

# Journal of Social and Political Sciences

**Sikandar, Syed Muhammad, Amadu, Latif, Arkorful, Vincent Ekow, and Aamir, Syed Muhammad. (2019), Imitation and Innovation Anchor: The Key Driver Role of Government. In: *Journal of Social and Political Sciences*, Vol.2, No.1, 34-46.**

ISSN 2615-3718

DOI: 10.31014/aior.1991.02.01.46

The online version of this article can be found at:  
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Published by:  
The Asian Institute of Research

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# Imitation and Innovation Anchor: The Key Driver Role of Government

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## Abstract

The role of government is crucial in building an effective science and innovation System. The economic growth of China is a knowledge-based economy, but more investment is needed to help boost human creativity and economic output. The current global technological leadership has touted China from been copying to fixed for a purpose, which makes China the extraordinary economic development from imitation to innovation as well as enormous investment in innovation, in which the government plays a critical fundamental role in the technological innovation of the country. The key drivers that were identified are science technology innovation policy, science driven by globalization and entrepreneurship. In furtherance, there were key challenges China still battling with, which include the strategic innovation ecosystem and human resource capital.

**Keywords:** Innovation, Imitation, Technology, Government role

## Introduction

Raging within the discourse of technology and innovation has for long been an emerging conceptual line that marks an attempt to integrate the efficacious role and/or involvement of government as an important factor in driving innovation and imitation state or private sector-led/backed initiatives. The deployment of concepts and the attendants sharing of perspectives to analyze the situation has largely moved away from the traditional-modern dichotomies of the past. The teleological view, central to science and technology initiatives and processes previously captured the endavour as a transformation from its emblematic traditional socioeconomic formations where profit motives of individuals spurred and drove imitation and innovation initiatives to destinations that are modern integrative in character, involving both government and private actors, with the former, by virtue of being a regulator, sits in the saddle as a chief driver and regulator influencing the initiative by way of issuing directives, laying the foundation to ensuring the thriving of same initiatives whiles laying the framework and a strong supporting foundation through policies.

The transfusion of neoliberal order onto state scenes via a myriad of economic programs have engendered a lid lift and clarified the once blurred lines on the role of governments in innovation and imitation activities. The role of governments in the process of driving technological developments, specifically in terms of innovation and imitation mechanism is generally a crucial one (Iyer et al., 2006; Siu et al., 2006). Governments around the world are broadening and deepening their support for innovation in the private sector and the economy more generally. When it comes to fostering technological innovation, elements such as important tax, legal, and fiscal considerations for a government becomes important. Governments have an important role to play in fostering innovation as; Innovation leads to technology; Technology is the prime driver of economic growth; In the absence of government intervention, firms will underinvest in technology, especially in basic research.

As indispensable and sine qua non as some people perceive of it, there appears to however be some vagaries and variations across countries and over time. The debate on the roles of government in innovation and imitation initiatives has mostly, and in an all-too-familiar discourse, fashion revolved around the roles of the government in the market for economic growth and development. As pristine and discrete as governance or the art of statecraft appears to be, it is not as distinct and discrete as it involves more than just state administration in the strictest sense of the word. In a more elaborate term, governance entails more and goes beyond just driving growth and propelling human growth and development.

There is no exact straight jacket model fit for measuring government roles in the multi-diversified state arena. Implicit within the tenets of governance resides its market roles which are indispensable for economic development. A system deficient of this growth to an appreciable extent is equally sapped of sustainable development prospects since economic growth is tied to the apron strings economic development which encompasses indices such as living standards; levels of literacy and education, health quality, availability of housing, etc. Given the sufficiently interlaced variables of growth led by the market, and of development superintended by the government, it is not far-fetched to assert that both are needed to sufficiently provide us with a more sustainable society. Governments intervention and roles in innovation and imitation are necessary to propel basic economic development. In so far as the roles of governments are concerned with regards to innovation and imitation, a distinction between economic growth and economic development must be drawn and clarified to enhance an understanding of the role of government. The complementarity between the government and the market to partner with one another could be a good fit for driving innovation and imitation initiatives. This could be amplified in government introduction of novel regulatory policies.

