See Athreye, 2005). From 1972 to 1999 nine (9) policy regimes were seen in the software industry alone with each of them targeting specific activities and achieving defined objectives.¹⁰ This led to a steady growth in the Industry at 30 percent annually for 20 years (Bhatnagar, 2006)

The success of such government policies along with firms' ingenuity in the software industry for instance, will be clearly appreciated when contributions of the software industry to India's economy is looked at. The National Association of Software and Services Companies (NASSCOM) estimated 2014-2015 export revenues to reach \$99 billion up from \$86 Billion. Together with the domestic market, the Indian Software industry is pegged at \$118 billion adding 11% to GDP up from 1.2% in 1998. The software industry alone directly employs 1 million people and provides indirect employment to about 2.5million. In a recent study by NASSCOM, it was found that the industry employs 2.2 million people directly and 8 million people indirectly, up from the previous years. Again its exports share accounted for 14 percent of the India's total export.

It is projected that by 2020, 18-20 percent of India's total export revenue will come from the industry with direct and indirect employment reaching 10 and 20 million respectively. Most interestingly, 74 per cent employees in this sector are less than 30 years old and 35 per cent are less than 25 years of age with 31 percent of employees been women by the FY2009. The point here is that, the sector not only provides employment but contributes to solving youth unemployment and gender inequality in India.

NASSCOM notes that in terms of foreign direct investment (FDI), the information technology-business process outsourcing (IT-BPO) accounts for 10 percent of all India's FDIs. In 2010 NASSCOM observed that India's share in global outsourcing market rose 55 percent up from 51 percent in 2009. IT-BPO sector has a footprint that covers 52 nations, 200 cities, and 400 delivery centers. 10 companies are listed on overseas stock exchanges and the entire industry addresses the

¹⁰Athreye categorized the Indian software Industrial growth into four stages—the early pre-1984, the n entry and Experimentation (1985-1991), Imitative entry and financial liberalization (1992-1999) and finally the consolidation and slowdown (2000 onwards). Each of these stages enjoyed different government policy regime that responds to the needs of the industry. A combination of tools were used including taxes of up to 100% duties in import competing products, FDI restrictions etc.

needs of over 400 Fortune 500 customers.¹¹ The regulation of investments to enhance local capacity was not peculiar to the software industry alone. The pharmaceutical industry also had government policies that regulated foreign investments for local capacity development. Mazumdar (2013) observes that the Indian government's Industrial Policy statement of 1948 initially adopted a liberal attitude toward Multi-National Corporations (MNCs) to lure them into establish manufacturing plants in India without licensing agreements. The liberal policy led to increased flow of foreign capital into the sector, but it was soon realized that the foreign companies did not establish any production plant in India, instead they were engaged in assembling bulk drugs imported from their home country with the obvious reason that it was cheaper and did not require heavy investments in plants and machinery.

To make sure that these foreign investments inure not only to the benefits of the foreign capital owners but also to local capacity building, the Indian government made it compulsory for MNCs to establish their production unit in the country and begin drug production from the basic stage under its Industrial Policy Resolution of 1956. This policy categorized industries into three classifications, demarcating areas where the state had exclusive control, areas for only domestic players and areas for the general private sector including foreign capital investments (Ministry of Trade, 1956). Sooner rather than later foreign companies established local production plants and started production in India in fulfilment of the regulatory requirements. It is worthy of note that while the 1956 policy recognized the role of foreign capital as a supplement to domestic saving toward investment, it dictated that the majority share in management, ownership and control should of investment be in the hands of Indians (Chand,). This was meant to enhance technology transfer and undoubtedly both the pharmaceutical and software industries benefitted from this provision.

A major push was given to start-ups under the policy through the provision of initial pre-requisites such as direct subsidies, tax differentiation, technical training at supervisory levels and large scale apprenticeship schemes of training (Ministry of Trade, 1956). Mazumdar (2013) recounts that during this period a large number of domestic companies entered the market mainly due to government support under the Industrial Licensing Act and started producing a wide range of products (p.20). Between 1952 and 1962, drug productions in the industry increased from Rs. 35 crore to about Rs. 100 crore. Besides, the capital investment for the sector was about Rs. 56 crore in 1962 as compared to its value of Rs. 23 crore in 1952 (Ibid). As a result of this policy, local indigenous companies took over the production of bulk drugs with MNCs possessing less than 12 percent share—only 19 out of 66 MNCs were engaged in bulk drug production.

