

Evolution of High-Tech Start-Up Ecosystem Policy in India and China: A Comparative Perspective

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Abstract As the developed and developing economies make the transition to knowledge-based economies, the high-tech sector has been the primary engine in enabling this transformation. Given this context, the policy making and implementation abilities of the countries' local administration assume significance. This study therefore attempts to examine the policy evolution undertaken by China and India which resulted in the emergence of high-tech startup ecosystems in these countries. Further, using a theoretical framework for an ideal entrepreneurial ecosystem, it tries to understand the similarities and differences prevalent currently in the Indian and Chinese high-tech startup ecosystem. The results of the study indicate that although both the countries took different paths, from a macro-perspective, they follow the same pattern as observed in the US and Israel policy making - that of the change in the role of Government as a regulator to that of an enabler of the entrepreneurial ecosystem. The differences and similarities between the key entrepreneurial ecosystem components provide additional knowledge about the currently prevailing conditions of the ecosystem in these countries.

Keywords High-tech policy, entrepreneurial ecosystem, India, China

I. Introduction

New and young businesses referred to now as 'startups' have gained growing relevance and importance among the policymakers and leaders of economies worldwide. In particular, as the developed and developing economies make the transition to knowledge-based economies, the high-tech sector has been the primary engine in enabling this transformation. The promotion of high-tech startups helps economies to generate new products, services and business models that differentiate the nations' output from the rest

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of the world and enhances the economic progress of these countries (Saxenian, 2002).

Startups have started to contribute in such massive proportions to economies worldwide on account of macro-economic changes such as lowering of entry cost for startups, maturing of the institutional finance industry (Venture Capital firms, Seed, Angel investment by firms and high net-worth individuals). Further, the ability to facilitate rapid and global adoption of a new product or service and better knowhow of how to manage these new and young businesses during their initial years of inception and operations have also paved the way in enhancing the contributions of startups to the economies. (Startup Genome, 2015). In monetary terms, the total value creation of the global startup economy from 2015 to 2017 reached \$2.3 trillion-a 25.6% increase from the 2014 to 2016 period (Startup Genome, 2018).

From the Asian perspective, the previous year - 2017 - has been a landmark year and achievement of a key inflection point in the overall global high-tech entrepreneurial ecosystem. For the first time in the world in recent centuries, Asia surpassed the United States in total amount of Venture Capital (VC) invested. Asia received a record USD19.3 billion as investment in high-tech startups as against USD18.4 billion in the USA in Q2 2017 alone (Venture Beat, 2017). China has been the primary reason for such huge investment inflows to Asia, followed by India. In 2014, only 13.9% of current unicorns were from China. In 2017 and 2018 so far, that number has grown to 35% (Startup Genome, 2018). In India, companies such as Flipkart, Makemytrip, and Inmobi are making their presence felt in the global marketplace attracting more than USD1 billion valuations (Nambiar, 2011). In just the first three quarters of 2018, India produced eight homegrown Unicorns (startups that are valued at USD1 billion or more) operating in India (NASSCOM, 2018).

A closer analysis and evaluation of this meteoric rise of high-tech startups in China and India reveals that many different and diverse components of the entrepreneurial ecosystem need to come together to create such momentum of high-tech startup emergence in these two countries. While a few of these are founder-specific and firm-specific factors (Wiklund et al., 2009), the majority of the factors for the successful emergence of high-tech startups need to be attributed to the external factors prevailing in these countries. Aspects such as funding, presence and ability of the region to attract skilled talent, access to addressable market, global connectedness are some of the external factors that play a huge role in influencing startup emergence in any region (Startup Genome, 2018).

Given this context, the policy-making and implementation abilities of the countries' local administration assumes significance. A quick review of literature reveals that many studies have covered China's entrepreneurial ecosystem and its phenomenal accomplishments (Scaramuzzi, 2002; Tang et

al., 2013), but very few have tried similar studies in the context of India - even though it has been recognized as the fastest-growing economy from the past three years. Further, there is scant literature about the different paths taken by the policymakers of these two countries while influencing the evolution of the high-tech startup ecosystems in their respective countries. The present study therefore assumes significance in this context.

This paper seeks to answer the following two research questions:

(i) What type of interventions and policy evolution contributed to the emergence of high-tech startup ecosystem in India and China?

(ii) What are the key differences and similarities in terms of entrepreneurial ecosystem components that led to the emergence of high-tech startup ecosystem in India and China?

The remainder of this paper will be as follows: The next section provides a review of literature of policy-making related to high-tech startup ecosystem prevalent in successful and emerged economies. Next, a framework for examining the entrepreneurial ecosystem of the two countries is presented. It is followed by detailed case studies of policy evaluation in the context of India and China. Inferences and theoretical implications are presented as the last part of this paper.

II. Evolution of Startup Policies in Developed Economies

Policy-making related to small business and more recently on high-tech startups across the world has evolved with time, reflecting the enhanced understanding of the contribution of knowledge and technology in the economy. Neoclassic economic theory that relied on capital and labor being the drivers of economic growth (Solow, 1956) guided the policy making for almost six decades of the twentieth century. From the 1980s onwards, neoclassical economists recognized 'knowledge' as the key factor in spurring economic growth (Romer, 1986). In the next two decades, it was established that entrepreneurship was one of the key ways in which knowledge was converted into economic knowledge, which in turn helped drive economic growth (Audretsch and Keilbach, 2004). High-tech startups emerged primarily out of the U.S. Only in the past few decades, other high-tech startup clusters outside the U.S. have emerged (Startup Genome, 2015).

