Pacific Business Review International
Volume 8, Issue 7, January 2016

The Coevolution of Global Entrepreneurs and Worldwide Technology Hubs

Gene F Brady
Senior Lecturer, Management and International Business,
School of Business, Southern Connecticut State University,
New Haven

Shyam Lodha
Chairman and Professor, Marketing Department,
School of Business Southern Connecticut
State University,New Haven

Abstract

In this paper we identify several characteristics of complex adaptive theory (CAT), a derivative of complexity theory (CT), and discuss these characteristics as they relate to worldwide high technology hubs (hi-tech hubs), and the subsystems, i.e., global entrepreneurs, which occupy these hubs. Seven case examples of live hi-tech hubs are then briefly reviewed in order to observe their behavior within the context of CAT. Our analysis reveals common threads that run through our samples, and possibly through global hi-tech hubs in general. We discuss the implications for future research and theory-building.

Key Words: Complex adaptive theory; hi-tech hubs; global entrepreneurs; edge of chaos; co-evolution.

Introduction

The Hi-Tech Hub Environment and Complex Systems

According to CAT, a derivative of the broader Complexity Theory (CT), creative activity of living systems thrives at the edge of chaos. The edge of chaos is located somewhere between the environmental borders of normal and random behavior (Dodder & Dare, 2000). It is at the edge of chaos that systems have access to untried solutions to adaptability dilemmas. Hi-tech hubs represent the edge of chaos, and it is to these hubs that global entrepreneurs. It is, therefore, a characteristic of global entrepreneur start-ups that they will be drawn to creative environments (edges of chaos) so that they may compete for breakthrough innovations in settings that are fertile with ideas.

Evolvement to Randomization and Back Again

Because global entrepreneurs are large-scale businesses, they tend to favor hubs capable of connecting with massive size markets. This attraction is further enhanced by the possibilities of: 1). Finding potential market breakthroughs to which they can respond and implement; 2). Collaborating with other firms to realize synergies in R&D, production or marketing activities, and; 3). Attracting venture capitalists (VCs) through their unique blend of talent and production forces. The term, evolvement, is particularly suited to GEs; their evolvement to the edge of chaos is a normal process experienced by live systems in their searches for ways to sustain their survival in the contexts of continually-changing environments. Once successful adaptation is experienced, the global entrepreneur can then return to a state of relative normalcy. However, this state is only temporary. Environmental forces are forever changing, thus increasing the need for continual innovation, development and implementation. Thus, normalcy is always in transition. Successful breakthroughs temporarily beget eventual orderliness. We can then posit that as orderliness is restored to a global entrepreneur following a successful product or process innovation, environmental tensions build up such that the global entrepreneur again tends to seek randomization within that product or process category. It is difficult to predict the future of global entrepreneurs heavily immersed in a hub's randomized activities, because an innovation often occurs unexpectedly and spontaneously. The back and forth sway between normalcy and randomization does not follow a linear trajectory. Also, some product markets of a firm may be in transition while other markets of the firm remain in relative stability.

Capacity to Self Organize

Because they deal with unpredictability, hi-tech start-ups, as with complex adaptive systems in general, need to have the capability to organize themselves with limited interference

of external forces. Self-organizing within hi-tech hubs is necessary because of the need for entrepreneurial start-ups to be empowered. Particularly, entrepreneurs need to be able to work on problems from beginning to end, have feedback from professional peers and work on a variety of tasks (Brady, 2009). Entrepreneurs are aided in self-organization by being proximal to other entrepreneurs with similar backgrounds, interests, and complimentary talents. Entrepreneurs are also aided by the technological accommodations that the hub management provides. Global headquarters of larger size firms are unable to provide on-the-spot leadership at the hub is simply not physically present. Instead, local entrepreneurial groups may rise to the occasion by filling leadership roles from among their own ranks. In such cases, headquarters may defer to self-leadership at the hub. At the same time, headquarters may support the entrepreneur effort by providing policy guidelines, financial resources, expatriates with appropriate functional expertise, and by encouraging two-way communication between entrepreneur agents and their headquarters.