The Indian story conveys two important points. It portrays an economy that regulated investments—*FERA rules and IBM exit, 1956 Industrial Policy*—for the purposes of amassing technological capacity in sectors that have grown to become a pull factor for investment. It is also

¹¹See more at: <http://www.nasscom.in/impact-itbpo-industry-indian-economy-and-society?fg=71038#sthash.xR9LT785.dpuf>

worth pointing out that the mere creation of liberal investment climate may not attract the requisite investments needed to amass capability and this stresses the need for selective/targeted policies. Secondly, India's success story depicts the effective use of local policy tools to amass adequate capabilities, at a time when the multilateral rules were less constraining to become a major player today. Needless to say, India used policy measures that would be described as market unfriendly in neo-liberal parlance in the 1970s up to the late 1990s to achieve market efficiency today. Without a doubt, the demand for local content and preferential treatment for domestic industries in the software and pharmaceutical industries would have been difficult if not impossible under the current WTO regimes (See Article III of GATT 1994, Articles 1& 2; and Paragraph 1&2 of TRIMS). Despite liberalization in 1991, the software industry had flourished signifying the inherent strength that it had developed due to the benign environment provided over a period of time and the deliberate government interventions leading to the decline in telecommunication cost (Jhamb, 2011). Put differently, by the time of full scale liberalization, Indian software and pharmaceutical industries had developed dynamic capabilities, tacit knowledge and adequate capabilities to survive international competition. This underscores the point that after all, international market liberalization is effective when participating nations have capabilities to contribute.

It will suffice to say the much celebrated Asian economies referred to as the Asian Tigers — South Korea, Hong Kong, Singapore and Taiwan—used similar unconventional policy measures in their early stages.

It is the argument of this paper that an investment needs protection or at least an environment within which they can thrive. For instance, the push for increased trade liberalization is partly due to the fact that global capital and business interests are protected or enhanced when international economic environment is liberalized. In the same vein, national governments have interests. If it is in the interest of governments to invest in markets stimulating technologies in order to correct local market imperfections in the short term towards long term sustainable development, then the same reasoning demands that it protects its investments.

The big question that arises is whether other developing countries in general and Ghana in particular can chart the Indian path in their quest to amass capacity. It is worrying to note that it will be difficult if not unthinkable in the contemporary international environment under WTO's trade related investment measures (TRIMs) to regulate/control investment.¹² Under TRIMs nations are supposed to give national treatment to foreign companies. This particular provision does not only constrain nation's policy space and policy learning particularly their industrial policy, it also kills nascent industries. Indeed, competition is good but unfair competition leads to stagnation. When viewed within the framework of the infant industry argument, many developing countries today will continue to face insurmountable problems due mainly to the fact that their nascent industries cannot

¹² See articles 1 and 2 of the TRIMs agreement. See also Article 1 of GATT 1994

develop *their tacit* knowledge in capacity accumulation because they are supposed to open up to steep competition from advanced industries. It cannot be derogated against that capacity accumulation especially in technology is an evolutionary process. This process need to be carefully and selectively guided with appropriate policies—in many cases policies that slap liberal economic orthodoxy in its face—Difficult to do in today’s world.

3.2 The use of government Procurement

Apart from tariff and non-tariff measures, one other policy tool that India used effectively to encourage its technology building in the software industry in particular is government purchases. Though the Indian software industry is significantly exported-oriented today, the role played by a government policy to procure and use Indian software cannot be under-estimated in the industry’s capacity building at least in its early stages.

Athreye (2005) intimates that in the early 1980s, domestic demands for software came from the public sector. He observes that the Indian government’s attempts to build nuclear and space capabilities, coupled with other high-profile public projects, such as the computerization of Air India reservations, the ASIAD games results and Indian railways provided learning opportunities for the first domestic firms (Athreye, 2005). Despite the small domestic installed base of computers, early Indian firms were exposed to a large variety of software platforms and a range of projects—mainly public—that varied in their complexity (Ibid). “Thus a range of programming skills and knowledge of software languages were accumulated by the Indian firms” (Ibis) through these public procurements.

