

## **Citizen-Innovators: What's Beneath Quadruple Helix.**

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### **Abstract**

*What makes a society better able in driving innovation intensity in comparison to others? This paper analyzes issues and elements relevant to the creation of a national innovation system from the perspectives of the quadruple helix model and the concept of citizen innovators. Based on a qualitative meta-analysis we review various articles that relates to national innovation system and develop themes to understand the roles and interactions of the helices. Our emerging findings reveal the importance of individuals, termed as 'Citizen Innovators' who are able to manage autonomy and constraints in accomplishing innovation systems of a society.*

**Keywords:** *Quadruple Helix, Citizen Innovator, National Innovation System*

### **1.0 Introduction:**

Capacity of countries to thrive innovation intensity varies across nations. While innovation of “new to the world” technologies historically concentrate in few large nations, such as the United States of America, the 1980s and 2000s invoke the inclusion of relatively small nations such as Switzerland, Singapore and South Korea into this group of dynamic nations (Furman, Porter, Stern, 2002). What still puzzle most researchers across the globe are: Why does innovation concentrates on specific locations? What makes a location authentic for innovation? Like a metaphor, innovation is a source of growth, life and dynamism for a nation. Yet, how best to re-create, manage and sustain it? Across countries, this is the consistent inquiry among policy makers, scholars and industry leaders. How to metamorphose the state-of the art process of “*creative destruction*” (Schumpeter, 1942) according to their time, context and people?

Furman et.al (2000) coined the fact that national innovation capacity is based on interrelatedness of investments, policies and resource commitment. We posit that innovation capacity of nations depends on something larger than this. An eco-system of the nation may play a central role in driving a national innovation system, and therefore drive its innovation capacity.

Quadruple Helix, as being an innovation model, composes of four main entities that play their own roles: universities (novelty production), governments (public control), industry

(wealth generation) and non-profit (societal growth) (Carayannis and Campbell; 2010; Carayannis, 2012; Godin, 2010; Leydesdorff and Meyer, 2006; OECD, 1997; Etzkowitz, 2003; Kramer, Jenkins and Katz, 2007). This helix broadly connected to the concept of National Innovation System (NIS). We intend to further investigate this critical inquiries as on-going empirical works have yet to reach a state of solid theory either conceptually or empirically. Not much has been empirically investigated from the perspectives of holistic collaboration among key parties of an innovation eco-system.

The next section describes the methodology applied in developing the qualitative meta analysis for this study. Consequently, this paper continues with discussion of the findings and implications for future endeavors in theory and practice. Finally we conclude by offering pathways for generating more in-depth investigations to both the studies of n-tuple helices and the novel concept of 'citizen innovator'.

## **2.0 Methodology**

In order to conduct this study, we vetted through various articles published since 1990. The articles are chosen based on their relatedness with the quadruple helix model. The concentration of the articles is inclined towards articles published in scholarly-oriented journals and not articles published in mainstream media such as Fortune Magazines and Business Week. Collection of data largely involves getting basic information from the titles and abstracts of the articles. Selected articles have quadruple helix and/or other related key words namely collaboration, innovation, entrepreneur, talent, interaction. Next, in order to make qualitative assessment displays the relevance, we identified two criteria, which are: 1) at least 60% of the article had to specifically address the related issues, and 2) the types of matter study should be able to be generalised for any situation.

## **3.0 Findings and Implications**

After having an established list, the totality of these publications have been read and a deep understanding of finding and conclusion has been reviewed. In general, most of the studies have been done in developed countries. Therefore, the models and ideas which have been presented probably are successful in the field of the related matters. On the other hand, the findings and conclusion do contribute to the success of this study. So, the main questions from this report that need answers are: 1) What are the roles of each helix?, and 2) What is the relationship between the helices?

These are the questions that this study attempts to answer and clarify. The main purpose of the data analysis of the articles is looking for recurring themes in the quadruple helix related matters. During the task of finding themes, there are some overlapping and similarities traits among the literature. Therefore, we consolidate the major themes that can cover all the significant and core issues related to the study.

### **Theme 1: Infrastructure**

Government intervention is needed at certain specific stages of the innovation process. The role of the government in innovation is not monolithic. The government needs to provide the necessary infrastructure investment. For example, in transportation, schools, power transmission lines, and land that can make or break a would-be center of innovation. In Bangalore, a government agency builds one of the first software parks for private companies. Governments also provide stable investment rules, regulatory incentives, and tax breaks that clusters need. In the U.S. in the 1990s, the Clinton administration's insistence on keeping e-commerce tax-free buttressed the bottom line of hundreds of innovative New Economy firms (Ernst et.al, 2012). The virtual and physical infrastructure of the university should provide an innovation stimulating environment described by 1) easy and direct access to newest information related to education, research, entrepreneurship and innovation; 2) Access to modern and fully equipped libraries, laboratories and workshops; 3) an open campus atmosphere which stimulates creativity and innovation and offers opportunities to meet innovators, entrepreneurs and investors; 4) provision of facilities and support for start-up companies and other entrepreneurial activities.