Seeking High-stakes Butterfly Effects

Global entrepreneurs at the hubs are in a high-stakes pursuit. Start-ups need to hit pay dirt before they have exhausted their funds or credit. Cost of living and access to the needed factors of production – labor, overhead, technical services – can be expensive, and frequently drive some smaller start-ups away. Yet, that possibility of a single creation magnifying into a worldwide transforming product lures these start-ups to remain in place, even sometimes beyond the point of financial feasibility. VCs migrate to successful hubs. Start-ups, in turn, are drawn to these VCs by the slightest hint of a potential that the VCs might find their innovation promising. This lure of a high payoff that emanates from a small discovery is consistent with the butterfly effect in chaos theory which demonstrates that a minor change in one part of a system can lead to a major change at the most abstract level of the system. The butterfly effect, described by Edward Lorenz (1963), maintains that a slightest change at the onset of a system's process could eventually result in a monumental and unanticipated change further along in the process. From his experiment, Lorenz speculated that the flap of a butterfly's wings in China could conceivably result in a tornado in Florida.

Co-evolution and Change

Consistent with CAT, the adaptive behavior of global entrepreneurs affects the behavior of the home hub as an entire system, as well as the nested and surrounding systems. These systems include VCs, entrepreneurs, local and national government, and support services. Co-evolution among these systems is continually taking place. The effects of this co-evolution can be mutually beneficial. The benefits may extend to competitive entrepreneurs, as the hubs' realignment to environmental forces brings about all-inclusive infrastructure and system enhancements.

The Rise and Fall of Hi-tech Hubs

Co-evolution implies a high degree of interdependencies among a hub's subsystems. However, Co-evolution does not necessarily equate to growth. Declining hubs can drag a number of entrepreneurs and supporting systems down with it, especially start-ups in their vulnerable early stages of growth. Hubs can fail for a number of reasons as when the rising costs of living within and surrounding a hub dissuades new entrepreneur start-ups from occupying them, or the emergence of more viable alternative hubs causes political support to be withdrawn from an existing hub. Within a hub, global entrepreneurs may be interlinked very tightly. A tight working connection between several entrepreneur entities can trigger an avalanche of decline upon the failure of a pivotal entrepreneur establishment. Similarly, because of the success of a few key players, hi-tech hubs can be in a high growth posture, pulling entrepreneurs, VCs, and supporting systems upward as well. This is particularly valid if the hub can accommodate growth through various incentives and infrastructure provisions.

Nesting

Any system is a part of some other system. A system cannot be fully understood without first understanding how it relates to its suprasystem. We can study the bee. We can dissect it and examine all of its integral parts under a microscope. Yet, we will have an incomplete picture until we learn how the bee relates to its hive and other environmental elements. And, so it is with technological hubs and the systems within those hubs. The hub is also a part of a larger system, the city, the county or province, the nation. Start-ups are nested within the hub itself, sometimes for a provisional period of time. The provision is that the start-up develops a product, or forms a strategic alliance with another entrepreneurial activity to jointly develop a product. The start-up or alliance then successfully appeals to a VC. Or, the VC seeks out the start-up. Ideally then, the product is developed and then successfully launched, often from the same location. Or, the would-be product fails for some reason. Global entrepreneur teams may also be nested in externally-located multinational corporations (MNCs). MNCs may send R&D teams to a hub that appeal to its unique focus and competencies. To the MNC the hubs represent clusters of scientific knowledge that allowing the MNCs to absorb and transmit new knowledge through such mechanisms as information technology, liaison agents,

steering committees and global coordinating managers. These mechanisms serve also to filter out extraneous data and ensure the security and purity of the information. These clusters tend to thrive near the randomization domain, at the edge of chaos. These clusters are effectively the battle units, struggling on the front lines of unknown, but potentially promising, discoveries; discoveries that may explode at any time, generating long sought after "aha" moments among their agents. These discoveries may be initially developed at the originating site, or subsequently formed out to other specialized sites for further development.

