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Paradigms of Information Innovation 3.0 for Hyper-connective Internet of Things Technology with Extended Technological Organization Environment Framework

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Abstract

Recent information and communication technologies have already opened up new prospects for technology groups, especially in a knowledge-based society. A contemporary technological era, which can be stated as the hyper-connective Internet of Things surpassed the traditional service pattern and innovation pattern by conveying personalized, localized, and con-text-aware services close to different actors and users. The conventional boundary of the organization is disbanding as well as traditional innovation and research & development limits. This research article conducts a preliminary study about the hyper-connective Internet of Things technology portent with innovation 3.0 version based on an extended technological organization environment framework (E-TOEF). This article discusses the emergence of innovation 3.0 as a paradigm shift from a manufacturing paradigm to an actor-oriented paradigm. There is a need to shift from a manufacturing mindset to more user ergonomics and be aware of the potential of hyper-connective IoT on the revolution of innovation patterns to be more cooperative, open, and user-centered. Besides, this article would strain some conceptual approaches for the next-generation innovation paradigm known as "hyper-connective IoT" entitled innovation 3.0. This new innovation version goes beyond open innovation and undeniably clearly beyond closed innovation which was an earlier version.

Keywords: Hyper-connective; Internet of Things; Information; Innovation; Perceptions; Technology

1. Introduction

The modern innovation discussion is centered around the transference from linear to systemic, open and close-centric models and on the question of how knowledge production progress under new and different

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innovation examples [1]. Thus, the new 3.0 emphasize strongly that technical knowledge creation and exploitation occurs in a variety of users and actor's innovation network, is highly collaborative and non-linear modes, not restricted to academia or government collaboration but also involving actors, end-users, and the broader civilian society to play a progressively more vital role in the process of innovation. A significant contribution to the fresh way of discerning innovation 3.0 process made in research done by [2] [3], and stressed that open innovation focuses on how to combine different aptitudes or technological proficiencies, whether they are exterior or interior in the organization, and relate them to commercial ends. Furthermore, existing research [4] recommends that the innovation 3.0 strategy logic pattern as described in Figure 1, needs extra exertions for knowledge enablers for developing a superior technical foundation apart from new technology which comes directly from research corporations or academia. Good examples of these organizations and corporations are Intel, Cisco, and IBM as imperative mechanisms for crowdsourcing.

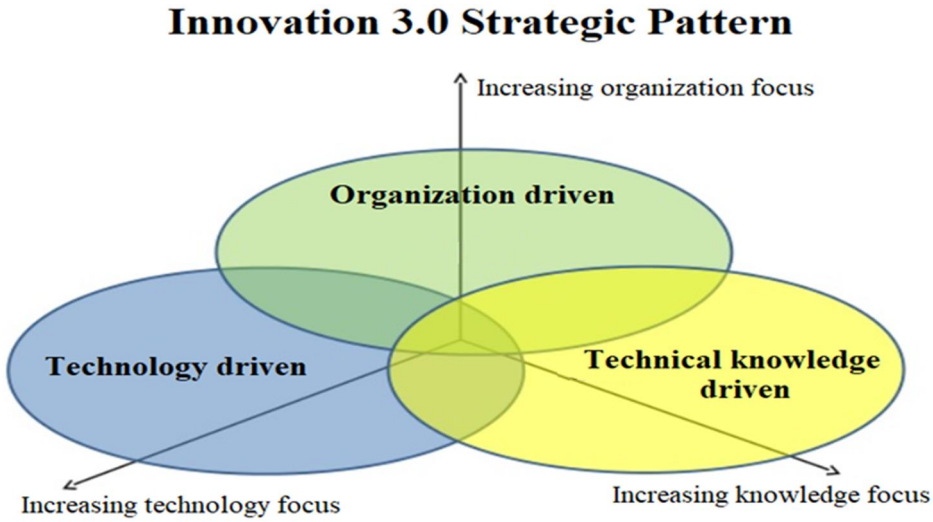

Figure 1. Innovation 3.0 evolutionary strategic pattern

Indeed, innovation 3.0 is estimated to evolve as a 3rd approach for technological enhancement that synergistically combines closed and open innovation. Thus, in this new digital era of hyper-connectivity, open innovation (early innovation 2.0) seems to be a relatively natural procedure, and an intermediate evolutionary step in the direction of the novel innovation 3.0 paradigms [5]. The big technology players like Intel, Cisco, IBM, and Siemens, who can sophisticatedly manage the 3.0 innovation process (e.g., applying "lead-user approaches", or using "toolkits", or organizing innovation contests to mature sufficient gravitational force to appeal to extra knowledge providers) [2].