In the late 1980s and early 1990s, government procurement remained an important policy tool for boosting India’s capacity accumulation in software. For instance, following the introduction of the Software Policy of 1986, the Indian government experimented with preferential procurement of domestic software and imposed duty of 60% on the value of imported software (Ibid). This was done to discourage import of software in favour of local software products. In both the pharmaceutical and software industries, the public sector played critical roles in spurring private capability accumulation, via procurement, training, technical assistance and consultation (Sampat, 2010). Government procurement continues to contribute a significant learning platform for Indian companies. For example, the Indian e-Government project which ropes in all sectors of governance falls upon Indian companies to become a reality. The use of government procurement demonstrates that, in technology capacity accumulation, the first customer is government. The use of public purchases provides an initial market and platform for learning. Thus the state through its various agencies has the potential to disseminate new ideas rapidly using its procurement, commissioning and regulatory functions to shape market and drive technological advancement (Mazzucato, 2015).

While this tool is important as the Indian case shows, public procurement as a policy tool has come under considerable pressures from liberalization on multilateral platforms. Transparency in government procurement was one of the four controversial issues—*Singapore Issues* so called— that appeared on the agenda of the first WTO ministerial in Singapore in 1996.¹³ The developing countries mounted a stiff opposition against any multilateral agreement on government procurement which eventually led to its rejection. An agreement on public procurement would require members to liberalize national and local government purchases to include foreign bids, publish all existing national laws on procurement and provide measures for complaints and redress if a foreign firm feels aggrieved by a bid decision. The developing countries argued that a multilateral agreement on procurement would limit their policy space particularly their industrial policy. It is important to recall that the government procurement was excluded from the GATT 1947. The 1979 and 1994 Government Purchasing Agreements (GPA) was plurilateral. As of now no developing country has signed this agreement for the obvious reason of retaining preferences in procurement as an industrial/development policy instrument and resistance from vested interests benefiting from closed procurement markets' (Woolcock, 2008)

However, while there exist no multilateral agreement on this issue in the WTO, it is worrying to observe that the issue has found its way into bilateral agreements. For instance the liberalization of government procurement is provided for in the economic partnership agreements (EPA) between the European Union (EU) and the African Caribbean and Pacific (ACP) countries.¹⁴ This implies that these countries may have limited space to use government procurement to prop up nascent industries and to direct industrial policy in the near future if the agreement becomes effective.

3.3 Patent as a tool for Technology evolution

Opinion is divided and studies have produced counter claims on the relationship between strong or weak patent laws and innovation. Some studies (Boldrin & Levine 2013; Parra, 2014) found no positive impact of strong patents on innovation, R&D, FDI and knowledge transfer—in some cases strong patents discouraged innovation. Others found that strong patents encouraged innovation, technology transfer R&D and FDI (Hall, 2014; Grabowski, 2002; Moser, 2003). Yet other studies have unravelled varying results of the impact of strong patent on innovation across industries and countries (Allred & Park, 2007). These findings project the point that there is no one-size-fit-all patent policy for all countries and across all firms and industries. What is important is patent laws must respond to the technological needs of a country as a whole and its particular industries.

¹³ https://www.wto.org/english/thewto_e/whatis_e/tif_e/bey3_e.htm

¹⁴ See the EPA text between ACP states and the EU for instance Article 167 A 2(a)

India presents a very interesting patenting history regime which underlines the need for patent laws to co-evolve with technology needs. India's patent story is one that has co-evolved with her technology, particularly in the pharmaceutical frontier. "India began its history as an independent nation with relatively strong intellectual property rights for pharmaceutical products. India adopted the British Patents and Design Act of 1911 after independence in 1947 and kept this law until 1972" (Arora et al, 2009). The birth of independence and India's quest for self-sufficiency ushered in a new dawn in patenting—patent must evolve with industry.

It was widely believed, at least in India, that the strong IPR regime effectively prevented the development of an indigenous drug industry (Ibid). This posture concurred with findings that there is little clear evidence to show that stronger patent protection encourages indigenous innovation in developing countries (Hall, 2014). This fed into the general belief in India that the existing patent laws benefited foreigners over Indians (Sampat, 2010; Arora et al, 2009). A specific concern was that the provision to grant product patents on pharmaceutical products—contrary to many developed and developing nation's patent policies at the time—was not in its national interest, leading to high drug prices and suppressing local production" (Sampat, 2010). This necessitated the setting up of several committees to review the Indian patent "with a view to ensure that the patent system was more conducive to the national interest" (Sampat, 2010).