Gilbert et al. (2004) reviewed the business policy making shifts in the U.S. and noted that a definite shift towards promoting entrepreneurship occurred during the decades of 1980s and 1990s. They noted that since 1800 in the U.S., public policy-making was dictated by the need to harness the market power of large established organizations by way of policy interventions such as regulation, government ownership and antitrust laws. However, during the

1980s and further, the U.S. government made a series of changes in its policy making stance. Firstly, it tried to minimize government intervention in the operations of the firms. Secondly, instead of constraining the firms by way of regulations and laws, the policy changes were more enabling in promoting small new entrepreneurial firms. Lastly, unlike earlier times, these entrepreneurial promotion policies were implemented at all levels of governance - at the federal, state, region and local county levels.

Israel is one of the success stories in the global economy for promoting a vibrant and robust high-tech startup ecosystem. The high-tech based enterprises in Israel account for approximately 10% of business sector employment. One of the key elements of Israel's success in the high-tech entrepreneurship is its ability to attract capital across all stages of the startup and enterprise lifecycle. Israel has the largest share of early-stage and seed venture capital funding in GDP of OECD countries and a large base of R&D-based inward foreign direct investments (OECD, 2016).

Israel's leadership in the high-tech sector has been attributed to three policy levers that have been continuously sustained since the past four decades. The first is its highly successful YOZMA Program which created and sustained a thriving VC ecosystem in Israel. The second key policy was to encourage tertiary education and skill development, including welcoming high-skilled migrants from the World War timelines – which has ensured high-skilled labour availability to Israeli startups. Perhaps the most important and key policy of Israel has been the continued investment in R&D, almost three times the global average. Israel currently has the second highest ratio of R&D expenditure to GDP in the OECD countries (OECD, 2016).

The United Kingdom (UK), in particular, the clusters of London and Cambridge, have put the country on the map of global high-tech startup hubs. London ecosystem in particular ranks as one of the top ten destinations for high-tech entrepreneurship over the past decades (Startup Genome, 2018). From being in the forefront of the industrial revolution in 1600s to now, keeping with times, UK is striving to be in sync with the globalization and technological changes that have prevailed over the world in the past five decades. The presence of the world's best R&D facilities, coupled with London being the global financial hub, has enabled the UK to remain in the top ten high-tech innovators lists over the years. Its innovations such as the ARM Chip, the Raspberry Pi, advances in Bio-technology and related areas (with applications in medicine, drug discovery and disease treatment) have been some of the key successes in the recent decades for the country.

The high-tech sector policy-making in the UK has mostly mirrored that of the USA. During the World War period, huge investments in R&D and technology enabled the creation of high-tech products and services, primarily to serve the military needs of the UK. Post war, as a side-effect, the knowledge

spill overs caused by these new inventions on account of applications of the technology in other areas ensured the creation of the modern high-tech sector industries in UK (Buxton et al., 1988).

In Germany, the government aiming to promote startups in high-technology sectors announced the START program, targeted at encouraging startups from universities and government research laboratories (The German Ministry of Economics and Technology, 1999). Being Europe's growth engine, Germany as a country and Berlin, in particular, have established themselves at the core of the high-tech startup ecosystems of the world and of Europe, in particular. Germany's quest for innovation creates ample opportunities for the prospective entrepreneurs, who are highly skilled (on account of the excellent educational infrastructure and world-class industries) and motivated to create new products and offerings. Over the past two decades, German policy has carefully encouraged the emergence of startups in the high-tech areas of energy, Internet technology, transportation and other fields. With programs such as EXIST and INVEST, the government has successfully created another opportunity for academia and industry to work together and create new products as part of the startups promotion.

As far as South Korea was concerned, Nam (2017) noted that, although the country's GDP increased about tenfold from \$1.3 billion to \$1.4 trillion during the period between 1953 to 2016, the government was working on structural reforms, aimed at identifying new sources of economic development in a bid to transition to a knowledge-driven society. The facilitation and development of an 'Innovation System' formed the central strategy of South Korean policy-making. Over the past two years, it has identified 17 regional clusters in which entrepreneurship is being encouraged by supporting commercialization of new ideas with mentoring and one-stop locations for all supporting structure for startups. Choi et al., (2015) noted that innovative new ventures were being the key mode to drive economic development in South Korea. They noted that South Korea had about 30,000 high-tech startups by the end of 2014, after recovering from the 1998 stock market (IMF) crisis.

III. Theoretical Framework

The emergence of entrepreneurial ecosystems for high-tech startups in different parts of the world is a recent phenomenon. Each ecosystem has evolved in a path different to that of the other, and has some unique capabilities and strengths (Cukier et al., 2016). Foster and Shimizu (2013) noted that there were major differences in the entrepreneurial ecosystems from one region to another, primarily due to government policies. However, they

seem to contain a combination of variables in their ecosystem that encourages the entrepreneurial activity to blossom (Arruda et al., 2013). This implies that, though different nations can have different economic environments, it is possible to build their own entrepreneurial ecosystems that can encourage successful business concerns.