### **Theme 2: Triangle education-research-innovation**

Universities, as agents of essential public research, have a vital use of results of public research and technology. In the current globalised economy, it is necessary to combine and coordinate the three elements of the knowledge triangle: education, research and innovation in order to ensure better visibility at national and international levels. To this end, the Council of the European Union adopted in 2007 a resolution emphasising the importance of management and effective protection of intellectual property to improve knowledge transfer between public and businesses. Thus, states must first ensure that all public research universities consider the transfer of knowledge as a strategic mission and secondly, encourage these same institutions to establish and publicise policies and procedures for managing intellectual property. Another aspect is the implications for human resources and education systems if they are to feed the

innovation society effectively. New opportunities for innovation and improvement in education systems lead to a greater emphasis on skills and training for innovation and on focussing on innovation in education and training.

### **Theme 3: Management and Strategy**

The management style of the university, governments and enterprises should characterised by openness to and support of innovation. The organizational culture celebrates tolerance, honesty, and respect for intellectual property, collegiality and intellectual freedom. The management represents patrons of innovation culture as they establish an environment for innovation and entrepreneurship with open regulatory processes that facilitate access to funding, internationalisation, cluster development and R&D programmes. Some of the key aspects of the management and strategy with an innovation culture include diverse and international talents. Through global collaboration with stakeholders, the management can provide the awareness of the importance of creativity. Plus, management might interested to organize training for creativity and innovation to encourage and facilitate investment in research and development.

### **Theme 4: Laws, policies and regulations**

Institutions with an innovative culture have laws, policies and regulations that are innovation-and entrepreneurship-friendly. They encourage and support entrepreneurial initiatives at all levels. The institutional legal framework needs to be realistic, inclusive and complete, which is better achieved when it is developed by incorporating input from all members of the community. For some time, institutional strategies and regulations of European universities and government-funded research organisations have included the explicit mission to develop contacts with the industry and to spread the innovative results in order to ensure that the society benefits from technological advances. Including researchers not only in the production of intellectual property, but also with the benefits associated with the commercialisation of its rights, some legal measures have been developed, offering an attractive profit-share incentive to the inventors-researchers. For instance, universities should pay the researcher a percentage of the financial earnings of a licence agreement or allow researchers to receive a profit-sharing on research projects (studies, analysis) pursuant to their research agreements.

Moreover the innovation policy encourages researchers to take part in the setting up of a start-up. Recent legal measures within Europe have enabled academics to become

entrepreneurs of their own spin-off companies (that exploit their research results), to bring their scientific expertise to the start-up or even to take part as managers or associates of the innovating company in question (which will also benefit from a collaboration agreement with the university). Cooperation takes the form of services (consultancy or training), research collaboration agreements, and licence agreements. In order to make this collaboration successful, universities need to be fully aware of the skills and competences of their own staff so that they can identify the most suitable partnerships. Consequently, intermediary offices have emerged both within universities and externally which evaluate the economic potential of the projects identified and ensure that the knowledge of the university is protected and the best international partners – commercial or otherwise - are identified.

### **Theme 5: Interaction**

Of course the different players within an innovation system have very different agendas according to their perspective on how innovation can best be developed and the role that they play. As such, governments focus heavily on the economic and social development agenda while businesses have to be far more conscious of their position within the market, their turnover and ultimately their profit margins. In contrast to this, the university's principal activity is knowledge creation. In this sense, the university plays a crucial role at the beginning of the innovation process, as in the creation and evolution of an idea. At an institutional level, the transfer of knowledge beyond the confines of academia has also become increasingly relevant. It now represents an essential third strand of a university's mission (after teaching and research) which not only helps to define the institution's relevance within an increasingly knowledge-based society, but also generates extra income through funding opportunities and commercialisation.

However, within the organisation itself, recognition must also be given to the value of the creation and development of the intellectual assets themselves. Innovation must be the lingua franca of the organisation, and management processes must facilitate rather than inhibit the idea creation process. Research ideas are formed by interaction, cross fertilization, and at the interface between disciplines. They need not have any direct economic impact and their implications may be far broader in terms of the needs of society, but this should not diminish their importance as part of the innovation process.