In the face of the vested interest of the government in state development, it is obvious government owes it as a responsibility to ensure sufficient investment as a way of preventing market failure. In realizing this, the government may choose to provide some forms of incentives to support research and development (R&D) in different sectors of the economy. This will go a long way to propel and enhance economic growth. This sequential line of reasoning to justify and validate the role of government in innovation has been taken a dominant center stage position in so far as the history of public-sector involvement, as well as a private-public sector partnership, as a novel means of driving development, more particularly in the innovation process is concerned. This notwithstanding, the economic underpinnings of the government's role in the innovation process could be more of a complex latticework than might first appear on a surface evaluation. According to Link and Scott (1998), as cited in M.P. Feldman et al. (2002). The case for a centrally entrenched position and probably, a validation and rationalization, with due regards to the role of government in innovation, from an economic point of view resides in the quite complex comparison of the potency of market resources with and without government intervention.

This requires a more tacitly tactical effort from government initiating a blend of regulative, financial and administrative intervention instruments. Threading this path, the government needs to tap from the synergy within the institutional environment, R&D and industrialization strengths, coupled with the technology features of the innovation in scouting for the innovation tasks and their associated challenges, as a basis for determining and devising an efficacious intervention strategy. As part of governments greater effort to pursue home-grown innovation within a complex web of technology, stringent multipronged government interventions are necessary.

The government, capitalizing on its stronghold of the economy should take advantage of its control, as a sound basis to explore the potential of intervention through a litany of instruments central to administration. More precisely, the state taking a lead role in driving them to specific, measurable, attainable, realistic and/or results focused and time-bound innovation should be prioritized. This paper seeks to critically interrogate the drivers of technological innovation and influence that government can play in spurring innovation.

### Literature Review

The implications of market success as evidenced in the foregoing disquisition on the role of government are enough a substantial basis to undergird an understanding of the underlying roles of the government, and the influence governments could play and exert in imitation and innovation drives which constitutes the core focal issue that this paper seeks to interrogate. With due regards to technology innovation and imitation, literature is replete with governments involvement and influence. Precisely in Korea, through government support, national innovation system policies have streamlined and managed playing field of firms from developed nations. The turn of the recent couple of decades has witnessed a robust and unbridle albeit an increasing level of accumulation in technological capabilities (Choung et al., 2011) which has, in turn, informed an expeditious changing landscape in terms of technological imitation and innovation. Not ending there, the Korean government has gone an extra mile, even beyond their jurisdiction to team up with other developed western countries by way of partnering the development of technology through networking and R&D alliance of domestic firms' innovation (Fagerberg and Godinho, 2004; Mathews, 2004; Kwak et al., 2011).

In the case of China, the replication of the role of government in innovation and imitation becomes more poignantly evident. In the mid-90s for instance, through a national policy of home-grown innovation targeted at specifically focusing on the role of administrative instruments, supporting Chinese firms to have a firmer stand in key technologies (Jefferson, 2009; Yu, 2011), a third-generation (3G) of the mobile standard was introduced. The third-generation mobile standard, which was preceded by a second generation (2G) national policy in the same year promoted the development and adoption of Digital Video technology. Since the introductions into the market, the global mobile telecommunications industry has undergone immense changes.

Wang and Kim (2007) emphasizes that, for China as a developing country characterized by a burgeoning and fledgling technology innovation, and a long history of technology import, the government had to take the lead in the standardization of such a complex system. This was possible because of the central control the Chinese government has over its economy. In advancement of the innovation system, China has made strides and exerted concerted efforts through the state-controlled telecommunications industry to invest in TD-SCDMA development and diffusion. The standardization results thereof offer a reasonable basis for us to understand the theoretical mechanism and practical reality of government interventions in countries advancing towards technology innovation. Hikino and Amsden (1994) also posit that an economy far from the technological threshold can grow quickly by imitating. By the existence of imitation, it presupposes that a technology template exists for which reason it makes the flow of ideas relatively easier and non-problematic. This enhances the management of ideas and resources as well as the flow of innovation which could be directed at enhancing innovation. This involvement of government stimulates and incentivizes firms to devote resources to innovation activities while encouraging the disclosure of inventions so that others can use and build upon research results, stimulating economic growth (Denicolò and Franzoni, 2003).