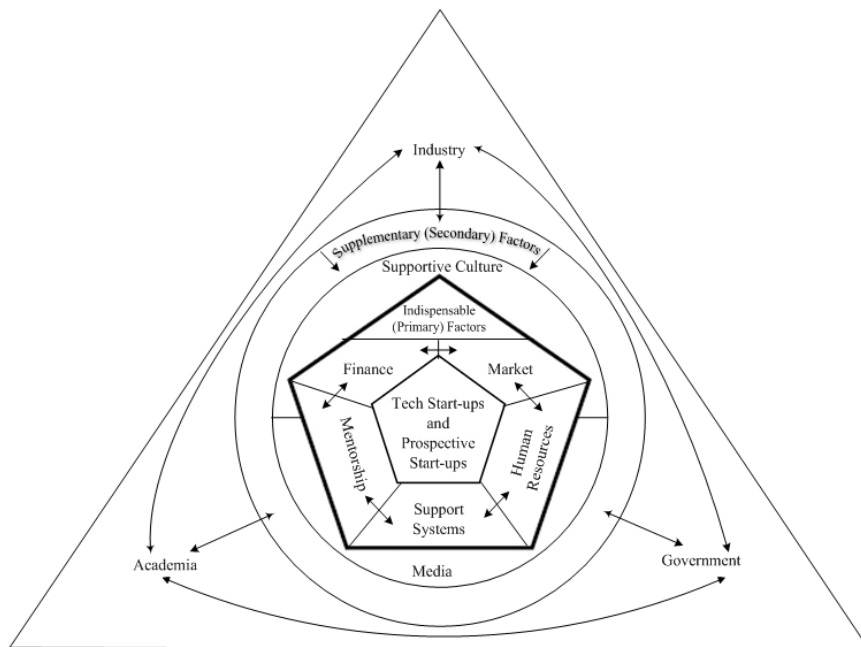
Isenberg (2011) noted that there cannot be a perfect formula for creating and sustaining an entrepreneurial economy. However, he noted that if the key benchmark elements of the successful entrepreneurial ecosystems were taken care of, they could serve as a guideline for creation of a new entrepreneurial ecosystem in other regions of the world. He identified certain critical elements or components or stakeholders which are essential for a blossoming, healthy and structured entrepreneurship ecosystem, which need to be identified at the outset, if they have to be promoted appropriately. These were the domains of entrepreneurship ecosystem and according to him, entrepreneurship is at the core of the ecosystem and it would comprise (i) policy, (ii) finance, (iii) culture, (iv) supports, (v) human capital, and (vi) markets.

Bala Subrahmanya (2017) further improvised the elements of entrepreneurial ecosystem and presented a framework for an ideal entrepreneurial ecosystem that comprised of 12 key components. This framework was based on the triple helix model proposed by Etzkowitz (2003). Within this triple helix model, an entrepreneurial ecosystem would comprise a nucleus consisting of tech start-up entrepreneurs, high-tech start-ups and prospective high-tech start-up entrepreneurs, with two outer layers as presented in Figure 1.

The first outer layer will include indispensable (primary) components consisting of (i) Sources of finance such as Seed Funds, Angel Investors, Venture Capitalists, Private Equities and Investment Bankers, (ii) Market, (iii) Human Resources, (iv) Support system comprising Accelerators, Business Incubators and Co-working Spaces, and common facility centers or common technology platforms/laboratories, and (v) Business and Technology Mentors. The second and outer most layer will comprise supplementary components such as (i) supportive local culture, and (ii) supportive media. Primary components are those without which an ecosystem will not emerge or sustain or effective, whereas secondary components are those which play only a supportive role.

Using this structure of an ideal ecosystem, this paper examines the similarities and differences between the high-tech entrepreneurial ecosystems in India and China. In particular, the focus would be on how each of these core ecosystem issues through the identified structural components plays a role in the nurturing and growth of a tech start-up in different stages of its lifecycle. However, before we evaluate the key differences and similarities that exist across these components of the entrepreneurial ecosystem between India and

China, we shall examine the evolution of the high-tech policies in these countries to obtain context for comparative analysis.



Source: Reproduced from Bala Subrahmanya (2017)

Figure 1 Ideal entrepreneurial ecosystem for high-tech start-ups: structure and components

IV. Case Studies of Policy Evolution in Emerging Countries

1. Policy Interventions and Evolution in China

Although China is being administered centrally since 1949, the path of the country to promote entrepreneurship and innovation is worthy of attention. In line with its ambitions to be the most economically prosperous country, China has been devising and implementing several policies to achieve its goals. Its initial investments on R&D, science and technology were channelized to help transform its defence related capabilities. These investments were used to establish basic and applied science capabilities to build advanced weapons systems to defend their country. Startups, entrepreneurship and commercial applications became the by-products of those military investments.

The OECD (2007) documented the shifts in policy-making in China over the past four decades in its review of the Chinese Innovation Policy. It identified five distinct phases of policy-making starting from 1975 to date. The incubation phase (1975-1978) has been described as the duration where the Chinese government decided to provide primary focus on innovation and entrepreneurship. During the experimentation phase (1978-1985) the actual actions of the government on the ground began to take shape. Special economic zones were created in 1980. Strategic programs such as the National and State level Key Technologies R&D Program were initiated in 1984, followed by initiation of reforms in the University sector and Science and Technology infrastructure in 1985.

The decade of 1985-1995 has been identified as the period of structural reform of S&T system in China. Starting from 1985, China started a series of science and technology interventions to spur entrepreneurship and innovation. The first was to create a National Natural Science Foundation (1986) with a funding support of up to \$2 billion, which funded the Basic Research Program in China, administered by the Ministry of Science and Technology. This provided the capital to pursue high-tech R&D which were aligned to the country's strategic objectives. Second, it created state level missions to pursue R&D activities under the leadership of Chinese Defence personnel and expat Chinese scholars. This initiative enabled creation of new products and services in the high-tech sector, catering to international markets as well.