Innovative Breakthroughs

At times an innovation can cause a period doubling cascade (Brady, 2014). An innovative breakthrough, long sought, suddenly and unexpectedly occurs creating an explosive-like catalytic chain reaction. This innovation breakthrough may then become a game-changing event. An analogy might be the hockey team that has lost seven straight games in a row. Everyone seems pessimistic about the chances for that team to come out ahead for the season, until finally the team wins a difficult game against the number one placed opponent. Then, it seems that this previous underdog can do no wrong. The team comes alive with enthusiasm and motivation, winning all of the remaining games, and ultimately the league championship. A technological breakthrough of a start-up within a hub can deeply and positively affect other entrepreneurs within the hub. A live example of these dynamics is the company, Skype. The breakthrough and excitement that accompanied the development of Skype software by Estonians and the location of principal offices in the hub of Tallinn, Estonia, contributed to Tallinn being able to offer one of the deepest pools of technical talent per capita in all of Europe. This talent pool led to unprecedented growth in new global entrepreneurs and VCs in the decade following the establishment of Skype (Lindsey, 2015). True to CAT, Skype had ventured onto the edge of chaos, somewhere in the domain of randomness. Once the breakthrough had occurred, Skype, along with an entourage of followers returned to a new normalcy, but on a higher plain.

Mergers, Alliances and Integration

In order to survive and grow in challenging environments, systems sometimes merge or form alliances with other systems in an effort to form single, more competitive systems. A pack of wolves can bring down a prey which would otherwise elude a single wolf. A wolf can merge into a pack and become one with the pack. Or, a writer and a researcher join forces to write a book; the researcher cannot write, nor is the writer alone sufficiently skilled in research methodology. Together, the writer and the researcher create a mutually, sought-after, synergistic alliance, enabling them to accomplish their aim. Once the objective is attained the writer and the researcher may go their separate ways. Within the context of the hi-tech hub, two or more start-up global entrepreneurs may integrate some or all of their skills to not only develop a prototype of a product, but launch the product and bring it to market.

Sample Cases

Although there are hundreds of hi-tech hubs throughout the world, we briefly illustrate in

the following live cases, some of the system characteristics of these hubs. Like individual

personalities, each hub has its strengths and weaknesses. In these cases, we are able to observe the power and drawbacks of several hubs and how these positive or negative features drive strategic decision-making within these hubs.

Dubai, United Arab Emirates - The Launch Platform

Innovation hubs that have successfully existed over the years have had time and opportunities to build connections to many markets. Such hubs often endure so as to be well recognized as proven launching platforms with the capacity to reach many different locations. Such launching platforms are a hub's evolutionary response that recognizes the need of global entrepreneurs to launch their products as soon after development as possible. One such hub that has received a lot of attention is located at Dubai of the United Arab Emirates. With the collaboration of its enriched firms Dubai has taken on the challenge of building comprehensive launching pads which enables it to leverage their innovations throughout the Middle East and North Africa with relative ease (Lindsay, 2015).

Dubai is destined to become an even greater and formidable global launching platform as it prepares to host the World Expo 2020, which promises to inject as much as $23 billion into the city. The World Expo is an alluring and infamous global event that occurs in a selected city every five years. It provides a gathering location for state-of-the-art technology and associated innovations. In the case of Dubai, The Expo will firmly solidify its role as a launch platform for economic, social and sustainable development. The example of Dubai suggests that within the CATS cognitive frame, a global entrepreneur will be attracted to the hub that is comprehensive, integrating sensing, developing and implementing processes into its launching platform. It will do this in the interest of reducing costs through consolidation of functions, and it may also do it to reduce complexity and risk.

