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Creativity and the Market for Entrepreneurs in the ICT Industry: The Whiteheadian Creativity Theory Perspective

ABSTRACT

Creativity is an important subject in business, economics, psychology, sociology and philosophy, fields that deal with creating and identifying new ideas. Whitehead defines creativity as the actualization of possibilities; he states that creative imagination is an important source of creativity. Space and time are also important factors, as creativity is evolving and evolutionary. Everything in real world is interdependent; thus, creativity is a social act. We propose the five Cs creativity model connecting creativity theories in several disciplines; we then apply the model to the creative economy in the U.S. and to the market for entrepreneurs in the ICT industry.

KEYWORDS: creativity, five Cs creativity model, knowledge, entrepreneurship, creative economy, ICT

INTRODUCTION

Creativity is the most commonly used English word in the news media and everyday conversation in Britain, according to Halewood (2014). This may not be unique to Britain, as it has become a universal phenomenon. The reason for the emphasis on creativity stems from the fact that creativity is the raw material of innovation (Lombardo and Roddy, 2010). Entrepreneurs carry out innovation (Drucker 1985), which is a source of competitive advantage of the firm and the nation. Naturally, creativity and entrepreneurship have catapulted to the forefront of economic policy and corporate strategy debates. Policymakers have realized that entrepreneurship helps create jobs and fosters economic growth, primary factors in their political success. Economists and management scholars also pay attention to the origination and innovation of the firm, because the global economy is going through a period of profound change and transformation. Creative firms such as Google, Apple and 3M Companies have become the most valued firms in the world. They are frequently in the news as success stories and major job creators; their strategies contribute to their firms' successes and foster economic growth. As entrepreneurs originate new products, processes, and services in response to changes in the economic environment, they create a disturbance in the equilibrium (Schumpeterian entrepreneurship: Schumpeter, 1934).

Holcombe (2003) argues that entrepreneurship discovers the stock of entrepreneurial opportunities and becomes the engine of economic growth. Creativity is an important source of entrepreneurial opportunity. Deeper understanding of the nature of creativity can generate more stocks of entrepreneurial opportunities. Entrepreneurs actively pursue creativity by themselves or encourage creativity of organizational members.

The Schumpeterian entrepreneur (Schumpeter, 1934, 1947) creates disequilibrium by creating new products, processes, services, markets and industrial organization. Foss and Klein (2010) argue that Schumpeterian entrepreneurship is exercised within the firm when it introduces new products, processes, or strategies; routine operations of the firm need not involve entrepreneurship at all. The outcomes of new capabilities are sources of above-normal profits (surplus) for entrepreneurs. Creativity is the raw material of Schumpeterian innovation. Schumpeter's (1934) economic development theory states that above-normal profits drive entrepreneurs to innovate, even though the creation of new capabilities is accompanied by

uncertainty and risk (Knight, 1921). When a firm consistently performs below competitors, the firm will not be able to stay in business for long because it will not attract resources.

Creativity, entrepreneurship and competence building are crucial sources for competitive advantages of the firm (Foss, 1999; Schiuma, 2009). Langström et al. (2012) argue that “to successfully develop entrepreneurship research in the future, we need to relate new research opportunities to earlier knowledge within the field, which calls for a stronger ‘knowledge-based’ focus” (p. 1154). Casson (2014) urges researchers to involve greater use of formal models and give greater attention to cognition and information processing. However, there is a paucity of studies on creativity, knowledge and entrepreneurship (Foss and Mahnke, 2000; Kirzner, 1999). Therefore, to fill the gap, this paper investigates the roles of creativity in entrepreneurship and risk management. The study also attempts to bridge the gap between abstract theory and descriptive empiricism by applying creativity and entrepreneurship theories to the ICT (information and communications technology) industry.