Further, to enable commercialization of the technology innovations, specific programs and interventions - such as the National New Product Program (1986) and the Spark Program for Rural Innovation (1986) were put in action. The Chinese government invested heavily in creating a state of the art Science research infrastructure under the National Key Laboratories Program, which included construction of research facilities, R&D databases, and a scientific research network. Finally, it was able to attract expat and overseas Chinese skilled talent by way of Seed Funds for Returned Overseas Scholars, the Chunhui Program, and the Cheung Kong Scholar Program among others. All these above initiatives over the three decades enabled the rise of high-tech entrepreneurship and innovation in China.

Blank (2013) observed that "in size, scale and commercial results, China's Torch Program from MOST (the Ministry of Science and Technology), started in 1988 is the most successful entrepreneurial program in the world. Of all the Chinese government programs, the Torch Program is the one program that kick-started Chinese high-tech innovation and startups". He analysed that the Torch program was executed independent of the Chinese state planning mechanisms and its independence allowed the program to experiment and take corrective policy actions based on the results on the ground.

The formation of Innovation Clusters, Technology Business Incubators (TBIs), provision of Seed Funding (Innofund) and Venture Guiding Fund (fund of funds) were the major components of the Torch Program. Blank (2013) noted that through sheer massive provisioning of basic science and technology infrastructure, China was able to artificially create a cluster by concentrating resources, finance and competences to a critical threshold, giving the cluster a decisive sustainable competitive advantage over other places.

The Science and Technology Industrial Parks (STIPs), Software Parks, and Productivity Promotion Centers were the outcomes of this initiative. Further, buoyed by the initial success of the industrial clusters, it has created sector-specific clusters as the next stage of evolution; for example Donghu in Wuhan - specializing in optoelectronics, Zhangjiang in Shanghai - focusing on integrated circuits and pharmaceuticals, Tianjin - biotech and new energy, Shenzhen - telecommunications and Zhongshan - medical devices and electronics. To complement all the above entrepreneur centric programs, and to strengthen the governance aspects of the entrepreneurial ecosystem in China, a provisional bankruptcy law was introduced in China in 1986. Further, in 1994, China introduced the first Company Law to address some of the gaps in new venture formation and exits.

The decade of 1995 through 2005 ensured further deepening and consolidation of Science and Technology reforms by China. An advanced program called as the CAS Knowledge Innovation Program was initiated during 1998 to promote deep science and technology-based innovations emanating out of China. In order to provide early stage capital support to entrepreneurs, China created InnoFund on similar lines to that of U.S. government's SBIR and STTR programs. This Fund was set up in 1999, and it offered grants (\$150 - \$250K), loan interest subsidies and equity investment to selected entrepreneurs. This seed fund Program was particularly aimed to enable early stage technology companies that have innovative technology and good market potential but are too early for commercial funding (banks or VCs). The criterion for applicants to this fund was that they have to have the product or service in high-tech R&D, have less than 500 people, at least 30% of the employees have to be technical and the majority of the company owned by Chinese (Blank, 2013).

Further, China decided to join the World Trade Organization (WTO) in 2001 providing its startups a much more broad based market access. In 2007, the Ministries of Science and Finance jointly created a Venture Fund of Funds to invest directly in VCs, co-invest and provide risk hedge funding to the VCs. The key objective of this initiative was to ensure there was sustained VC flow to growth stage high-tech enterprises.

After initiating and stabilizing the high-tech entrepreneurship and innovation ecosystem in China, the government, since 2006, has shifted focus on further scaling up of the initiatives in depth and breadth. To achieve the same, it unveiled the medium term and long term strategic S&T plan in 2006, which provided the guiding framework for execution of entrepreneurship and innovation support activities in the high-tech sector till 2020.

These policy initiatives have resulted in 54 additional industrial parks that have incubated about 60,000 companies with 8 million employees. The Science and Technology Industrial Parks contributed 7% of China's GDP and close to 50% of all of China's R&D spending during 2014. About 1034 Technology Business incubators were created inside these clusters to enable startup emergence. The Innofund has funded about \$1 billion across 9,000 entrepreneurs since its inception.

2. Startup Policy Evolution and Related Activities in India

India's policy-making towards small businesses and most recently on startups has evolved over time to address a variety of issues. Bala Subrahmanya (2015) explained that evolution of Indian policy-making towards small businesses could be viewed less than three distinct phases since independence. He described that the first phase (1947-1991) was characterized by the building up of both protective and promotion measures for Small Scale Industries (SSI). The second phase (1991-2006) was characterized by the dilution of protective measures and the strengthening of measures to enhance the competitiveness of SSI, whereas the third phase (2006 onwards) focused more on developing the Micro Small and Medium Enterprises (MSME) sector as a whole and its integration with the large domestic and multinational enterprises, while giving scope for the exit of inefficient ones.

During the last decade, the government has particularly focused on promoting and supporting technology and knowledge intensive entrepreneurial small firms. The government tried to provide a mechanism to support individual technology based entrepreneurs through the Technopreneur Promotion Program (TePP), anchored by the Ministry of Science and Technology, Government of India (DSIR, 2014). The formation of Technology Business Incubators (TBI) by the National Institute of Science and Technology Entrepreneurship Development Board (NSTEDB), Department of Science and Technology (DST), and the Council for Scientific and Industrial Research (CSIR), through National Chemical Laboratory (NCL), Pune was another important step in promoting technology driven entrepreneurship in India (Bala Subrahmanya, 2015).

The introduction of PRISM (Promoting Innovations in Individuals, Startups and MSMEs) scheme in the Twelfth Five Year Plan is another policy intervention by the government to support knowledge intensive entrepreneurship in India. PRISM is open to any Indian citizen with an innovative idea or public-funded institutions or organizations engaged in the promotion of innovation. Further, PRISM scheme can also be availed by the above entities to translate their idea into working prototypes/ models/processes (DSIR 2014).