Santiago, Chile – the Costly Hub

A hub can become so attractive that the demand for its services drives up the cost of living. Start-ups, particularly, often have limited cash reserves, making it sometimes prohibitive to move into a high-cost business center. When this happens, the hub may resort to special incentives to offset the financial burdens. The hub of Santiago, Chile is such an example. With a population of 6.3 million, Santiago draws in many émigré entrepreneurs with attractive packages, including as much as $33,000 in actual cash outlays. For this and other reasons, Santiago is becoming known as the best city from which to reach the Latin American market (Lindsay, 2015). Aside from its rich mix of engineering talent, there are other reasons why Santiago has attracted so much traffic. A coastal city, it has all the tourist entrapments, including beaches as well as mountains. The business benefits, recounted above, make it hard for innovators to turn down an opportunity to work alongside highly successful entrepreneurs. Santiago has a well-established infrastructure to support the needs of global entrepreneurs. Set in the capital city, the hub finds it easy to offer these entrepreneurs the financial, political, legal and government support they need. Santiago is also a prominent gateway to South American markets. Nested as a subsystem of Chile, Santiago derives much of its attractiveness by virtue of being engulfed within a highly dynamic economy. Within our cognitive CAT framework, examination of the hub at Santiago suggests: The drawing power of a technological hub will reach a point of diminishing returns as supply and demand drives up the hub's cost of living. However, the rising cost of living can be offset by the hub's extension of added incentives and accommodating infrastructures.

Tallinn, Estonia – The Digitally Astute Hub

Global entrepreneurs are drawn to foreign locations that serve as deep pools of technological expertise. Such a location is Tallinn, Estonia with a population of over 435 thousand. Though small, as international tech centers go, the high concentration of "techies" more than equates with larger, but less innovative, knowledge centers. Tallinn, which housed such noted start-ups as Skype, continues to churn out high performance, fast-growing companies; some of which are among the quickest-expanding in Europe. As a demonstration of Estonia's commitment and reliance on internet technology, the country offers e-residencies to anyone in the world. E-residencies entail allowing foreigners, as well as residents, to enroll in an elaborate network whereby network members, digitally speaking, enjoy a web of services – banking, tax benefits, and government services – as though they were literally residents of Tallinn. The examination at Tallinn appears to support the suggestion that global digital superiority can serve as a core competitive advantage for a hub.

Istanbul Turkey – The Gateway Hub

Istanbul is Europe's largest gateway to the East, and includes 76 million Turks as well as Turkic inhabitants of Russia and Central Asia. As these inhabitants are often deprived of goods and services that are relatively abundant elsewhere in the world, talented entrepreneurs are drawn to obvious opportunities that exist at this gateway. These opportunists include talented technocrats many of which have graduated from Europe's top universities. Such talent is plentiful enough, but therein lays a problem. Crowded conditions have driven the cost of living upwards. As well, the authoritarian political climate in Istanbul has watered down the exuberance for innovation (Lindsay, 2015). We might then say that innovative human capital is drawn to locations that serve as hinges between large potential markets. However, the flow of such traffic is mediated by local environmental forces, including cost of living and political climate. Even so, Turkey's VCs and young entrepreneurs are proven to be very adaptable and have been seen to reap benefits from seemingly improbable ideas.

Shenzhen China – The Speedy Hub

Speed to market can become a vital advantage. Consistent with CAS theory, markets advantages flow to technological hubs that not only come up with game-changing innovations, but bring these innovations to market quicker than its competition. One such hi-tech hub that offers speed as a particular competitive advantage is located in Shenzhen, China, which, attesting to the value placed on speed is popularly termed "instant city." (Lindsay, 2015). Through unique process modeling, designed to smooth out the flow from innovation to market, wheel-spinning wastes are avoided. The process might flow something as follows: develop prototype, raise funds, and build buzz, manufacture, and then ship through proven logistics networks. The convenience factor is allied with speed. Global enterprises opt for Shenzhen because the facilities for design, manufacture, packaging and distribution are available here in one single location. Also, as a port city, Hong Kong permits speedy shipping of finished goods with its economical, modern and well-developed transport technology.

Although, the attraction of global entrepreneurs to Shenzhen has driven up the cost of living, China has been proactive in offsetting such costs by bestowing on Shenzhen special economic status. Because of this status promising entrepreneurs can enjoy tax exemptions and other economic advantages designed to lure foreign investment.