2. Hyper-connectivity of IoT over Innovation 3.0

Hyper-connective Internet of Things (IoT) technology shall provide high efficiencies across many industries, and their benefits to consumers are substantial [6] [7] [8]. For example, users may benefit from IoT technology used in smart fridges that autonomously monitor the consumption of food and beverages and re-order goods [6]. In this context, hyper-connective technologies will affect actors' behavior in several aspects of the users' daily life [9]. Recent studies also have examined the technical issues of implementing hyper-connective IoT [10] [11]. It is mentioned in [12] that security and privacy issues are significant encounters for

user-oriented hyper-connective IoT applications. Different sectors of agriculture in rural areas including health care, smart homes, and smart plus apps in the digital city as determined in Figure 2. Internet of Things is bridging the gap between the virtual and digital worlds by bringing together people, information, and things while generating knowledge through hyper-connective IoT platforms [14] [15].

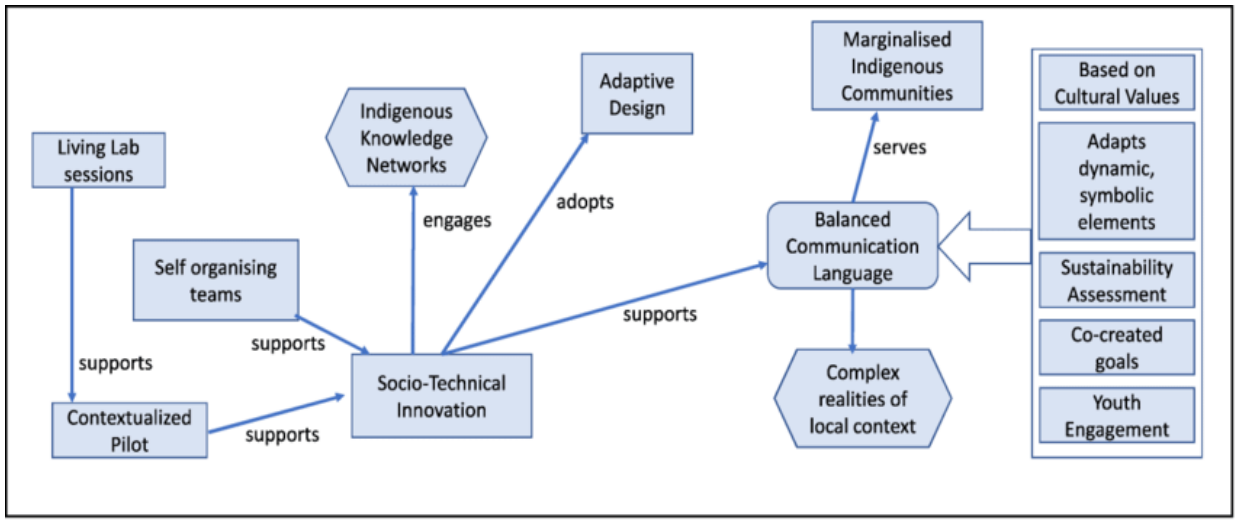

Figure 2. Pathway of hyper-connective IoT technology transformation [12]

Hyper-connective IoT achieves this by addressing security, privacy, and trust issues across these dimensions in an era where technology, computing power, connectivity, and the number of diverse types of smart devices are all expected to increase. In this regard, hyper-connective IoT is driving digital transformation, and this phenomenon has emerged as an essential dynamic that has the potential to substantially increase traffic in different regions of the world as explained in Figure 3. In the past few years, it has turned out to be clear that visual networking applications are often used concurrently with other applications and sometimes even other visual networking applications, as the visual network becomes a persistent backdrop that remains "on" while the user multitasks or is engaged elsewhere [10].