Sampat (2010) recounts that a report by a former Supreme Court Justice Rajagopala Ayyangar provided the basis for a new patent law that changed the Indian pharmaceutical frontier. A practical answer to the question; is the patent system necessary in India, arose. Ayyangar argued "the precise provisions of patent law have to be designed with special reference to the economic conditions of the country, the state of its scientific and technical advance, its future needs and other relevant factors so as to minimize if not to eliminate the abuses to which a system of patent monopoly is capable of being put" (Ibid). Consequently the Patent Act of 1970 was enacted and modelled on the Ayyangar recommendation.

Among several things, the new law which became effective in 1973 limited patent strength, broadened grounds for issuance of compulsory licenses and provided for a research exemption. Patent term was shortened from sixteen to fourteen years and then to seven years in food, drugs and medicine. One remarkable thing was that product patents in pharmaceuticals were abolished and compulsory licensing after three years was made mandatory (Sampat, 2010; Mazumdar, 2013). In furtherance of its pharmaceutical company evolution, the Indian government amended the 1970 Patent Act. In the amended Act, an MNCs could patent only one process with further provisions that foreign companies with an equity holding of more than 40% and engaged in the production of only formulation products or bulk drugs not involving 'high-technology', should reduce their equity holding to 40% or below (Mazumdar, 2013 : 22). The New Drug Policy (NDP) of 1978 had reservation for the domestic manufacturer for the production of various categories of drugs (Ibid).

The combination of the 1970 Patent Act and further regulations gave the domestic companies an edge in the pharmaceutical industry.

Following the patent act, the indigenous sector acquired capabilities to produce three quarters of bulk drugs (Chaudhuri, 1984). It is estimated that foreign firms' share of retail sales in Indian market dropped from 75-90 percent in 1970, to 60-75 percent in 1981, 49-55 percent in 1991 and 28-35 percent in 2000 (Chaudhuri et al, 2006) .

So it will be realized that from the beginning of the late 1990s and early 2000s, there has been a great shift in regulatory frameworks for the pharmaceutical sector. For example the NDP of 1992 and 2002 ushered in a shift toward full scale liberalization. Measures such as the abolition of the compulsory licensing for MNCs, 100 percent inward FDI has been allowed, new regulations to deal with spurious drugs to maintain international credibility are being implemented and more importantly WTO-compliant measures have been adopted, one of which is the introduction of product patent (see Mazumdar, 2013). What is important to note here is that these measures at this stage are capacity-reinforcing rather than capacity constraining because the needed capabilities have been amassed.

As noted earlier, it is conventional wisdom that technology evolution is a combination of invention, innovation and imitation. The Indian patent architecture took the local companies through these processes effectively. India became an important exporter of generic drugs accounting for 4 percent of global generics market in 2004 and projected to reach 33 percent by 2007 (Mani, 2006). This success story of growth and development of the pharmaceutical industry in India is due partly if not wholly to the flexible provisions of the Patent Act of 1970 and other supportive policies of the Government of India (Mazumdar, 2013).

With full knowledge of the Indian's evolution process in the pharmaceutical sector, it is important to look at the same process through the prism of the post WTO/TRIPS-compliant regime in order to raise relevant questions going forward. Mazumdar (2014) observes that the new regime has been implemented in three phases. As obligation, in the first phase India recognized the '*mailbox*' system.¹⁵ The second phase implemented by India in 1995 which is demanded of TRIPS parties is the recognition of the patent period of 20 years for pharmaceuticals and compulsory licensing. The last phase is the extension of product patent regime to areas including pharmaceutical which was until 2005 absent under the Indian Patent Act, 1970. It is acknowledged that, theoretically, there exist some flexibilities in the TRIPS agreement—a transitional period of up to 10 years was given to developing and least developed countries— that notwithstanding, the nagging question posed below still remains. The big is question would India's story have been the same under such an agreement?

¹⁵ The mailbox system was an obligation under TRIPS for members, with effect from 1 January 1995, to available a system whereby applications for patents for pharmaceutical product inventions can be filed.