The paper is organized as follows: Section two discusses concepts of creativity; Section three proposes a five Cs theory of creativity and examines the five C theory of creativity in ICT firms; Section four describes the link between creativity and entrepreneurship (Schumpeterian entrepreneurship). Section five analyzes the market for entrepreneurs in the ICT industry. Section six presents discussion of these ideas and finally, section seven concludes the paper.

CREATIVITY

Mesle (2008) argues that novelty is essential for our survival. If the firm does not change, the firm will not survive in competition. Creativity is input for creating novelty in products, processes, services and markets. It is, therefore, important for us to have a deeper understanding of creativity.

Several academic disciplines have studied the nature of creativity. We propose to build an integrative theoretical model by connecting concepts of creativity from philosophy, cognitive psychology and sociology. Philosopher Whitehead (1929, 1978) offers basic foundations for creativity by linking the potential to the actual. Psychologist Gibson (1977) points out that affordances change behaviors of animals, including human beings. Sawyer and DeZutter (2009) stress the importance of groups in creativity. Sociologist Bourdieu's (1977) and Giddens' (1979) structure is akin to Gibson's physical affordances on human behavior. We will discuss these concepts in this section to provide a deeper understanding of theories on creativity from different disciplines. We will then present our integrative model, which includes factors discussed from these diverse disciplines.

Whiteheadian creativity

In understanding Whiteheadian creativity we need to grasp the nature of Whitehead's proposed solutions on philosophical problems. Hartshorne and Peden (1981) indicate that Whitehead has proposed to help solve three major philosophical problems: (1) many and one, (2) the issue of efficient and final causes, and (3) the problem of permanence and change. The problem of permanence and change involves the first two problems. Whitehead's proposed solutions on these problems are the core of his creativity.

First, the issue of “many and one” is about two aspects of the universe. One includes a factor of unity, involving the connexity of things. The other, equally fundamental in the universe, is a factor of multiplicity. According to Peden (1981) there are many actualities. The description of unity requires many actualities. For Whitehead, the summation of the many into the one, and the derivation of importance of unity in purpose and unifying purpose from many involves the notion of disorder, conflict, and frustration. These are primary aspects of the universe and

creativity. Shaviro's (2009) illustration of the many and one is easy to follow. He argues that Whitehead radicalizes Kant's argument about the manifold and explains many and one.

Whitehead (1929/1978) insists on the formal unification of diverse data, and multiple prehensions, in every entity's concrescence or final satisfaction (1929/1978). During a process of becoming, the prehended data are "unintegrated," or not yet integrated: but they are at least "compatible for integration" (26: Category of Subjective Unity). (Shaviro, 2009, p. 74).

This integration of many into one is creativity. Shaviro points out that for Whitehead, every achievement of unity is something that has never existed before: something different, something radically new and different from any entity in the many which it unifies. Many and one in Whitehead reverses the traditional thinking in philosophy which advocates one and many. This many and one is about a combination of many into one. In traditional philosophy, one creator creates many. However, many become novel one and add one to many in Whitehead. According to Shaviro, Whitehead seeks after "the most general systematization of civilized thought" (Whitehead, 1929/1978, p. 17) and the primary stage of philosophy is a process of "assemblage" (Whitehead, 1938/1968, p. 2). Shaviro further elucidates the process that philosophical speculation collects the most heterogeneous materials and puts them together in the most unexpected configurations which are like the practice of collage in modernist painting. The combination of heterogeneous materials results in a new material. Combination as today's knowledge creation (Kogut and Zander, 1992; Nonaka, 1994) is akin to 'the many into one' and the combination in Whitehead.

According to Stengers (2011) creativity introduces novelty into the content of many, and unity is a synthesis derived from many occasions. She provides an example of a judge's decision. The judge asks many relevant questions from many witnesses and decides. The decision of unity (synthesis) bears a new consequence (novelty). This novelty becomes new data. She points out that Whitehead's process and reality (1929/1978) offers a "new conception of the world," the master themes of which are complexity, emergence, self-organization, and so on. Stengers further argues that we should recognize Whitehead's intuition of the centrality of creativity, as these concepts link to the ontological principle:

[Whitehead's] principle states that "there is nothing which floats into the world from nowhere" (PR, 244), that is, that whatever happens must be related to reasons. And creativity is not a reason, for "actual entities are only reasons" (PR, 244). (qtd. In Stengers, 2008, p. 92).