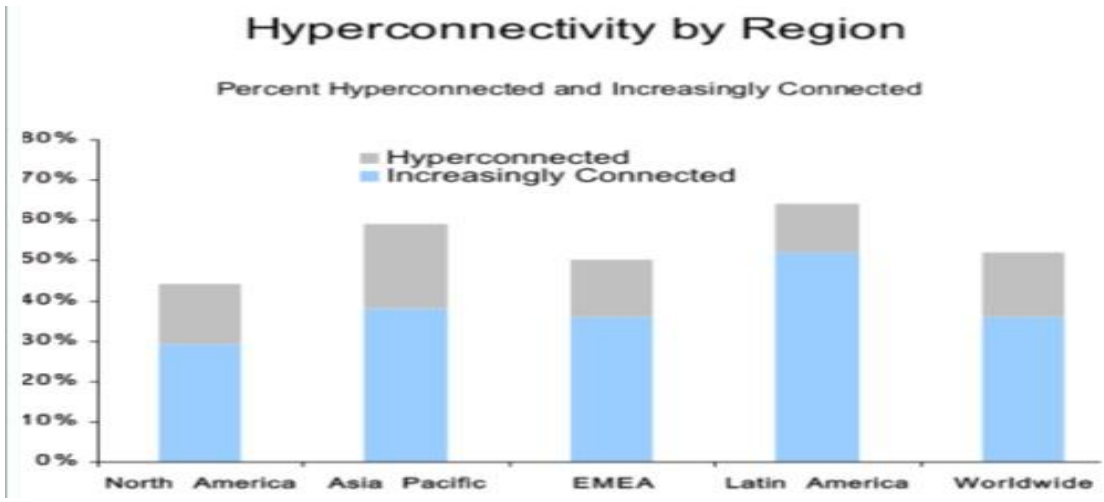

Figure 3. The increasing connectivity of hyper-connective IoT devices and services

Hyper-connectivity refers to active multitasking on one hand and passive networking on the other. Passive networking consists mainly of background streaming and downloading [12]. Ambient video like pet cameras, home security cams, new stubborn video streams, etc. is an element of passive networking that opens crossing the network to exceed significantly the number of video minutes watched by consumers [11]. As shown in the graph above, North America increased in hyper-connectivity approximately by 30 percent, Asia-Pacific increased by approximately 40 percent, and Europe, the Middle East, and Africa (EMEA) increased in hyper-connectivity approximately by 38 percent. On the other hand, the Latin American region has an increase in hyper-connectivity by approximately 50 percent and the worldwide hyper-connectivity has increased by approximately 40 percent. Currently, connected humans are by now in the minority of internet users. Rendering to industry forecasts, the number of networked devices overtook the worldwide population in 2011 and would extend to 15 billion connected devices as early the year 2015, or a landmark to be achieved as late as the year 2020, possibly exploding to 50 billion by the year 2022 [13].

3. Social Choreography Shift for Innovation

Current ICT plays an increasingly significant part in the revolution of our culture, and environment and leads to what we knew as an info society, network culture, or knowledge-based society [12] [14]. The role of ICT in the organization has already transformed from a supportive instrument into a significant contributor to the form of organizations [14]. With current ICT, now the users are not just stable at their workplace or the place of business anymore. They can systemize and direct their interactions and exchanges just in time. Dealing with administrative documents in the workplace was replaced by communication in the real context and thus improved the efficiency of work.