Fairchild, Intel, Hewlett-Packard, Apple, Sun Microsystems, and Cisco are essential to the evolution of Silicon Valley, but so is the presence of great universities such as Stanford and the University of California at Berkeley. Frederick Terman, Stanford provost

between 1955 and 1965, is sometimes called “the father of Silicon Valley” for encouraging his students to start businesses. Two of his students are William Hewlett and David Packard.

Talents within governments also play a critical role. To illustrate, Stanford in 1946 from the U.S. Office of Naval Research, had directed the staff which was responsible in developing jammers to block enemy radar. In the early 1960s, the U.S. military was the market for the first wave of integrated circuits, which were largely made in northern California. The non-profit sector was less visible, but it played a significant role in the 1990s — especially as computer firms began to invest in clean and healthcare-related technologies (Ernst et.al, 2012).

### **Theme 6: Innovation management**

Because entrepreneurs are generally open to organisational reform and opposed to unproductive bureaucracy, Quadruple Helix can and should become seedbeds for organisational innovation. A successful quad system needs organisations that are willing to continually reform themselves and collaborate on building the capabilities as a whole, spreading good management practice from one organisation to another. Infosys, for example, has created and spread a variety of distinctive new management approaches, including internal networks that seek out ideas. The company provides a variety of rewards — peer recognition as well as money — to employees for such proposals. Some entrepreneurially-minded people within the organisation are put on a fast track for promotion as a result. This practice, unusual for India at the time it was launched, has spread to other companies in Bangalore (Ernst et.al, 2012). Managerial innovation also spreads through funding institutions — either government-based like the U.S. National Science Foundation or non-profit philanthropies — which increasingly require grantees to create partnerships across sector boundaries. University researchers, for example, may be asked to work with local communities, the private sector, and the media. This in turn requires these organisations to recruit (and learn from) people with special skills and experience in partnering with different kinds of institutions. In this way, organisations that are not familiar with management reform — including many government agencies and universities — discover that there are better ways to make the most of their people and processes.

### **Theme 7: ‘Citizen Innovator’ as the Fourth Helix**

Sustained innovation flows from the ideas and actions of creative, capable individuals. Ernst et.al (2012) in their interviews with leaders (senior executives and start-up entrepreneurs alike) identified that same skills, talents, and attitudes are repeatedly mentioned. People who can combine them, and put them into action, are essential for the success of an organization. These attributes include 1) synthesis- people need to “connect the dots,”; 2) “human ecosystem” perspectives; 3) Communication skills; 4) Intellectual curiosity; 5) Empathy; 6) Substantive knowledge; 7) Cross-sector experience, well beyond their own silo, preferably in a different, wider range of experiences. Equal to such characteristics of individuals, “user” or “citizen-innovators” need to be understood in terms of these essences. Moreover, the “user” will always be rooted in a socio-cultural context, and this context is likely to represent a complex weave of dependencies.

Helix-models in a general fashion, suggests interdependencies among the various strands. But strands tend to be defined as separate entities. This simplification may be convenient for dealing with the various “roles” in the innovation process. But it obscures the dynamics of the process. Consider the concept of “user”. From the point of view of enterprise, he or she is an “employee” or a “consumer”. From the perspectives of government, the user may be a “party” or “a client” or an “individual” that should work towards the betterment of their community through economic participation, public, volunteer work, and other such efforts to improve life, and can be termed as “citizens” (Tisch, 2010).

Obviously, the concept of “citizen-innovator” who contribute for socio-economic improvement is always construed from a particular point of view. But, even if one particular aspect is emphasized, they could be still multi-dimensional. Rather than just augmenting the quadruple helix models proposed by Arnkil et al.(2010), it may be useful to consider a variant type of “citizens” within the ideals of roles, relationships, commitment and dependencies among the other three helices. Needless to say, these different actors need to be previously equipped with the appropriate types of knowledge, skills and abilities to both effectively generate and implement new ideas. However, innovation only flourishes when the work environment is supportive of these efforts. A university with an innovation-enabling culture provides an unambiguous and solid environment that sets up the “rules of the game” and guarantees that these initiatives will receive full support. The employees, students and its other relevant stakeholders could be characterized as “citizens”. They should be given plenty of opportunities to explore, investigate and experiment, for example, think “out of the box” and the management provides support through active encouragement of these activities. The experimental and innovative scenario places significant demands on the university’s

employees who are included in changing working processes in connection with interdisciplinary collaboration, project work in new areas, cooperation with external partners, and enhanced use of information technology. This university model also implies a staff body with a very heterogeneous educational and professional background with a large fraction of them coming from foreign countries. It is not unusual that this type of staff may have a career alternating between the academic world and the private sector. “Citizens” (students, administrative staff, lecturers and researchers) are characterised by high professional standards combined with their willingness to engage in interdisciplinary and project-oriented work. Constructive criticism, flexibility, openness and tolerance are considered as key qualifications. Finally, a university with an innovation culture may have a share of staff that is employed on the basis of collaborative agreements with enterprises and partners provided always that the university is the supreme authority in terms of employment.