Here, Whitehead states that whatever happens must be related to reasons. Reasons are causal efficacy. Physical efficacy is about the past occasions and creativity connects them. Mesle (2008) explains the connectivity on how each actual entity creates itself out of the past actualities. "Each actual entity must reach out and grasp those past actual entities, draw them in, and create itself out of them" (Mesle, 2008, p. 98). For Whitehead (1929/1978) the actual world is a process, and the process is the becoming of actual entities. Thus, actual entities are creatures; they are also termed 'actual occasions.' (PR, P. 22). Whitehead's principle of process (PR, p. 23) is relevant here. His principle of process states that "how an actual entity becomes constitute what that actual entity is." The attributes of novel being (creatures or actual entities) depend on how that actual entity became. For instance, an actual entity selects eternal objects and sets the final cause (aim) in the process of becoming. The selected eternal objects and the final cause determine the attributes of the novel actuality created by this creativity process. The principle of process constitutes the nature of creatures (outcomes of creativity).

Efficient causes (causal efficacy) are actualized entities (many) and they can cause retention of the same characteristics in the novel unity. Each actual entity also selects eternal objects (pure potentials) and actualizes them in the creativity process. According to Whitehead, selected eternal objects enter into the process of creativity. Not all eternal objects are selected in the process. The final cause (vision) is teleology (aim) and would affect the choice on the type of eternal objects (possibilities). The final cause (vision) can provide a guiding judgment for choices in change and novelty. Final cause defines the attributes of novelty because it is an ideal that the actual entity is pursuing. Whitehead (1929/1978) states that "definition is the soul of actuality: the attainment of a peculiar definiteness is the final cause which animates a particular process (p. 223)." The attributes of actualized entity (novel unity) are determined by the final cause and the principle of process.

As stated before, the Whiteheadian creativity process explains how the many become a novel unity. He uses the term 'satisfaction' when the many become one. Many are concrescing and they are relating to each other in the creativity process. Whitehead states that creativity is conditioned by other entities (society) in the process. Other entities in a business firm can be employees in the organization, competitors, suppliers, new technologies and regulations. These entities are stimulants to creativity. It is worth noting Shaviro's (2009) description on Whitehead's stimulation:

Whitehead insists that thought is stimulated, rather than paralyzed, when it is pushed to its limits, and when its "tentative formulations" break down under the pressure of changed circumstances, or simply in the face of additional evidence. Such is the point at which new concepts, and new categories, need to be invented (Shaviro, p. 146).

As the business firm faces the pressure from changed circumstances of markets, emergence of new technologies and regulations, people in the firm tend to be creative in meeting the pressure. Stenger's (2011) arguments that Whitehead's creativity is about complexity, emergence and self-organization are interesting since self-organization states that entities interact based on local information and interactions form (emerge as) a macro pattern (Kauffman, 1993). Emergence in Stenger's view is much like the end result of Whitehead's creative process. A new pattern formed is a novelty and it is creative advance.

the effect. "This passage of the cause into the effect is the cumulative character of time. The irreversibility of time depends on character" (PR, 237). Griffin (1988) points out that a positive relation can exist between efficient and final causation. According to Shaviro (2009) final cause in Whitehead is always at work, alongside the efficient (mechanistic or physical) cause and supervenes upon the efficient cause. For Whitehead creativity is the basic force of the universe. Creativity is caused by the self-causation, causal efficacy and final cause. Self-causation and final causation are interior causes and efficient cause is an exterior cause (Griffin, 1988). Natural Sciences primarily focus on discovering efficient causes. Scientists' controlled experiments are to discover efficient causes. Self-cause is the self-preservation of actuality. Whitehead's causality is forward causality which implies that the past causes the present and the present does not cause the past. The future will not cause the present because the future is not actualized yet. The actual entity is the only cause in the process of actualization. The present causes the future and causality is cumulative. The forward causality in process philosophy is applied to causality in econometrics where scholars employ lagged independent and dependent variables in testing their causality.