This deadweight shows up in different ways, in different forms and has been fashionably tailored in very different setups. Sohn (2008) undertakes a comparative case study analysis of the benefits of innovation, inter alia, of imitation activities and posits that, although imitation weakens the incentive to innovate, it can be of immense benefit to the larger society by leading to a larger number of the concatenation of innovations. Conversely, imitation may be of immense benefits when firms demonstrate a varying R&D capability. This would help provide not only higher consumers' surplus but also, higher values for firms (Fershtman and Markovich, 2010). Whereas imitation also disadvantages the current profit of firms engaged in the innovation, it appreciates the probability of further innovation. Because this has been the situation, it increases the prospect

and propensity of firms making profitable discoveries (Bessen and Maskin, 2009). Imitations become a spur to innovation (Koléda, 2005; Furukawa, 2007; Aghion et al., 2005). Moreover, the lack of innovation can in turn deleteriously affect imitators who would obviously be left with nothing to imitate. As such, it logically follows that innovators and imitators must coexist in the technology space. This endogenous partnership has been described in the literature through the well-known Lotka-Volterra model, whose application in economics was first examined by Andersen (1994) and which has been applied with a specific focus on innovation in (Bharagava,1989; Morris and Pratt,2003;Watanabe et al.,2003;Castiaux ,2007;Lee et al.,2005;Kim et al.,2006;Michalakelis et al.,2012;Balaz and Williams,2012;Chang et al.,2014;Guidolin and Guseo, 2015) to cite only a few.

Governments have played significant roles in not only technology innovation but also in the transition of states from imitation to innovation (Pavitt, 1976). The roles, influence, and interventions of government, especially of "newly industrializing and developing nations bent on creating governmental interventions to accelerate IT innovation within their borders" (King et al., 1994, p. 139) contributes to shaping the technological progress (Abernathy and Chakravarthy, 1979), There has been, and still continue to be varying approaches and perspectives on discourses revolving around the topic of government roles in innovation. Whereas people regard technology more of an innovation that calls for a joint effort between government and other kinds of organizations (Funk and Methe, 2001), others perceive government as a unique actor imbued with the ability to motivate a cluster of technology players with wide-ranging interests and capacities to take part in the innovation process while ensuring effectiveness and efficiency in teamwork. (Beerepoot and Beerepoot, 2007). Central to this discourse is the stakeholder theory which assumes innovation as a socio-technical process by different stakeholders including the government. The prime focus, preoccupation, and powers of these different stakeholders determine the process of technology adoption (Shin, 2008).

In Korea, during successful deployment of the 3G, the government streamlined the collaborative relationship among industrial stakeholders by capitalizing on their interest and capability. The government is a focal actor that admits other able and efficient partner actors into the actor-network of an innovation initiative. Innovation is regarded an endeavor that requires the formation and subsequent consolidation of a network of diverse actor networks by the government, in concert with the non-government actors (Gao, 2007; Lee and Oh, 2006). In accentuating the essence of the formation of networks, Lyytinen and King (2002) present research of evidential value through the formation of actor networks and frameworks conceptualizing mobile industry changes precipitated by an ever-changing interaction between and amongst actors from the diverse domains of the innovation space, the marketplace, and the regulatory regime. In analyzing changes within the mobile telecommunications market in some countries through the actor-network perspective, specifically on building and maintenance, , this framework has been referenced largely (Gao and Rafiq, 2009).

Also, of utmost relevance to institutions, thus both government and non-government, the entirety of the corporate establishment is the environment that shapes innovation activities. These set of structures are relevant and cardinal entities in terms of setting up rules of practice to impact on technology innovation (Nelson and Nelson, 2002). King et al. (1994) made a milestone in treatising on the institutional factors that underlie information technology innovation. Their treatise has been the framework within which key analysis of government actions in the diffusion of a broad range of information technologies, like broadband (Choudrie et al., 2003) and the Internet (Montealegre, 1999) are situated. Deep-seated and central to the disquisition is the introduction of the cliché of national innovation system which is conceptualized as the web of public and private institutions whose endeavours set the tone for the initiation, importation, modification, and diffusion of novel technologies (Freeman, 1995). Lundvall (2007) also asserts the role of the government relative to the still-evolving national innovation system. In his view, the government is a key component of a national innovation system that can act as an umpire to compensate for the shortcomings of firms. Hence, people have come to understand the role of the government in streamlining and rationalizing the establishment structure and the roles of a national system of innovation tailored to complement national innovation initiatives. From the myriad applications of this theory, Freeman (1988) observed, and indicated how Japan had established a unique national