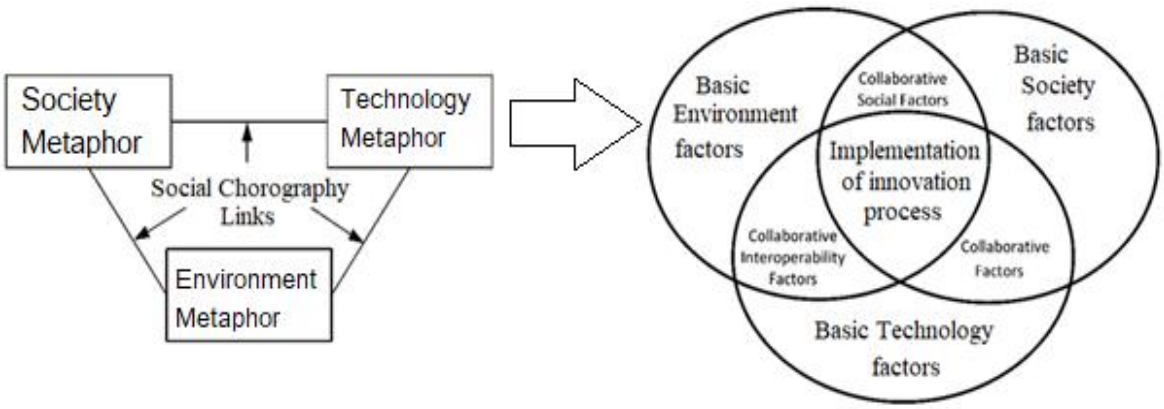

Figure 4. Metaphors in implementing the process of innovation [10]

A famous Austrian social scientist Joseph Schumpeter has proposed three distinct metaphors of innovation drawn from their exploration of the spatial properties of continuous modernization, namely, technology, environment, and society as shown in Figure 4 [10]. Social choreography is composed of three distinct links to initialize the process of innovation. Each metaphor is like objects which are clustered together to form a mutual relationship between other fundamental collaborative factors in the process to pledge formal innovation practice [16]. These metaphors are interrelated with each other since they are the critical elements of the procedure for implementing innovation. These metaphors have dynamic interactivity with each other. After analyzing the Joseph Schumpeter model for the implementation of innovation and readily diffusing the latest technological knowledge with essential actors in an organization [5]. From the angle of convolution

science, the traditional science labs and R&D boundaries are also dissolving which leads to the emergence of innovation 3.0 as a new pattern of innovation. Therefore, the paradigm shift from manufacturing pattern to service pattern in the technology innovation process is ready [4].

4. Extended Technological Organization Environment Framework (E-TOEF)

To study the adoption of hyper-connective IoT technological innovation 3.0, it is suggested to revise the previously developed technology organization environment framework. The framework identifies three major aspects (technological, organizational, and environmental) of the process of innovation progression, which starts from the adoption of diffusion and that an efficient implementation of innovation, and lastly the vibrant adaption of the diffusion process [16]. However, for about the last two decades, the E-TOEF has been known as a decent parameter and utilizer as an underlying conjectural framework in various research on innovation evolution and diffusion in individual or numerous technological and pure business firms and large organizations as shown in Figure 5.