Final cause is about value and purpose of an actuality. Mesle (2008) points out that self-creativity requires some aim, some goal. Teleology and purposefulness play more significant roles in human and human organization. Teleology in Whitehead is an ideal direction for creative advance. The teleology of civilization is directed to the production of beauty (Whitehead, 1933, p. 265). Whitehead proposes the beauty as an ideal to be pursued (Shaviro, 2009). For Whitehead (1933) beauty is a wider, and more fundamental notion than truth. The reason that Whitehead gives a priority of beauty over truth is that truth merely concerns the relations of appearance to reality, and the notion of conformation to reality in the case of truth is narrower than that in the case of beauty. Whitehead (1933) elaborates his arguments:

Beauty is the internal conformation of the various items of experience with each other, for the production of maximum effectiveness. Beauty thus concerns the inter-relations of the various components of Reality, and also the inter-relations of the various components of appearance, and also the relations of Appearance to Reality. Thus, any part of experience can be beautiful. The teleology of the Universe is directed to the production of Beauty (Whitehead, 1933, p. 265).

Beauty is the internal conformation of the various items of experience with each other, to produce maximum effectiveness. Beauty concerns the inter-relations of the components of reality. Beauty for Whitehead is harmony and proportion. Harmony among various components, various fields, people, and harmony in everything is an ideal to be pursued. Current global conflicts stemming from extremes may be mitigated by adopting his ideal of the beauty (harmony and proportion). Extreme income inequality today may cause instabilities in society and retard economic growth. Extreme income inequality can lead to reduction in consumption and result in low investment as well. According to Wallack (1980) Whitehead adds value and purpose to the materialist conception of nature. Materialism accepts physical causation (external causation) only. Whitehead's addition of value and purpose to the nature can be envisaged from his integration of mental and physical poles. Whitehead (1933) expands the conception of teleology by espousing the value of civilization that is a certain ideal for life on this earth: The ideal concerns both the individual human being and societies of men. He puts forward a general definition of civilization that a civilized society is exhibiting the five qualities of truth, beauty, adventure, art, and peace. Today, firms are beginning to adopt a broader conception of their goals including stock holders, employees, communities and the natural environment. Whitehead's notion of adventure is relevant to innovation and new product development in business. Whitehead (1933) indicates that "without adventure civilization is in

full decay (p. 279).” Without innovation and adventure of entrepreneurs the firm will decline. Whitehead (1933) points out that adventure of imagination leads to the physical exploration and realization of the adventure of imagination. According to Mesle (2008) the world is a deeply interwoven with relational process in Whitehead and can change the way we feel and act. Therefore, we need a coherent vision of our world which requires different perspectives from many fields such as science, culture, philosophy, religion and people.

Hosinski (1993) indicates that “there are two types of process: transition (from one actual entity to another) and concrescence (development within one actual entity). Efficient causation concerns transition; final causation concerns concrescence. Both are in the final real facts of our experience (p. 96).” Hosinski summarizes the relationship between efficient cause and final cause by citing Whitehead’s *Modes of Thought* (1938).

If we stress the role of environment, this process is causation. If we stress the role of my immediate pattern of active enjoyment, this process is self-creation. If we stress the role of the conceptual anticipation of the future whose existence is a necessity in the nature of the present, this process is teleological aim at some ideal in the future. This aim, however, is not really beyond the present. For the aim at the future is an enjoyment in the present. It thus effectively conditions the immediate self-creation of the new creature (Whitehead, 1938, p. 166).