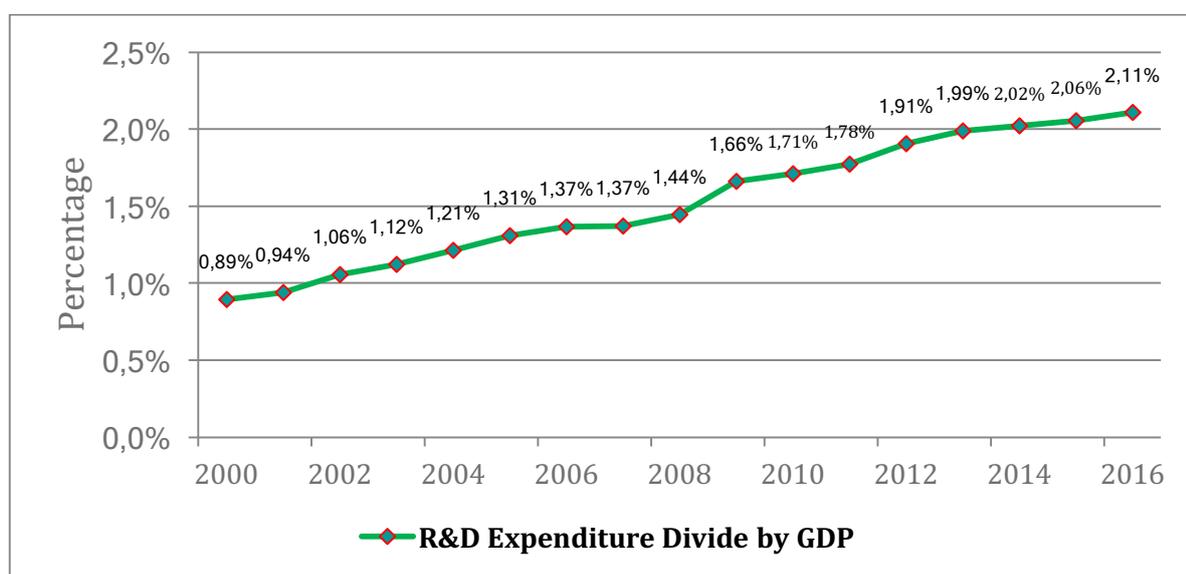
system of innovation which facilitated the collaboration between the different industries and research institutes to effectively and actively invest in technology innovation.

Other kinds of theories are also used. For example, drawing upon the game theory, Chiang (1995) interrogated a challenged collaborative R&D project due to conflict of interest and other factors of technological uncertainties. Amongst other things, it proposed that government pursues and spurs collective goals, provide the protocols of collaboration by different actors, referee the negotiation process, and offer managerial support to ensure a joint actor network. People have observed the significant role of the government in innovation. For example, the government can aid domestic firms to acquire innovation capability by instituting state-led standard-setting consortia, establishing science parks, intervening in royalty negotiations with foreign firms, and driving technology standardization (Funk and Methe, 2001; Kwak et al., 2011; Mathews, 2004). The government can also promote innovation by procuring products (Georghiou et al., 2014), investing in R&D, seeding development of services, mediating private sector competition, and convening diverse interests and facilitating cooperation (Wang and Kim, 2007). It is on this premise that a holistic investigation of the view of government, its influence and overall intervention in innovation and imitation is thematically discussed below.