In the past two years, the Government of India has created policies that have allowed companies to invest in technology incubators (of academic institutions approved by the Central Government) as a part of their Corporate Social Responsibility (CSR) initiatives under the Companies Act, 2013. This is aimed at increasing the financial capital availability to the early stage high-tech startups operating out of India. Further, the policy recommendations of the Inter-Ministerial Committee for MSMEs (Ministry of MSMEs, 2013) identified key areas including financial support to high-tech startups as one of the primary areas of focus. Following these recommendations, the market regulator Securities Exchange Bureau of India (SEBI, 2015) has introduced new policies targeted at registered angel investors and VCs to allow for ease of investing in startups.

The Government of India has further introduced new funding programs in the past couple of years to help support and promote technology and knowledge driven entrepreneurship. The India Aspiration Fund was launched by the Ministry of Finance, Government of India in 2015, with an initial corpus of Rs. 2000 Crore to finance and promote startups in the technology intensive sector. Further, in the union budget of 2015, the government announced another program called the Self-Employment and Talent Utilisation (SETU) program with an initial corpus of Rs. 1000 Crore to act as a techno-financial incubation programme to support startups and technology intensive entrepreneurial small business. The SETU program was mandated to be executed by the National Institution for Transforming India (NITI) Aayog.

To promote innovation in the country, the union budget of 2015 announced a new program called Atal Innovation Mission (AIM) under the NITI Aayog. The AIM program was conceived to be the innovation platform for the nation involving academics, entrepreneurs and researchers which would facilitate the discussion of national and international experiences and result in fostering a culture of innovation, R&D and scientific research in India. An initial budget of Rs. 150 Crore was earmarked in the union budget of 2015 for the AIM program. These are concrete examples of how government action has recognized the importance of supporting knowledge-intensive high-tech startups in the country.

During the 2015 Independence Day speech, the Prime Minister of India announced the "Startup India" initiative, which would encourage entrepreneurship among the youth of India, with an aim to create 1.25 Lakh entrepreneurs in India. Further, in subsequent visits to other nations, particularly to the U.S., the Prime Minister has engaged with prominent startup leaders of the ecosystem to understand the modalities of how Silicon Valley became the best example for a thriving startup ecosystem. The Department of Industrial Policy and Promotion (DIPP) held more than 40 consultation meetings with all players of the startup ecosystem across the world to understand the high-tech startup ecosystem aspects, and announced a comprehensive action plan in 2016.

The primary aim of the Startup India Action Plan (2016) is to accelerate the spread of the startup movement in India from digital/technology sector to other sectors such as agriculture, manufacturing, social sector, healthcare, education etc. Secondly, the action plan has specific initiatives and plans to accelerate the startup movement from existing tier 1 cities to tier 2 and tier 3 cities including semi-urban and rural areas. A variety of schemes and incentives were announced as part of the launch of this action plan. The action plan has been divided into three areas: simplification of regulatory procedures and handholding for startups, funding support and incentives, and, Industry-Academia Partnership and Incubation.

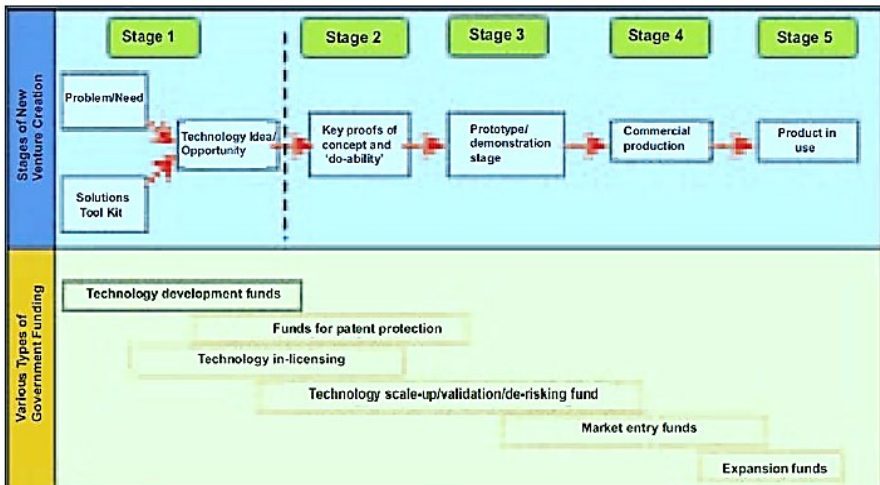
Under the simplification of regulatory procedures, the main aim of the policy is to reduce the regulatory burden on startups and lower the compliance costs as well. A scheme for self-certification of compliance by the startup with about nine labour and environment laws, and, no inspection from regulatory officials during the first three years of formal operation of startups are a few of the policy changes to existing laws that are mentioned under this area. Further, creation of a single point of contact for knowledge exchange and access to funding for startups, by provision of a startup portal accessible to all stakeholders of the ecosystem has also been proposed as an action that will be completed in 2016.

Recognizing that Intellectual Property Rights (IPR) as a strategic business tool for startups, particularly to those in the knowledge intensive sector, a system for fast-tracking the patent application examination process, as well as rebate in fees for startup filed patent applications has been proposed. Another important area where regulation has been relaxed in favor of startups is under the public procurement norms from the government. From April 1, 2015, all central government, state government and public sector units have to mandatorily procure at least 20% of their orders from MSMEs. Further, for all manufacturing sector startups, the 'prior experience / turnover' clause would be exempt, allowing them to participate in tenders. Also, to ensure that startups can wind up operations easier, in case of business failure, provisions for

voluntary closure or fast tracking of business has been introduced in the Insolvency and Bankruptcy Bill (IBB) tabled in the Lok Sabha (the lower house of India Bicameral Parliament) in 2015.