This quote clarifies the concept of self-creation (cause), efficient cause and final cause and relationship between them (see the figure of creative process above).

Third, the problem of permanence and change involves two aspects in Whitehead. The first aspect is about the dominant Western philosophy, the “subject-predicate forms of thought” (Whitehead, 1929/1978). In traditional Western philosophy, the subject stays the same (permanence) and predicates are changes. For example, pencil is yellow, white and green, short, long etc. The pencil is not changing and characteristics of the pencil are accidental. They happen to be green or white. Whitehead abandoned this subject-predicate form of thought and replaced morphological description with description of dynamic process. Whitehead contrasts permanence and flux. He proposes permanence to analyze flux, and eternal objects to determine the characteristics of flux. Mesle (2008) offers a case of our body. If we took away all the parts of body, there would simply be nothing left. The body simply is all of those parts together, changing as its parts change. We may also draw the firm as another example. The firm is abstract and the firm is nothing other than all kinds of actual people. If we take away all the people, there is no firm. The firm is all of the people together. These examples also illustrate the change from macro prudential as well as micro prudential. The change can come from the whole as well as the parts. We now introduce Whiteheadian creativity.

Creativity, according to Whitehead (1929, 1978), is creative advance into novelty (i.e., transforming something into something better) and a key feature of his creativity is the actualization of potential (possibilities). Young (1985) defines creativity as actualizing our potential, involving the integration of our logical side with our intuitive side. It can involve an advance in thought but retain links with the past. Young’s definition of creativity aligns with Whitehead, whose initial work was published in 1929. We employ Whitehead’s creativity concept in our paper. Whitehead’s creative imagination implies that an individual connects dots, combines various ideas and makes choices on relations with other individuals and ideas (eternal objects). According to Shaviro (2009), Whitehead (1929, 1978) and Heidegger (1959) ask two important questions in philosophy. Heidegger asks the question of being, “Why is there something, rather than nothing?” Heidegger’s question is about the ontology or being of the firm in economics. Why is there a firm rather than a market? This question has been a fundamental question in theories of the firm because it deals with the origin and foundation of the firm. The transaction cost theory of the firm (Coase, 1937; Williamson, 1975, 1985) further clarifies market

and hierarchical organization. This question boils down to the make or buy strategies of the firm and clarifies the concept of being of the firm. The clarification of this question took almost fifty years and has helped develop the field of supply chain management (Williamson, 2008).

Whitehead (1929, 1978) asks the question of becoming, "How is it that there is always something new?" For Whitehead creativity is the basic force of the universe. Shaviro (2009) points out that Whitehead breaks the tradition of philosophy from the orientation toward the past to the future. The new is the fundamental concept and the production of novelty is an ultimate metaphysical principle in Whitehead. The emergence and creativity are oriented toward the future. Shaviro's interpretation on Whitehead's futurity offers the nature of Whitehead's future orientation.

For, just as the past remains active within the present by means of the "vector transmission" of efficient causality, so the future is already latent within the present, thanks to the "multiplicity of pure potentiality" (Whitehead, PR, p. 164) that can be taken up by the living actual occasion. "The past is a nexus of actualities" (Whitehead, PR, p. 214); it is still actual, still a force in the present, because it is reproduced as a "datum," physically prehended by each new actual occasion. On the other hand, the future is available, without having yet been actually determined: it takes the form of eternal objects, or "pure potential" that may be conceptually prehended (or not) by new actual occasion. Whitehead says, therefore, that "the future is merely real, without being actual (Shaviro, 2009, p. 97).

The vector of transmission of efficient causality remains within the present. We need to discover efficient causes to understand current events. Whitehead's futurity implies that the future is available now as possibilities. Deeper understanding of the vector transmission of efficient causality can provide foresight on the direction and forces of changing events. Whitehead (1933) also indicates that business organizations quantify the quality of change in the air. Entrepreneurs sense the feeling on the quality of change in the air and quantify it for innovation and formation of new firms. Capturing the vector transmission of causality requires processing of information to discover patterns and actual entities that caused change in the new actual entity. Lately, big data processing has been emerging as a way of capturing and detecting patterns and future directions of events. Data science has emerged as an academic discipline and it draws growing attention from both academia and industries.