### Research and Development (R&D)

In a 2017 report of innovative countries and their respective rankings by the Global Innovation Index, China ranked 22nd in the year 2016. The impressive performance of China to become a middle-income country in the list of 25 innovative countries is a phenomenal and enviable achievement. (Index 2017). China has gained a level ground in terms of ranking when it comes to research by well-known science index citation such as Elsevier and Springer. In this respect, China garnered the second-most worldwide citations of academic research papers, just behind the United States. The number of articles and papers published by Chinese academicians has been phenomenal in the various research areas. It has been ranked for the seventh consecutive time in a roll which is an indication that China has made significant improvement and appreciable inroads in science technology and innovation.

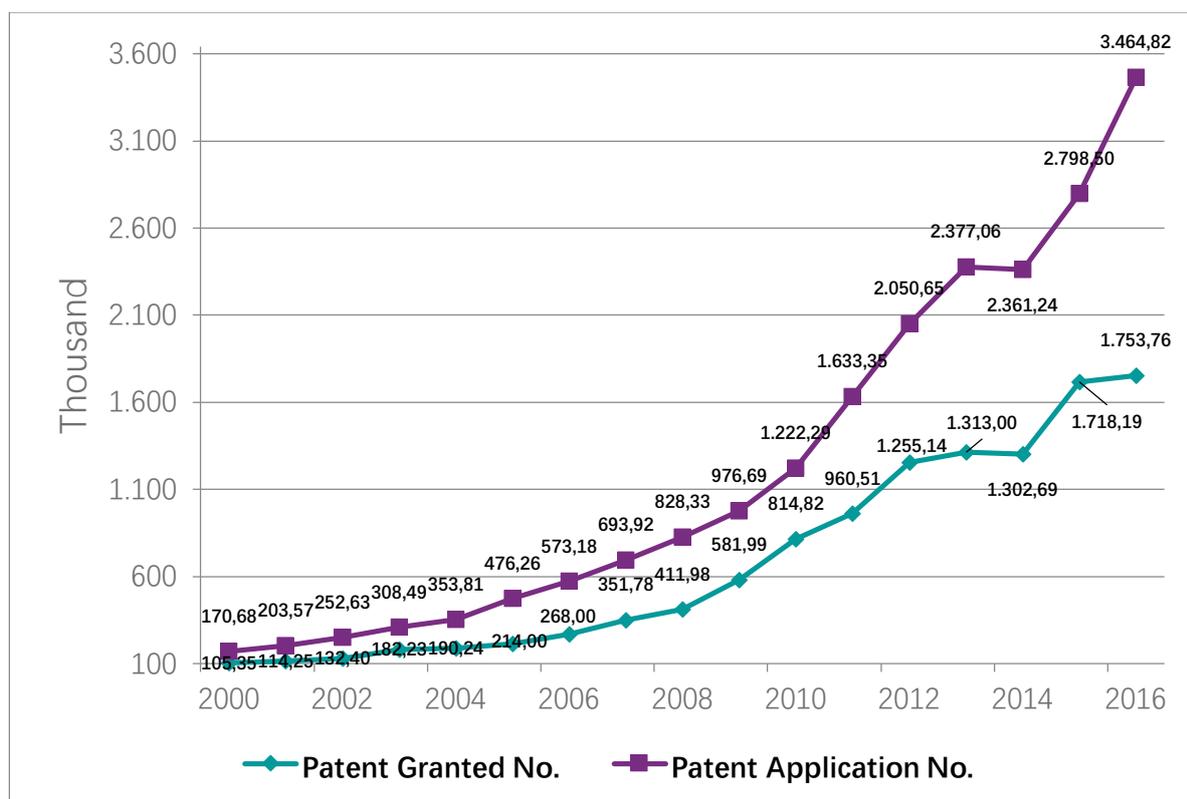
Considering R&D, expenditure, China has always been on the increase for some time now. For example, in the year 2016 during the financial crises when most of the countries had reduced their budgetary allocations to R&D, China as a country rather increased their funding in R&D. In a Report from Ministry of Science and Technology, China's R&D spending had reached 1.56 trillion in 2016, with a larger chunk of these funds coming from small, medium enterprises. This means that China is making an innovation improvement in the sector of science and technology development which has made it economy to grow up to 56.2% in the year 2016. This also demonstrates that China is becoming a research-intensive and innovation-driven economy- and not a labor-intensive economy anymore. The below figures show the expenditure on R&D in China from 2000 to 2016.