Among the last set of easing regulatory hurdles and providing incentives to startups, income tax exemption for a period of three years of formal incorporation has been promulgated. Further, to encourage seed capital investments, tax exemption has been provided for any excess consideration of valuation above the Fair Market Value (FMV) of shares of the startups.

As can be observed from the national level policies, the government is laying emphasis on enabling access to capital to these high-technology startups since this has been viewed as one of the most significant causes of failure of startups. Given this extra emphasis from the state and central governments, it is prudent to review in detail, some of the key financial support schemes available to startups. The funds provided by these schemes could be used at all stages of the high-tech startup lifecycle, starting from idea validation stage to the full-scale commercialization stage. Magesh, Vibhor and Premnath (2009) provided a detailed overview of the funding schemes made available to the entrepreneurs by the government. They noted that needs at each stage of technology commercialization and new-venture development were to be understood before one could fully exploit the funding landscape and funding opportunities offered by the government. The graphic presented in Figure 2 provides a brief outline of the various stages involved in starting and growing a technology startup.



Source: Reproduced from Magesh, Vibhor and Premnath (2009)

Figure 2 New venture creation and technology commercialization process flow chart

In summary, policy-making in India with respect to promotion of knowledge-intensive firms and startups primarily has been focused on making the right amount of capital allocations through various schemes and programs. However, since the response from the entrepreneurial community was tepid for these capital allocation related policies, suitable policy changes were initiated to attend to other core issues of IPR management, reducing regulatory barriers to conduct business and supporting technology upgradation among others. These policy actions from both the central and state governments indicate that the administration recognizes the need to promote knowledge-intensive entrepreneurship in the country. However, the lack of knowledge of what factors contribute to the lifecycle of these high-tech firms have created barriers in decision making, resulting in slower than expected response in policy-making and implementation.

V. Discussion and Inferences

The policy evolution of India and China indicate that the two countries have pursued different paths to enable the high-tech entrepreneurial ecosystem in their respective countries. From a perspective of outputs, scale, size and speed, China clearly is ahead of its peers in the world – and is poised to be overtaking USA as the most dominant region for the pursuit of high-tech entrepreneurship. China has started to reap the benefits from its early investments and sustained focus on enhancing basic science and R&D infrastructure, which it started over four decades ago, in the 1980s. It has responded with agility and scale, in understanding and acting on the macroeconomic changes that took place along the way during this time period.

The Chinese government's investments in funding the high-tech startups through various programs over the four decades and also creating an exit option through the setting up of new capital markets clearly is a commendable and replicable policy action to laud. These policy interventions have resulted in China becoming one of the most advanced and sought -out places to pursue high-tech entrepreneurship. Its policy initiatives have nurtured each of the critical elements of the entrepreneurial ecosystem, and through new Programs and policies, China has successfully managed to create a thriving entrepreneurial ecosystem during the current years.

India, on the other hand, has started its focus on high-tech ecosystem promotion about two decades late in comparison to China. For about four decades since its independence in 1947, policy-making was skewed towards protecting and stabilizing the existing SMEs. Post the economic liberalization during 1991 and onwards, there has been gradual shifts in the country's policy-

making to identify, encourage and support innovation via high-tech enterprises. Although it is a late starter in comparison to China, India's policy-making towards creating a high-tech entrepreneurial ecosystem has accelerated multi-fold in the past decade. Gaps prevalent in many elements of the entrepreneurial ecosystem are being addressed through quick policy actions - creating a better ecosystem for the pursuit of high-tech entrepreneurship in the country.

In comparing the policy evolution of the two countries, it is important to understand that there are structural differences in both these economies. China has a centralized style of government functioning whereas India is democratic in terms of processes and policy-making. This aspect has its benefits and challenges as related to policy-making and the resulting outcomes at the micro level. The Chinese regime was able to drive the key changes in the economy due to the nature of its centralized style of governance. This has helped China to evaluate the impact of its policy-making, make changes when the desired macro level outputs have not been achieved, and ensure that in the long-run - China is able to achieve the goal of realizing an innovation and knowledge-driven economy. In the case of India, the entire cycle of policy definition, implementation, validation of initial results, corrective measures enforcement leading to achievement of the desired goals relatively take a longer time in comparison to China.

The other area where China has reaped the benefits of centralized governance is in the mechanism of inducing interactions between the industry and academia within China. The Government in China not only laid out the policies and associated incentives to encourage enhanced interaction between the industry and academia, but also ensured that the grants and incentives provided were used to achieve the desired results within the stipulated time. The push to universities to also account for being directly responsible for regional economic development by providing thrust to high-tech entrepreneurship, apart from their standard functions of teaching and basic research has provided rich dividends to the country.