Silicon Valley – The Role Model

Silicon Valley (SV) is the granddaddy of the worldwide technological hubs. It is located in the San Francisco Bay area, teeming with a quarter of a million informational technologists, and as many VCs, production workers, homeless people among others. All told, the area is bursting at the seams with a total population approaching five million. SV is the most tried of the world's hi-tech hubs, and serves as a role model for other hubs. It is ranked number one among the 20 top hi-tech hubs in terms of performance, capital invested and "talent". If systems that are declining tend to drag its nested systems down with them, here we see the opposite effect. The phenomenal growth of resident companies, including such notables as Adobe Systems, Apple, Cisco Systems, e-Bay, Google, Hewlett-Packard, Lockheed-Martin, Netflix, and Yahoo has precipitated the rise of ancillary systems and thousands of emulating start-ups. For example, one-third of all VC investment in the U.S. takes place within Silicon Valley. As we observe from our other hub examples, constriction of living and working space has driven up the cost of doing business.

Bangalore City, the Silicon Valley of India

Bangalore City is nested, not only physically, but politically and economically, within the transformation mission of India herself. In 1991, Prime Minister Atal Bihari Vajpayee placed IT among the nation's top five priorities. This priority continued to be reinforced through integration of the IT mandate into planning policies. Today, Bangalore City houses 35% of India's IT professionals, who form a young and active culture. Largely because of this talent, we see, today, a remarkable transition from solely IT offshoring services to market disruptive innovative and entrepreneurship activity. Specifically, Bangalore City contributes to 35 percent of the national software exports. Nonetheless, Bangalore City is still considered as the backbone of India's $60.5 billion IT offshore industry.

Bangalore City is a pleasant place to live and work. It is a cosmopolitan city with a pleasant climate. Yet, as with the other hi-tech hubs we examined, the city's growth and success is outstripping its infrastructure. To relieve this, the government has taken measures to improve the infrastructure by building more, for instance, ring highways and hi-speed rails.

Certainly, the preceding narrative paints a picture of coevolution and expansion within Bangalore City as well as throughout India at large. However, there are countervailing tensions as well. Some of Bangalore city's richest young talents are being drawn to competing hubs in the U.S., U.K., and even nearby Singapore and Australia. Although there are opportunities in India, and Bangalore City in particular, professional efforts are not everywhere recognized in the industry. The strains of rapid growth are taking toil. Over-time work, less pay, mental stress, and work-life imbalance are some of the reasons young engineers seek opportunities elsewhere. And frequently, those that leave are the best software engineers, leaving behind those with less vision and perseverance than is required for breakthrough entrepreneurial discoveries.

Discussion

Our sample cases broaden the understanding of the dynamics associated with global hi-tech hubs beyond that explainable by mere surface application of CAT. The concept of totality is offered in the example of Dubai. The example points out that entrepreneurs and investors are drawn to hubs that are recognized for innovative activity, but are even more drawn to hubs that offer innovative opportunities as well as a full range of associated services. In Dubai, the expedient supply chain connections to established markets becomes near as important as product development. Also, in the example of Dubai we see how a hub, as a holistic system, is viewed as a grandiose and singular investment opportunity by the national government, apart from how VCs might view their agenda for promising start-ups within the hub. This latter observation highlights the notion of nesting that was explored in our earlier discussion of CAT characteristics. The attractiveness of start-ups within a high tech hub is partially a function of the success of the hub as a total system, as viewed by its benefactors, i.e. local and national governments.

Santiago exemplifies the supply and demand features of hi-tech hub traffic. The multiple

attractions of Santiago, Chile draw in a mass of people, including innovators, investors and

tourists. The resulting high cost of living actually contradicts the hub mission by driving

away people most in demand – a young, aspiring mix of foreign engineers and scientists desiring

to work next to established global entrepreneurs. The incentive packages are just that – packages

tailored to bring in the right people, and to motivate them further once they become established.

A continuous commitment to infrastructure improvement assures that the right kind

of people will find comfortable accommodations once they

arrive. The process of a hub's

success bringing about demand pressures that eventually leads to its dysfunction has wide

application. We witnessed the same dynamics in Istanbul. The difference is that Istanbul

experienced more difficulty in offsetting rising costs because of its political climate. In summary,

we observe that the capability of a hi-tech hub to attract valuable human resources is affected by the quality of the supporting local and national governments.