**Figure 1** Growth Domestic Expenditure on R&D in China (2000-2016), Source: China National Bureau of Statistics**Patent Application**

It is always good to find measures to implement intellectual property rights management- in earnest protection of the rights and interests of intellectual property owners. This, however, said stringent measures should be adopted to make sure engineers and scientists do not over enjoy monopoly power relative to inventions that are very sensitive and critical to the life of people. This right would encourage institutions such as technology and science parks, universities and science-related research institutions to come out with new theories and inventions. China has made penetrating inroads to accelerate to develop their own standardized technical system and put them into practice in some key manufacturing realms where core technologies have been advanced or where domestic companies are in a strong market position.

China is also doing well when it comes to patent application filings which is yet another strong indicator showing how China is leading in science and technological innovation. As posited by the World Intellectual Property Organization (WIPO) on the aspect of activities for patent and trademark applications for 2016, China in the year 2016 received more patent and trademark applications than the USA and other developed nations Worldwide. Filing for patents, trademarks, and industrial designs reached a record high in 2016 amidst an increasing demand in China. China received about 236,600 of the nearly 240,600 additional patent filings, that precipitated a 98% growth. Trademark applications jumped by 16.4% to about 7 million, and worldwide industrial design applications grew by 10.4% to almost 1 million – all being growth driven. Below is graphical representation showing data application granted from 2000 to 2016. This is a clear indication that China economic growth is built on a strong economic foundation based on an intellectual property right

**Figure 2** Patent Application Number and Patent Granted Number in China (2000-2016) Unit: thousand, Source: China National Bureau of Statistics.

USA and China have taken dominance in the patent application filings in the world. The growing speed of patent application in China cannot be overlooked. This likely to influence inventors who aren't even considering selling

their product in China to the patent in China because of the positive signs relative to an increase in Chinese patents.

### **Drivers for China's Growth in Technological Innovation**

China's innovation model has for a long time been a major pre-occupation of the international community (Li-Hua, China's Embracing Innovation Leads to its Peaceful Rise 2017). Looking at the trajectory in performance and achievements in science, technology, and innovation, it will be prudent to pose this mind-boggling question: How is China able to become one of the destinations for doing business in the world? How does China become the second largest economy in the world? How does China transit from labor-intensive economy to a knowledge-based economy?

China, becoming the second largest market in the world is driven by three key factors. China National Science Technology and Innovation (STI) policy. Globalization drives China's into a new era that both government and firm can take advantage of global innovation resources to catch up with developed economies. And lastly, China's entrepreneurship.

### **National Science Technology and Innovation Policy**

Government plays a vital role in the economic development of both USA and UK. This has contributed to making these countries a model for other developing countries. This confirms the indispensable role government in influencing innovation drives. By this, it could be said that failure or inability of the government to take the risk in their developmental policies then exposes the state to retrogression and stagnation. Because this has been the case, developed polities which are of the conviction that the economy should be driven by science and innovation (Ernst 2011) assign significant prominence to the role of government. As it is in the case of the United States of America, for a long time, in line with political and ideological reasons, the state has been the main driver of innovation. The situation is not quite different in China where the state equally propels the economic fortune based upon policy put in place by the state to indigenous industries to compete with the rest of the world (Ernst 2011) (Someren, T. C. R. van, & Someren-Wang, S. van. 2014). In recent times, stringent measures have been put in place by the Chinese government on STI policy via a Global Leadership action plan put in place in 2016. These three stages of action plan comprised an action plan of the National Strategy of Innovation-Driven Development. This action plan placed science and innovation at its forefront and identified three main strategies of innovation-propelled development, which is to make China the best destination for industrialization. The steps among other things seek to achieve the following:

Step 1, China should become an innovative country by 2020

Step 2, China should move to the forefront of innovative countries by 2030 and the best place to do business;

Step 3, China should become an innovation power by 2050 and to become an economic giant

The Action Plan (AP) is purposed to match western companies within a few years. This is a homegrown policy to make Chinese scientist make a major breakthrough by 2025 (Knight 2017). China significantly increased its number of publications on science and technology innovations for about 7% of the world in the year 2006. This is evidenced in its citation in science research where it ranked 13<sup>th</sup> in the world. However, in sharp contrast in the year 1998, China's contribution to S&T receded to a low ebb, owing to how its economic growth was substantially an investment-propelled one.