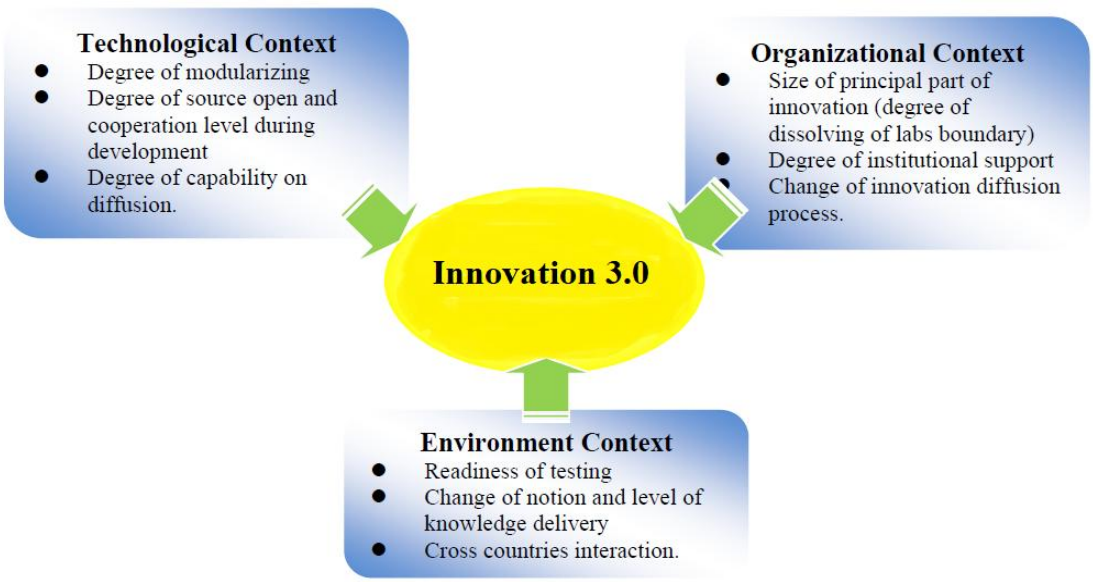

Figure 5. Extended Technological Organization Environment Framework for Innovation [18]

This article argues innovation from a macro level technological perspective, that E-TOEF can be encompassed for inspecting and enlightening the variances among different innovation modules. The extended TOEF framework in Figure 5, shows the technological context, defined regarding several descriptive measures: grade of modularizing, the degree of source open and the notch of support level during expansion, and the class of capability on diffusion [6] [7]. The organizational context describes both the static and dynamic relevant factors, which include the size of principal actors and users in the innovation 3.0 version, the degree of institutional support, and last but not least change in the innovation diffusion process [1]. The environmental context describes the arena in which the readiness of testing especially technology, the evolution of notions, and the level of technical knowledge delivery [9]. Based on this extended framework, refers to the distillations and physiognomies of innovation 3.0 as a paradigm shift from servicing to actor or user-centric which will utilize the hyper-connective IoT technology. As distinct in [15] about innovation 3.0 version as the fundamental ability of a firm to synchronize organizational structures, processes, and culture with open

collaborative learning processes in surrounding communities, networks, and stakeholder groups to ensure the integration of different external and internal knowledge (i.e., competencies or technological capabilities, and to exploit this knowledge to commercial ends). Innovation 3.0 should provide the ground for strategies based on an eclectic choice of advancing innovation management practices from previous innovation paradigms. Innovation 3.0 is expected to evolve as the third way for synchronized organizational structures to combine closed and open innovation. Trust is supposed to be the enabling parameter in balancing necessary multiple relationships with communities. One of the methods developed to encourage a long-term perspective of innovation 3.0 is the three-horizon model of social change [15] as shown in Figure 6. Each horizon determines the social change in society when adopting transformative innovation. 'First horizon' system losing strategic fit and therefore dominance over time; a 'second horizon' of innovations seeking to exploit the opportunities emerging in a changing world; and a 'third horizon' in tune with deeper trends in society that eventually emerges as the new dominant system – perhaps a generation from now.

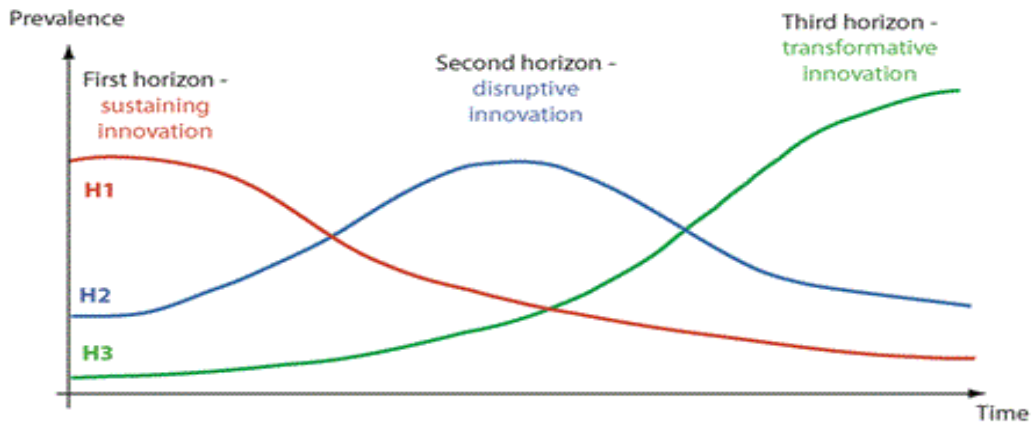

Figure 6. Three Horizons of innovation

Some of the second-horizon innovations will ease the pathway toward the third horizon. The first will absorb others to extend its life a little longer, working against the grain of longer-term changes in the operating environment. The three-horizon show that it takes a longer view and there is also a third form of innovation "transformative innovation", that intentionally shifts existing systems towards a new sustainable way of operating in the changing environment [16].