The experience in Tallinn, Estonia demonstrates the potential of creating a virtual environment to attract a particular blend of human resource, in this case, information technologists. Feeding off the momentum that has established Tallinn as a haven for the brightest and most motivated IT specialists, the hub offers a world of conveniences based on a host of internet services. This is understandable, since the hub sees its core competency as IT. Tallinn could, however, profit from the view shared by the preceding hubs that see themselves as a more comprehensive complex. We have seen that some start-ups seek "one-stop" hubs.

An example of start-ups enjoying a core competency besides technical expertise is Istanbul. In the case of Istanbul, it is the access to the huge Eastern European market, And, as we noted in our review of the several other examples of successful hubs, human capital continues to be drawn to the virtues of the hub in spite of the hub's adverse political climate and the crowded conditions. Similar to several of our other examples, the abundance of traffic needs to be mitigated by the government's reactiveness in offsetting incumbent costs through desirable economic incentives. As well, Silicon Valley's increasing density has driven up the wage structure for desirable personnel such that one needs to be a millionaire in order to enjoy a middle class existence.

Implications for Future Research

From this brief exploration we are led to venture the following provisional generalizations:

1. Nations and provincial governments seek to foster the growth of hi-tech hubs within their domain as a means of becoming competitive in the global market, and thus advancing their economic and social goals. As to an extrapolation to CAT, we offer: The chaotic domain abutting a system may serve as a source of strength for the system. Accordingly, systems seek to foster and nurture chaotic subsystems within their own boundaries.

2. The success of hi-tech hubs leads to overcrowdiness and diminishment of productivity within these hubs. The reaction of hub governance will include personal incentives to offset cost of living, and improved infrastructure to accommodate increased traffic of human capital. For CAT we further offer: Successful innovative activity within a system's chaotic domain will increase the cost of innovation. Systems will impose efficiency measures and increase market appeal in order to maintain high levels of innovation.

3. Although all hi-tech hubs compete on the basis of innovative activity, they differ widely on the extent that they compete on the basis of what support or ancillary services they provide. Hubs will have secondary competencies depending on location and the availability of resources that may be unique to their situation. For CAT, among competing chaotic domains of systems, those domains that offer the most valuable support services will draw the most innovative activity.

There are literally hundreds of hi-tech hubs scattered throughout the world in various stages of development. For instance, there are over 20 in the United States and nearly 15 in India alone. This large number lends itself to empirical research where some of the propositions brought forth in this article could be more rigidly tested. Also, since a wide range of development is represented in the sample, longitudinal studies could be fruitful in demonstrating how hubs adjust to their environments at the different stages of development.

Additionally, CAT has been applied as the theoretical backdrop for our explanations of systems behavior within and among hi-tech hubs. CAT is an interdisciplinary area of scholarship, and several mainstream disciplines could be useful in explaining and predicting CAT phenomena, in general, and the behavior of hi-tech systems in particular. Based on our observations thus far, the other relative disciplines might include economics, sociology and organizational theory. Some of the more contemporary work that may find particular relevance to hi-tech hubs include that of Morgeson, Mitchell, & Dong (2015) on how some events become meaningful and impact organizations across time and space. Relevant as well is the excellent literature review by Grodal, Gotsopoulos & Saurez, (2015) on the technological dynamics of industry evolution.

References

Brady, G. 2009. Empower to win: An action guide to the imperative leadership style of the 21st century. Bloomington: Xlibris Corporation.

Dodder, R. & Dare, R. 2000. Complex adaptive systems and complexity theory: Inter-related knowledge domains. ESD 83: Research Seminar in Engineering Systems, Massachusetts Institute of Technology.

Grodal, S., Gotsopoulos, A., & Saurez, F. F. 2015. The coevolution of technologies and categories during industry emergence. Academy of Management Review, 40: 423-445.

Lindsay, G. March, 2015. Pushing the boundaries. Inc. 30-38.

Lorenz, E. 1963. Deterministic nonperiodic flow. Journal of the Atmospheric Sciences, 20: 130-141.

Morgeson, F. P., Mitchell, T. R., & Dong, L. 2015. Event systems theory: An event-oriented approach to the organization sciences. Academy of Management Review, 40: 515-537.