Developing countries that seek to evolve their capacities in these two sectors and by extension all other sectors must cross not only the TRIPS questions, but also that of TRIMS.

4. What can Ghana learn from the Indian Experience?

Ghana's economy is pre-dominantly agrarian. According to the 2010 population and household census, about 42 percent of the economically active population are engaged in agriculture. Manufacturing constitutes a paltry 11 percent (Ghana Statistical Service, 2010). Ghana's GDP growth rate from 2005 to 2013 has been between 4.6% and 15% (Ghana Statistical service, 2014). Growth however slowed in 2014 to 4.0 down from 6.6% in 2013 (Ghana Statistical Service, 2015). During the period the Services sector recorded the highest growth of 5.7 percent, followed by Agriculture (4.6%) and the Industry sector with 0.9 percent. This makes the service sector the biggest in terms of GDP contribution. According to the 2014 Ghana living standard survey (GSLs 6) 24.2 percent of the people are poor (Ghana Statistical service, 2014). The World Vision estimates that about 30 percent of Ghanaians live on less than \$1 a day and 54 percent live on less than \$2 a day. With higher unemployment and mounting fiscal deficits, Ghana's growth prospects in its current form do not exude hope.

With this kind of economic outlook, Ghana, acknowledges the role science, technology and innovation can play in accelerating its growth to achieve sustainable development. In its *Science, technology and Innovation policy of 2010*, Ghana fully appreciates that the key to unlocking its sustainable development is through STI. To this end, the policy specifically seeks to "facilitate mastering of scientific and technological capabilities; provide the framework for inter-institutional efforts in developing STI and programmes in all sectors of the economy to provide the basic needs of the society; create the conditions for the improvement of scientific and technological infrastructure for research and development and innovation" (MEST, 2010). In order to achieve these objectives, policy makers must fully understand that, mastering of scientific and technological capabilities is an evolutionary process. This evolution is a non-linear but interactive process, requiring intensive communication and collaboration between different actors, both within companies as well as between firms and other organizations such as universities, innovation centers, educational institutions, financing institutions, standard setting bodies, industry associations and government agencies (Tödting & Trippl, 2005). What is important to note is that this process does not occur by itself, rather it must be conceived and nurtured with appropriate instruments and tools of public policy. This is to say that capacity accumulation may not be a radical change, instead assembling a smaller set of reasonable choices and implementing them comprehensively and systematically while

being flexible and responsive to evolving characteristics. Policy has to allow for its own learning (Lall & Teubal, 1998). Identifying and selecting the appropriate sector (s) that constitutes the “nuclei of development” and nurturing them with appropriate policies remains at the core of this enterprise.

With this understanding, this paper observes that Ghana’s quest for technological progress has been purely *functional* in approach—Policies have generally tried to garner non-existent market mechanisms to fulfil its technology needs. The 2010 STI policy acknowledges that over the years a lot of investments have been made in science and technology infrastructure yet the investments have not yielded the expected economic growth (MEST, 2010). The explanation to this tardiness is not farfetched. These investments are done in a horizontal manner without adequate selectivity. The market has failed to also respond to these investments simply because, the market itself is either non-existent or the right incentives have not been created.

Again, there is no doubt about the fact that Ghana has very rich STI institutional arrangements yet progress has been sluggish. At the ministerial level, there exist the Ministry of Environment Science and Technology (MEST). Apart from this there exist the Council for Scientific and Industrial Research (CSIR) with its thirteen research institutes, the Ghana Atomic Energy Commission (GAEC), the Environmental Protection Agency and other applied research and development institute like Town and Country Planning Department (MEST 2010). The problem is that there exist no government specific measures that create good interface between these institutions, industry and Universities. Coordination hence remains one of the biggest market failures in Ghana’s STI architecture. Owing to this, researches done by the various institutions do not get to industry and vice versa. This makes co-evolution non-existent.