The Zhongguancun Science Park located in Beijing and set up in 1988, was the first science park in China since 1988 and the biggest, located in Beijing. Since its inception, as a result of the various policy initiatives, this part now houses more than 20,000 high-tech startups. These startups are ably backed by various academic and R&D institutions, including, but not limited to, Peking University and Tsinghua University, the Chinese Academy of Social Sciences and the Chinese Academy of Engineering, state-level laboratories, national engineering research centers, and national engineering and technological research centers. Another example of such a transformation is the Zhejiang University, which has a very robust knowledge transfer mechanism involving all the key stakeholders of the entrepreneurial ecosystem. The Zijing Innovation town, an idea pioneered by Zhejiang University, with the support of the local

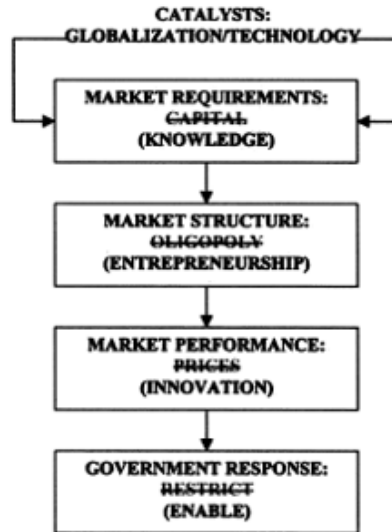
government and industries, is a living example of the enhanced and deepened industry - academia interactions leading to regional economic development.

In the case of India, the democratic mode of government has meant that government usually is the facilitator in enabling the transformational change. This has meant that the onus is on the universities and the industries to come forward and reap the benefits of the new policy measures and incentives. In general, the industries in India have not been supportive of long-term radical and high-risk collaborative programs and this has resulted in the interactions between industry and academia to be more of transactional in nature - barring a few instances (IIT Madras, NCL Pune) where there is real impact of a deeper and meaningful interaction between the industry and academia.

The pitfalls of the differences in governance is that startups in China do not have the relative freedom to choose their area of impact - as freely as in India - on account of focused and targeted policy initiatives and incentives. In other words, startups in China could be seen as converging to achieving a specific set goal, whereas startups in India could be seen as variance seeking - more exploratory across different domains. This has important implications on the time to realize the full benefits of policy-making in these countries. China is seen to benefit in the short-run on account of stricter focus on select few areas (based on manufacturing and recently on high-tech areas that are manufacturing intensive), whereas India lags China in the short-run in terms of the quality and quantity of startups.

While there are differences in the timeline of when serious policy actions started, and its effects trickled down to the ground, one aspect common across the globe is that both India and China have started to respond to the shifts in macroeconomic conditions in similar fashion. Gilbert et al., (2004) noted that the structural changes in the U.S. economy, particularly during 1990s caused the policymakers in the U.S. to shift focus from controlling large firms to promoting entrepreneurial small firms. It also resulted in a fundamental change in the role of government from that of an overseer of business, constraining the freedom of firms to contract, to that of a partner to business, enabling and fostering the development of new small firms.

This shift in policy emphasis as a response to a changing source of competitiveness from the traditional factors of capital and labor to the emerging factor of knowledge is depicted in Figure 5.1. This shows that when competitiveness was generated from capital and labor, the policy response towards large enterprises was restricted in nature, while small business was the target of preservationist policy. By contrast, when knowledge is the source of competitiveness in emerging markets, policy shifted towards enabling the startup and growth of new enterprises, or what can be termed as entrepreneurship policy (Gilbert et al., 2004).



Source: Reproduced from Gilbert et al. (2004)

Figure 3 Change in U.S. policy making during the twentieth century

The cases of India and China as described in this paper also indicate that the Chinese policy-makers supported a similar transition – and the Indian policy also is taking a similar approach in response to these external trends. While the above analysis provides a macro perspective of differences and similarities that both countries demonstrate, in the forthcoming discussion, we examine the twelve components of the ideal entrepreneurial ecosystem against India and China to understand the micro aspects of how these critical aspects of the ecosystem are faring in the respective countries. Table 1 describes the role and importance of each component and Table 2 discusses the similarities and differences further.

The key similarities between the Indian and Chinese high-tech entrepreneurial ecosystem are that both economies have abundant supply of sources of entrepreneurship, are in a position to provide a large addressable early market to high-tech startups, and have the ability to rapidly skill the youth of their countries through their Universities. Further, both these economies need to focus on pursuing policy support on attracting global talent to their respective countries, which may also help alleviate the problem of lack of local mentorship prevalent in both these economies.

Bala Subrahmanya (2015) noted that the new generation startups emerging in India represent the third wave in the evolution of small businesses in India. He reasoned that these new startups were essentially technology / knowledge-based and emerged largely due to the ICT revolution and globalisation. He

further observed that there was limited knowledge among policy makers and entrepreneurs about the unique aspects of these new startups. He argued that these ICT based startups were very different from the older generation MSMEs based on a variety of parameters.

Most importantly, the entrepreneurial background of these new startups were different to that of the previous generation MSMEs. The ecosystem of Technology Business Incubators (TBIs) and Accelerators that has started to grow in India to support these new ICT startups were very different from the traditional support systems provided to the MSMEs. Further, the mode of financing for these new startups (by Angel investors, VCs) were also different to the traditional funding institutions. He further remarked that very little is known about the lifecycle events of these ICT startups. These observations, aided by the democratic nature of governance in India, explain the relative lack of outcomes in India when compared with China.

Table 1 Description of role and importance of elements of the entrepreneurial ecosystem

No.	Components	Role & Importance
1	Entrepreneurship	It is at the core of ecosystem for birth, growth and exit of start-ups.
2	Markets	Markets would include early product adopters, repeatable customers, networks & MNCs.
3	Finance	Angels, Private Equities, Venture Capital, public capital markets for IPO and debt instruments.
4	Human Resources	Labour force, technical workforce, and managerial talent.
5	Education & Research	Institutions which produce non-graduate and graduate workforce, technical & managerial talent, innovations, entrepreneurial training, etc.
6	Government: regulatory framework & policies	Favourable laws & regulations for tax incentives, venture capital, bankruptcy, property rights, labour and exits; public research institutions.
7	Large Companies including MNCs	As customers, sources of entrepreneurship, nurturers of start-ups through accelerators, sources of technical and managerial workforce, investors, technology providers, acquirers of start-ups.
8	Mentors/Advisors	Technical and managerial advice for start-up creation, stability, growth and exits.
9	Support Institutions	Accelerators, Technology Business Incubators, Soft infrastructure (professionals - Lawyers & Accountants) & hard infrastructure (telecommunications, transportation & logistics)
10	Cultural Support	Tolerance of risk, failures, support for innovation, creativity, drive & hunger for achievements; higher social status for entrepreneurs; respect for wealth creation.
11	Media	Publicizing: start-up creations, its pre-requisites, support available, failure consequences, and achievements of success
12	Immigration of talent	Sources of entrepreneurship, human resources, advisors/mentors, finance, support networks, etc.