The concept of “citizen innovator” can be traced from the theories of innovators (Hayward et.al, 1983; Bogers et.al, 2010), citizenship (Turner, 1990) and social identity (Turner and Reynolds, 2001), talents (Ventegodt et.al, 2003; Dries, 2013; Gallardo-Gallardo et.al, 2013) and ‘innovation talent’ (Yu Wei and Sun, 2012). The owner of innovation processes in a nation is best championed by committed high-skilled people who raise research, development and commercialization level at universities and industries, while greatly influence the cultivation of younger talents. This is the preliminary concept of Citizen-Innovators. They should be in the driver’s seat for an innovation capacity model. Besides making most of the development work, Citizen-Innovators should decide which kinds of innovations needed for their nation as they have in-depth understanding of the contextual eco-system, while having a strong sense of belongingness to the nation-state they commit. Hence, there is a need to study issues of Citizen Innovators within the interplay of citizenship theories (Turner, 1990; Marshall, 2009) and open innovation theories (Prpic et.al, 2013; Gassman and Enkel, 2004; Chesbrough, 2003; Hossain, 2013). In bridging these research gaps, we can relate the endeavor to study this topic more in-depth as we incorporate numerous challenges related to the transition from old research- and technology-driven innovation models (including the Triple Helix model) to more user-oriented innovation models. This is a huge cultural change, and may be a challenge for developing and less developed nations whose people may have migrated for more attractive locations; or even not being viewed as socio-economically ‘attractive’ to talents.



#### **4.0 Conclusion and Future Possible Research**

An ecosystem is not linear. It is a web of interrelationships, different systems, niches and pathways coming together to sustain life. An innovation ecosystem framework should not be linear but rather a web, an interlocking systems and pathways helping to sustain and formulate a functional evidence-based policy making. An ecological system of innovation can be constructed at a number of levels of abstraction and detail—from an individual technology project, to the enterprise, to the industry sector, to the national, regional and even global level.

The new architectural framework for a national innovation policy proposed in this study extends the traditional linear chain model to the innovation process and enlarges it to incorporate all aspects of society, including academia, government, industry and the public, thus creating a comprehensive National Ecological System of Innovation. Despite a national outlook, the framework suggests retaining the focus on organisational level and metrics and tools for measurement at that level.

Quadruple helix is based on a nourish of high mutual trust. Citizen innovators in all four sectors must work cooperatively, knowing that their interests will be protected well beyond the transaction at hand. When this trust is missing in a prospective cluster; in those cases, people act only on their short-term interests, transaction by transaction, ready to pull out quickly with the first faltering step. Trust must be built gradually, through social infrastructure such as professional associations, social clubs, and other forms of ongoing contact and exchange. When all four sectors act together, they can pull and push one another into game-changing collaborations, beyond what any of them could achieve alone. The communities of practice that grow around them become creative havens where people build careers that transcend any one particular company or organisation.

QH can bridge the innovations gaps between civil society and innovation. An innovation gap in this context can mean a “technological innovation gap”, a “trust/moral gap” and a “public sector innovation gap”. The foundation of Quadruple Helix model requires transformation of the society. It is the driving force and socioeconomic impacts of innovation and entrepreneurship. However, the contemporary society turns out to be more complex than even molecular biology and exhausting the scope of the double helix model for explaining inter-related phenomena. Uniqueness of contemporary societies precipitates the paradigm change from an industrial society to a knowledge based society. It leaps the traditional Triple Helix model. Such a progress of idea open doors for future researchers to continue exploring n-tuple helix’s interesting partners in renewing any local-regional “innovation ecosystem”.

For some possible areas of future research, we suggest the usage of theory triangulation to further identify, explore and examine dimensions of “Citizen-Innovators” as we are projecting a novel idea. Secondly, the relationship of the helices is just being conceptually identified in this paper. Researchers could further examine such a relationship phenomenon to ensure the accurate and proper results. This may be on top of case studies that focus on the approaches to benefit from various societies and convert them into opportunities for other developing and less developed nations as innovation should dynamically precipitate more goodness instead of damage and harm.

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