### **Driven by Globalization**

In as much as Chinese industries have the potential to producing in larger quantities, it is urgent and dawns on the collectivity of the industry to develop an outward and advanced technology on their own to suit the globalized world. In achieving this, the effort could be made to collaborate with other countries with the

technological might to assist in developing novel technology. Also, Foreign Direct Investment (FDI) can benefit innovation activity via spillover channels such as reverse engineering, skilled labor turnovers, demonstration effects, and supplier-customer relationship. Under a "market for technology" policy, China has been the largest recipient of FDI among the developing countries in the 1990s. What's more, China has already become the global center for many different stages of production. In Recent years, through administrative action, institutional innovation, and IP protection as well as encouragement on firm R&D investment, China has been actively developing a new technology policy based on the promotion of its own technical standards. Through actively participating in the globalization, China will not only benefit from the global value chain collaboration but also will contribute to the innovation around the world.

### **Supported by Entrepreneurship**

Entrepreneurship is a multilevel phenomenon that begins with the combination of human creativity, financial resources, and technological capital; fostering the discovery and establishment of new ways to organize production processes and new institutional forms; and leading to such outcomes as venture growth and new ventures. New venture growth is a defining characteristic of developing economies (Phan, Zhou, & Abrahamson, 2010). As the largest transition economy in the world on the way towards a market-based economic system, entrepreneurship as economic activity has been an important engine of the Chinese economy. Domestic entrepreneurial organizations, including private start-ups, township and collective enterprises and transformed state-owned enterprises (SOEs), have emerged as one of the most important driving forces behind China's rapid economic development (Yang, J. Y., & Li, J. 2008) (Yang & Li, 2008).

With regards to funding enterprises, the Chinese government has indeed initiated Small and Medium Enterprises (SMEs) to make the national economy grow and by so doing the government makes readily available funds for them. China as a country had the opportunity to join the World Trade Organization (WTO) in 2001. China has also rolled out various initiatives and policies to assist SMEs. 90% of these SME have contributed greatly to the economic fortunes of the country. The government of China has implemented financial regulations and the establishment of a national policy agenda to assist in the development of innovation science and technology.

China as a sovereign country has steadily transitioned from imitation to innovation on the basis of having enough human resources capacity which constitutes a key hold to national competitiveness. To raise S&T innovation capacity, a nation or an entity must develop and assemble a contingent army of experts in S&T innovation. Among the 2.8 million S&T workers in China in 2005, 1.36 million were full-time R&D professionals, and 1.11 million were scientists and engineers. Given the general top brass quality research professionals in China, it becomes incumbent that S&T expertise is motivated to commit themselves to their own initiatives and enthusiasm wholly. While research units are staffed due to the abundance of qualified personnel, vast of talent exists in the R&D community.

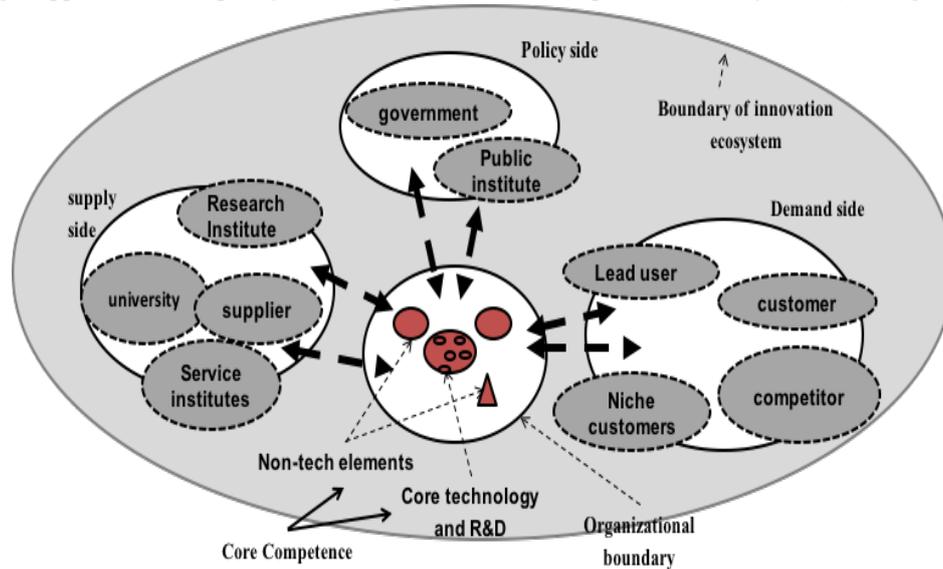
### **Challenges in Building Science Technology Innovation in China**