In view of these challenges, the paper recommends the following:

Firstly, as noted earlier, coordination is the biggest market failure in the existing STI architecture in Ghana which requires rectification. This means that government must intervene with appropriate policy measures that will create good interface for co-evolution to engender capability accumulation. This requires government to bring industry, research institutes in priority areas and universities to interact. This interaction should be facilitated by selecting workable ideas and projects and providing direct financing for R&D to prop them up. Like the Indian approach in the software and Pharmaceuticals, workable ideas in their embryonic stages should be protected to evolve—using tax and non-tariff incentives. Given the fact that Ghana has a very poor private financial sector in general for start-ups (Abor & Biekpe, 2006; Ahiawordzi & Adade, 2012) and venture capital in particular for embryonic ideas, it is incumbent on government to lead the market in creating such critical fibre for technology evolution. The paper takes note of the Venture Capital Trust Fund Act, 2004 Act 680, which established the Ghana Venture Capital Trust Fund (VCTF) in

2004 and other cohorts financing arrangements for SMEs such as Youth Enterprise Support (YES), Microfinance and Small Loan Centre (MASLOC) among others. It is admissible that these arrangements are novel; however, its focus has been poor. The approach in this financing architecture aimed at propping up SMEs and start-ups has been '*business-as-usual* and *functional in nature*. Since the beginning of the 1980s, one can count more than twenty-five private sector financing arrangements by the government of Ghana and Development Partners, however, private sector development, capacity accumulation and thus competitiveness has been tardy (See Abor & Biekpe, 2006; Ahiawordzi & Adade, 2012). Neutrality in policy approach will not bring about the necessary capabilities in STI needed to develop. Policy makers must re-focus such novel policies at specific activities that exude rippling spillover effects. This is to say government must be selective in applying such policies. As the Indian approach and by extension the Asian Tigers have demonstrated, targeted interventions are the way to go. Not just the Indian (Asian) experience but a critical review of much touted market economies in the west will reveal that indifference in approach to policies do not work in capacity accumulation in STI (see Eickelpasch and Fritsch, 2005; Reinert, 2007).

Secondly and closely aligned to the first recommendation, government should invest in the needed infrastructure that exudes the potential for capabilities acquisition. For instance, to improve the software industry, the Indian government in 1988 established the Software Technology Parks (STPs), provided offices and computer equipment for start-up companies, granted access to high-speed satellite links and provided uninterrupted power supply and invested in education through the establishment of National Technology Institutes (NTI). Such capacity enhancing investment must be done.

Additionally, the government of Ghana should provide the market for start-ups through government procurement. The World Bank estimates that in 2014, government consumption expenditure or procurement alone constituted 18% of Ghana's GDP up from 10% in 2003.¹⁶ This means that government is not only a facilitating machinery of states, but also a huge market in itself and a consumer. Government of Ghana should therefore use this market to encourage its local industries to develop their capabilities as the Indian experiences demonstrate. The increasing interest in most government and quasi government institutions to digitize their data and records for instance ought to provide opportunity for Ghanaians IT start-ups. If this will be possible, it requires government intervention to use local start-up to execute such jobs.

Lastly, the purpose of this is to provide a broad thinking on how Ghana should go about its quest to accumulate capacity in technology—based on the experiences of India in software and pharmaceutical industries—in order to participate in the global knowledge economy. It is therefore beyond the scope of the paper to designate a particular sector(s) for the approaches recommended here. However, the paper suggests that Ghana like India can for instance develop its technology

¹⁶ <http://data.worldbank.org/indicator/NE.CON.GOVVT.ZS>

startup (tech startups) and pharmaceutical industries when the recommendations made are followed. Ghana has a promising local pharmaceutical sector which needs government assistance to break its bounds. According to the Pharmaceutical Manufacturers Association of Ghana (PMAG), the sector currently has thirty-eight registered firms with three listed on the Ghana stock exchange (Starwin Products, Ayrton Drugs Manufacturing Ltd and PZ Cussons). It is refreshing to note that more than 75% of these firms are owned by Ghanaian entrepreneurs.

It is estimated that Ghana's pharmaceutical market is made up of 30% locally produced and 70% imported—mainly from China and India (Harper & Gyansa-Lutterodt, 2007). PMAG for instance posits that the ECOWAS Secretariat recognizes Ghana as the producer of best quality locally manufactured drugs due to the stringent criteria, inspection and enforcement procedures of the Ghana Food and Drugs Authority (FDA) and the recent efforts made by local manufacturers to meet the Ghana FDA requirements. Several other reports and studies have concluded that if properly given attention, Ghana can become a pharmaceutical power house in the African or ECOWAS sub-region (For overview see Harper & Gyansa-Lutterodt, 2007; Seiter & Gyansa-Lutterodt, 2009). One problem identified by these studies is that the local pharmaceutical companies operate under capacity. This under operationalization is caused by capacity constraints in qualified personnel, unreliable and expensive water and electricity supply, high taxes on imported raw materials, lack/inadequate funding among others.