Whitehead (1929, 1978) argues that events are constantly becoming. Griffin (2007) explains that Whitehead's phrase constant becoming refers to the fact that "now" does not stand still, but always divides a different set of events into past and future. Therefore, there are infinitely many "nows" and they divide past and future. Whitehead's appetite is an appetite (desire) in the present and an urge towards the creative advance. The firm's appetite can be profit, value and purpose. Firms make decisions (choices) to fulfill the appetite and the potentiality will be actualized. We observe that new trees and plants pierce through the interstice in the rock and the present as an interstice is, therefore, important in Whiteheadian creativity.

Griffin (2007) further clarifies the concept of a settlement of the past and future. According to him the past is fully settled, while the future involves potentialities still to be settled. The vector transmissions of efficient causality on the past offer an understanding of the settled past. He points out that the present, the "now" between past and future, is assumed to be the time in which potentialities are being settled. Wallack (1980) states that "the time-span, or temporal duration, of an occasion is its present; it covers both its potentiality and its actualization" (p. 104). Wallack (1980) further points out that the epoch is the unit of Whiteheadian time and an epoch cannot be understood as an instant. An epoch can be a minute, hour or month. It varies depending on what the occasions are. Therefore, Whiteheadian time is relative compared to Newtonian absolute time. Potentialities are latent in the present. Therefore, the future is

available or immanent at the present as potentials (possibilities). Mesle (2008) illustrates how decisions or making choices create the future. "The future does not exist and the future must be created. The creatures of the present must decide between many possibilities for what may happen, and their collective decisions bring the moment into being" (Mesle, 2008, p. 7). Shaviro (2009) point out that both the physical causality and making choices from eternal objects are involved in Whitehead's creativity.

We cannot ignore the physical chain of causality that is at work in a given event; but we do not want to stop there. We also "require to understand," as Whitehead says (cited in Stengers 2005, 42), the reason behind this chain of causality, the "decision" that makes of it what it is.... Whitehead warns us that such 'decision' cannot be construed as a causal adjunct of an actual entity. It constitutes the very meaning of actuality" (1929/1978, 43). (Shaviro 2009, p. 25).

This citation illustrates the importance of the decision in creativity. Whitehead (1933) points out that "progress is founded upon the experience of discordant feelings. The social value of liberty lies in its production of discords (p. 257)." Because of the created discords the creatures of the present face crisis, confusion, frustration and chaos (Hartshorne and Peden, 1981) in making choices and thus time is not linear. However, the produced discords are sources of creativity because discords are diversities. Disjunctive diversity will converge into conjunctive unity and novelty through interactions among entities. The beauty is our final cause and beauty in Whitehead is harmony and proportion. The future outcomes are probabilistically distributed because identifying efficient causes is not exact science and the efficient cause may not be the sole determinant of outcomes. Time is moving and events are dynamic and becoming. The decisions or selections are about actualizing potentials along with efficient causes. Actual entities are physical causes and eternal objects are potentials, alternatives and contingencies for becoming of actualities (Shaviro, 2009). A potential cannot be a cause because it not actual. An organization may not actualize the most valuable potential in making choices among alternatives and not tap the reservoir of possibilities. Therefore, making the right choices and decisions in individuals, organizations and nations is crucially important in creating the better future of an individual, an organization, a nation and the world. This is the nature of Whitehead's creativity and his quest for beauty which is harmony and proportion. Therefore, Whitehead's creativity and beauty can be applied to solve problems in all entities including individuals, organizations and the nation. When these entities actualize potentials, they reach self-enjoyment or satisfaction.