Technological innovation in every developed nation come at a cost and hence most nations are unable to absorb this cost. China has a lot of hindrances when it comes to innovation in terms of their ecosystem, human resource capital, and open innovation.

### **Competence-based innovation ecosystem**

The world is competitive when it comes to technological innovation hence, a firm can survive competitive merit without a portfolio of core technology that can build a core competence (Chen, J., Yin, X., & Mei, L. 2017). Such efforts made by government need to incorporate their internal processes while taking into account factors bordering on the external environment. The need to configure firm to enable successful absorption of knowledge from external sources needs to be considered as well (Cohen, W. M., & Levinthal, D. A. 1990). According to (Chen, J., Yin, X., & Mei, L. 2018) the best way to build innovation ecosystem is to have an informed strategic

innovation. To build a competence-based innovation ecosystem, we need to have the best players inside and outside and to protect the right of the firms (Euchner 2014). The problem China is facing got to do with how to apply the right approach to STI policy to build up the national and provincial ecosystem. (See Figure 3).



**Figure 3** Core Competence Based Innovation Ecosystem Framework; Sources: Chen Jin. Enterprise Innovation Ecosystem, Science Press, 2017

### Attracting the best talents and resources from all over the world

The Chinese government has played and continues to play a significant role in science and technology which has led to significant development in China's economy. This monumental achievement occurs as a result of collaboration between research institutions and industry in China (Lu, L., & Etzkowitz, H. 2008), China is still contending with inadequate human resources, more especially with small and middle enterprises (SMEs) (Sabir, R. I., & Sabir, R. M. 2010). Couple with this, China faces a lot of brain drain as more of its citizen seek for greener pasture in most of the advanced countries such as USA (Dodani, S., & LaPorte, R. E. 2005). The cultivation of talented people will be made according to the characteristics of different types of research work. It is an undeniable fact that China has a large number of low cost of labor in the field of science and engineering. Annually, the turnout of doctorate degree holders in Science and Engineering fields in China exceeds that of the US. (Barlow, 2011). However, many home-grown Chinese doctorate certificate holders are regarded as fall shorts of the global standards. This has created a disproportion in salary earnings- and job-related value and personnel disparities between the outside and home-grown trainees/personnel. A good number of these scientists and engineers are trained by high notch academic institutions in the western countries. China is also considered to be using foreign technology transfer for its rapid economic development (Fu, X., Woo, W. T., & Hou, J. 2016).

### Conclusion

China's overall grand aim is to use the USA and the EU as their benchmark when it comes to innovation. China is successful because it's able to turn its weakness into a strength. Innovative China represents big opportunities. Same time it is a face of a looming threat as well, more particularly to the economic powerhouses and giants in the much-advanced polities. Within three decades, China has made giant strides. In its effort, it has been able to transition from a hermitage resident sleeping giant and leapfrogged to the status of a dynamic cat to pounce on the strongest and agile economic mouse. China has devoted much of their time, resources and energy from copycat to economic giant. China has a great potential to become the hub of innovation in the world. Gradually, China's market is gaining grounds in the world. China seems to have lived up to the dictates and expectation of the maxim: "it is an honor to produce the master's work." This is more pronounced in how the Chinese are adept at copying and improving the original work. To validate or possibly rationalize copying, Chinese have their

saying Green comes from Blue, but it is better than Blue, is often-times bandied around. Chinese industries had to innovate in China in order to develop cheap products for the markets. China has different strata's of copying to fit for purpose, through to moving from being followers to engineering world standard products and undertaking global expansion, including acquisitions.

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