The paper suggests that just as the Indian experience show, this promising sector can be given special government policy. For instance Ghana can adopt a cluster industrial policy for the sector through agglomeration of local manufacturers and co-locating them with relevant research institutes. Government can provide funding for R&D on medicine on Priority Endemic Disease (PEDs) such as malaria, tuberculosis, HIV/AIDS etc. Specialized infrastructure investment and unlimited power access can be guaranteed when such a cluster policy is effective. Special tax incentives should be provided to make them competitive while providing incentives for relevant departments of universities to collaborate with industry to supply the requisite personnel.

An emerging software/IT cohort in Ghana is the ITES-BPO model (Information Technology Enabled Service/Business Process Outsourcing). In 2009, At Kearney placed Ghana at 15th globally in its Global Services location Index and second to Egypt in Africa. Ghana overtook South Africa which was first in Africa in the 2005 and 2007 rankings. Ghana has put many measures in place to stimulate investment in this sector comprising free zones that offer tax breaks up to 10 years, followed by 8% rate thereafter, and full exemption of custom duties on equipment imported for R&D (The Report, 2012). While such measures are necessary, they are not sufficient to engender capacity building by local firms. Government must put in deliberate measures to create linkages between foreign IT firms and local start-ups for easy technology transfer while investing in the right infrastructure and technical training. This is important because the prospect of such investment promises great

dividends in terms of employment and contribution to GDP. The Hewitt Associate report on Ghana in 2006 notes that ITES/BPO sector has the potential of creating 37,000 direct jobs, 150,000 and US\$750m in revenue within 5 year—between 2009 and 2014. It is refreshing to note that there is an emerging IT industry in Ghana. For instance Ghanaian IT Dropifi and SMSGH made it to the Forbes Africa Magazine's Top 20 Technology Start Up Companies in Africa placing 3rd and 17th among top start-up from Kenya, South Africa and the UK. In 2013, Forbes listed ten Ghanaian IT start-ups with promising fortunes—Dropifi, Orgaroo, Afriyaye, ClaimSync, Leti Games, RetailTower, Trokxi, FreelancePro.me, mPawa and Saya Mobile. Another notable firm is Bsystems. This should be the beginning of Ghana's story by nurturing such ideas with appropriate policy tools and making the right investments that respond to their need. The urgent need for strategic policies to prop up this emerging sector couldn't be riper. The success of Ghana's quest to build a knowledge based economy depends on it.

5. Conclusion

What this paper has sought to do is to demonstrate how and why there is the need for countries to amass capabilities in science and technology to drive their development. To this end it has been argued that nations need adequate policy space to choose the best policy mix that responds to their unique situation. It has been demonstrated, using the Indian experiences in amassing capabilities in software and pharmaceutical industries that there is no ideal or one-size-fit-all model for innovation policy, as innovation activities differ strongly between countries and across firms (Tödtling & Trippel, 2005). The approaches may be a mix of conventional and non-conventional methods in this drive.

To this end I have argued that there is the need for each country to choose the best mix of policies that respond to its need in an evolutionary manner. There is the need for policy space in an increasingly interdependent and rule-based world so as to give room for developing and least developed economies especially in Africa to catch up. A continuation of the current trends in international development policy will lead to a situation where there will be a convergence in policy but a divergence in capabilities. Indeed the international system must give practical meaning to the special and differential treatment of developing countries to manoeuvre their way through capacity accumulation to development. What is important is also responsible governments with focused policies.

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Cite this article:

The role of policy space in technology evolution: Evidence from India and what Ghana can learn

Citation Format: APA

Fosu, R. (2016). The role of policy space in technology evolution: Evidence from India and what Ghana can learn. *S O C R A T E S*, 4(2), 83-107. Retrieved from <http://socratesjournal.com/index.php/socrates/article/view/207>

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