5. Discussion on Innovation 3.0 as Novel Homogeny

This paper provides a simple view of a paradigm shift towards innovation based on hyper-connective IoT technology entrance into the present digital society and further discussed the practical innovation approaches of innovation version 3.0 based on the extended TOEF framework. The analysis and conclusion might help to understand the change in innovation activities in a new service organization, industry, and other technology firms in the current information age. Meanwhile [2] and [13] have suggested that society develops more through supportive effort instead of officialdom; organizations more through provision instead of manufacture alignment, and the convergence of present information communication technology contributed to this direction. Encouraged by the rise and convergence of hyper-connective IoT, the prompt development of ubiquitous computing, which is demonstrated by mobile technology, makes it likely to interchange effort away from the static desks and laboratories to backing innovation and the service work engaged with users and actors where they are in their living context. Innovation 3.0 means a route of creating changes to roughly establish by hosting

something new and changed. The goal of innovation 3.0 is a positive change, to help and make value for actors and users, to create somewhat enhanced. With innovation 3.0, leading to surged efficiency is the fundamental basis of increasing affluence in a digital lifestyle and economy [17]. The emergence and convergence of hyper-connective IoT provide people with a more flexible approach to innovation, take the innovation close to users, and allow more integration of innovation services. Thus dissolving the traditional boundary of laboratory research and R&D activities, and further pushing the transition of innovation pattern to innovation 3.0. In [16] it suggests different archetypes are important for embedding the firm to successfully implement the innovation 3.0 paradigm. The Communities of Affinity (COA) are cohesion between agents motivated by a similar inherent attitude toward a firm's products and services. The "Communities of Practice" (COP) are pooled by agents with mutual problem-solving interests. In contrast to a COP, members of "Communities of Interest" (COI) are under no compulsion to solve a common problem, although they may in practice do so. In "Communities of Science" (COS), reliable knowledge is expected to emerge continuously. The scientific community consists of the total body of scientists, their relationships, and their interactions [18].

6. Conclusion

Exciting approaches toward a comprehensive understanding of hyper-connective IoT in the innovation 3.0 context have still not been in the research medium, but there might be some upcoming challenges. Some key opportunities for this portent that could be an initial step for further research. First, regarding the opportunity, there is a vital and prosperous collaboration across the Internet of Things-related devices and high-band networks and other proficient modes of parallel communication that can give an edge in the digital connective environment. Second, with simplified networking in real-time, a user could enjoy reliability and high performance. Third, hyper-connectivity is designed for energy affiances, for real-time tracking of products, and for enhancing security and compliance with things and devices easily. Fourth, for the commercial or business-related environment, it provides a real-time event notification and accelerates the business processes and efficient solutions and outputs. Besides technology innovation, the emergence of the complex collaboration of parts of innovation is an outcome like the double-helix structure of internet technology development and application innovation. The role of the users and essential actors in the innovation process cannot be neglected. Taking advantage of hyper-connective IoT convergence, innovation 3.0, which involves the users in a technological knowledge-based society, will guide a paradigm shift of innovation from manufacturing-centric to more actor or user-centric. Another aspect of innovation 3.0 is knowledge, and one of the interesting factors could be how knowledge production evolves under new and different innovation paradigms [17]. The knowledge production and exploitation happen in a variety of multi-actor innovation networks, in highly interactive and non-linear modes, not limited to the public/private universities – industry and government collaboration but also involving common users and the broader civil society to play an increasingly important role in the innovation process [5]. The innovation 3.0 taxonomy provides technology-based organizations with a tool for planning open innovation strategies and practices. It helps technology-based companies to take into account different sides of managing open innovation-related knowledge. An interesting issue for future research would be to perform some case studies on financial institutions creating open innovation strategies with the help of innovation 3.0 paradigms [14].

Conflicts of Interest: The authors declare no conflict of interest.

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