Events are conditioned to change and the conditions involve actualities and nature in Whitehead. Mesle (2008) states that Whitehead looked more deeply at the character of life as novelty. Novelty is the root of life and essential for our survival. An additional aspect of permanence is eternal objects. Eternal objects (pure potentials) are permanent and remain as potentialities even if they are actualized. Pure potentials (possibilities) can be actualized again and again without being exhausted as they are actualized. Eternal objects (pure potentials) are crucially important in understanding Whitehead's creativity. Shaviro (2009) points out that Whitehead's eternal object is akin to the Kant's transcendental and the Deleuze's virtual. Shaviro (2009) clarifies concepts of the transcendental, virtual and potential.

It (an eternal object) remains available for other events, other actualizations. This is another mark of the transcendental. As Deleuze similarly says, referring both to Kantian Ideas and to his own notion of the problematic virtual, "true problems are Ideas, and ... these Ideas do not disappear with 'their' solutions, since they are indispensable condition without which no solution ever exist" (Deleuze 1994, 168). Eternal objects and problematic Ideas never disappear (Shaviro, 2009, p. 43).

Whitehead defines two meanings of potentiality: general (pure) potentiality and real potentiality. Pure or general potentialities are referred to eternal objects and eternal objects are permanent. The permanency of an eternal object may imply that the eternal object remains as a potential even if it is employed in creativity. Whiteheadian philosophical problems are about changes, creativity and innovation in business and economics. Whiteheadian creativity is an open-ended rational and interactional process (Hartshorne and Peden, 1981) and it endures. Weber makes an important point on Whitehead's process: "Actual processes are never twice the same because they depend on their environment and because this environment is always changing" (Weber, 2016, p. 359). Continuing improvement in today's business parlance is also an open-ended process and will endure because of high velocity of environmental changes in today's business. Business innovation and change are conditioned to environments. The firm faces problems as economic environments change. Ideas for solutions to problems are indispensable in solving problems. Ideas are raw material for innovation and formation of new firms (new businesses). Deleuze's notion of the problematic virtual is akin to the conception of Popper's (1982) evolutionary epistemology. Popper argues that all organisms are facing problems and they are constantly, day and night, engage in problem-solving. A solution eliminates errors, but the new solution comes with new problems. This is the reason why entities involve in continuous innovation and creativity.

For Whitehead, real potentiality is conditioned by the data provided by the actual world (Whitehead, 1929/1978, p. 65). He clarifies his real potentiality further:

General potentiality is absolute, and real potentiality is relative to some actual entity, taken as a standpoint whereby the actual world is defined. It must be remembered that the phrase "actual world" is like 'yesterday' and 'tomorrow,' in that it alters its meaning according to stand point. The actual world must always mean the community of all actual entities, including the primordial entity called 'God' and temporal actual entities (Whitehead, 1929/1978, p. 65).

Wieman (1946), who is one of the prominent students of Whitehead, points out that possibilities are created by the creative events. The created possibilities are "real potentials" for Whitehead (PR, 1929/1978, p. 65). A real potentiality is the datum for creativeness and every being is a potential for becoming. Scientists create new possibilities for businesses and new technologies are sources of changes and innovation in businesses. Therefore, Whiteheadian creativity involves the actualization of both real and pure potentialities.

Since Whitehead's creativity places novelty, innovation and change at the center of the universe, we can apply it for establishing foundations of the creative economy. The Whiteheadian universe consists of events and processes and for Whitehead (1929/1978) all events are becoming. The essence of his philosophy of organism is creativity, and creativity is the ultimate reality. The nature of the universe is becoming. Shaviro (2009) points out that Whitehead's philosophy is grounded on events, becomings, and continual change and novelty. Whitehead's process philosophy fits well into today's business buzzwords, "continuous improvement or innovation". We, therefore, employ his concept of creativity in this paper to explain phenomena in innovation and entrepreneurship. Whitehead (1978) redesigned language in his explanation of creativity. He stresses that philosophy expresses the larger generalities in metaphysics, and the larger generality is creativity. He further argues that creative advance and creative imagination, the key elements in creativity, can be taught. According to Fetz (1990), "creative advance is the Whiteheadian term for the totality of natural events, for the current of cosmic happenings, insofar as it is not simply reproduction, but a production of new actual entities of a higher level" (p. 202), the transformation of something into something better.