Source: Adapted from Bala Subrahmanya (2017)

Table 2 Summary of comparison of elements of the entrepreneurial ecosystem

No.	Components	India	China
1	Entrepreneurship	Steady rise in entrepreneurial intent. Startup Exits – which were an issue have recently started increasing	Fledgling state of entrepreneurial entry and exit – as evidenced by startup rate and M&As of late stage startups
2	Markets	About 20% of the local market is accessible to high-tech startups. Indian laws and governance framework have been improved to enable startups to sell to the world	Due to the state run policies, China is able to provide a very vast local market. Further, its leadership in manufacturing is helping startups access worldwide markets more easily
3	Finance	Early stage and seed funding challenges remain. Growth stage funding is available in plenty	Mature system of funding support across all stages of the startup lifecycle
4	Human Resources	Key strengths of the country. English language speaking ability has been a positive differentiator for India thus far.	Language barrier that existed in the past decade is now slowly being addressed. China has successfully brought back highly successful and skilled expats back to the country
5	Education & Research	Academia and Research activities are now directed towards taking up the challenge of getting to global leadership in their areas	Sustained investments in R&D have placed China in the second position globally for high-tech sector related work and patents
6	Government: regulatory framework & policies	Increasingly supportive policy framework over the past decade	Sustained and incremental investment and support to promote high-tech entrepreneurship and innovation
7	Large Companies including MNCs	Large presence of MNCs in India – but primarily for back office and captive R&D work.	Increasing presence of MNCs – although China has been very restrictive to entry of foreign companies
8	Mentors/Advisors	Frugal support system at the moment – will perhaps get better over time	Increasing exits have started to enable the formation of a good mentoring network – although more can be done in comparison with global hubs
9	Support Institutions	Steady increase in the number of Incubators, Accelerators and supporting infrastructure over the past decade	Massive push by the Government to setup Incubators, Research Parks across the country to enable entrepreneurship at scale
10	Cultural Support	Opportunity driven entrepreneurship is slowly raising on account of the increasing middle class. Failures are a stigma	Failures are not taken in the right context. Societal underpinnings still drive the cultural aspects in China
11	Media	Supportive media and balanced reporting of success and failure	State controlled media in China
12	Immigration of talent	Huge inflow of expat Indians to pursue high-tech entrepreneurship in the last decade	Focused incentives to Chinese overseas skilled personnel are providing rich dividends to China

In terms of key differences between the Indian and Chinese high-tech entrepreneurial ecosystem, the most striking one is the sheer scale and size of the Chinese activities in promoting high-tech entrepreneurial ecosystem. Its massive investments in all components of the entrepreneurial ecosystem have enabled the rapid rise of China as the world's second best and thriving ecosystem for high-tech entrepreneurship today in the world (Startup Genome, 2018). India has been steady and sustained in its investments and support towards high-tech entrepreneurship on the contrary, and has focused on increasing its resources and support towards the same over the past decade, particularly in the last five years. India is more open in terms of rule of land (democratic) in comparison to China (state led/controlled) – and this may entail a few transnational entrepreneurs to choose India over China.

VI. Conclusions

This paper has attempted to understand the policy evolution in two emerging economies of the world – India and China. In doing so, it has outlined the different paths that the respective governments have taken to promote high-tech entrepreneurial ecosystem, as well as the mode in which they have operated to achieve the results that are visible as on today. Further, by comparing the key elements of the ideal entrepreneurial ecosystem to the present conditions prevalent in both countries, it has tried to throw light on the similarities and differences that exist in each of these components, which has enabled us to obtain a micro-level understanding of the critical elements that influence the entrepreneurial ecosystem.

At the macro level, we are able to understand that both countries have pursued similar policy interventions, in line with those in developed economies such as USA and Israel to promote the entrepreneurial ecosystem. But, since China started these interventions at least about two decades earlier to India, the results of these policies are visible externally today, in comparison to those of India.

In the U.S, the decades of 1970s and 1980s had the most impact and contribution to employment and economy from high technology startups. The advent of internet in the U.S. and incremental successes in biotechnology industry disrupted the marketplace through creation of new startups that leveraged these technologies to provide new products and services in ways that was not possible before. At its peak, these entrepreneurial companies contributed 20% of the U.S. employment in the decade of 1980s. Even though in recession, between March 2009 and March 2010, 394,000 new businesses were formed, creating 2.3 million jobs in the U.S. (Center for Economic

Studies and Kauffman Foundation, 2012).

European countries also have followed suit in policy-making towards driving their economies to a knowledge-driven society. Germany and UK are at the forefront of this structural change in Europe. Asian countries such as South Korea have also aggressively promoted startups in the high-tech sector as the next growth engines, as the state led large industries have started to stagnate. The same phenomenon is being witnessed now in the case of China and will be in India if the policy trajectories and its implementation goes as planned.

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