Whitehead further argues that free imagination, controlled by the requirements of coherence and logic, plays a very important role in creativity when we seek larger generalities in philosophy. He uses an analogy of the flight of a plane for creative imagination in discovery:

The true method of discovery is like the flight of an aeroplane. It starts from the ground of particular observation; it makes a flight in the thin air of imaginative generalization; and it lands for renewed observation rendered acute by rational interpretation. The reason for the success of this method of imaginative rationalization is that, when the method of difference fails, factors which are constantly present may yet be observed under the influence of imaginative thought. Such a thought supplies the differences which the direct observation lacks. It can even play with inconsistency; and can thus throw light on the consistent, and persistent, elements in experience by comparison with what in imagination is inconsistent with them (Whitehead, 1929/1978, p. 5).

The firms and all organizations are entities in the universe and are a part of the universe which is becoming. Therefore, creativity can be applicable to the discovery of entrepreneurial opportunities. Since theories require imagination (Casson, 1998), the influence of imaginative thought is critical in constructing a theory in the market for entrepreneurs. Potential entrepreneurs start from the ground of particular observation on entrepreneurial opportunities, make a flight of imaginative generalization, and land for renewed observation rendered by rational interpretation. This method can throw light on whether imagination is inconsistent with observation or reality. The entrepreneurial theory based on imagination needs to be consistent and logical and be examined by the applicability of its results beyond the restricted observation, as we can then construct generalization in the market for entrepreneurs. We believe that Whitehead's choice of words, imaginative rationalization is a crucially important point. He states that "rationalism is an adventure in the clarification of thought, progressive and never final" (Whitehead, 1929/1978, p. 9). We continue to clarify our thought on creativity in economics and management and make progressive improvement.

In Whitehead's philosophy of organism "the ultimate is termed creativity" (PR, 7). Whitehead clarifies creativity in his *Process and Reality* (PR):

'Creativity' is the universal of universals characterizing ultimate matter of fact. It is that ultimate principle by which the many, which are universe disjunctively, become the one actual occasion, which is the universe conjunctively. It is in the nature of things that the many enter into complex unity. 'Creativity' is the principle of novelty. Actual occasion is a novel entity diverse from any entity in the many which it unifies. Thus, creativity introduces novelty into the content of many, which are the universe disjunctively. The 'creative advance' is the application of this ultimate principle of creativity to each novel situation which it originates (Whitehead, 1929/1978, p. 21).

Here, Whitehead points out that creativity is the nature of the universe and the universe consists of many actual occasions. Although Whitehead is neutral on creativity which may result good or bad outcomes, Fetz (1990) argues that the creativity advance is transforming something into something better. What do we mean something better? Whitehead favors the fidelity of open ended search for what is true, good and beautiful. Mesle (2008) points out that such a search at its best engages us continually in a relational process. Therefore, we can surmise that the ultimate criteria for innovation or judgments for creativity are goodness, truthfulness and beauty. Of course, profits are an important criterion for judgment in economics.

Creativity is always found under conditions, and described as conditional (PR, 31). For Whitehead, creativity is conditioned by social environment (p. 203). Whitehead's ontological principle states that there is nothing which floats into the world from nowhere. Actual occasions

are reasons (see the creativity process above). Actual entities make up Whitehead's society. He stresses that creativity is caused by self-cause, efficient cause and final cause, and argues that creativity is social. These are ideas from Whitehead's speculative philosophy and we can apply them in economics and management. If we apply these causes to a business firm's change and innovation, the firm is a continuing and ongoing entity. Firm's change, innovation and creativity are accidents of environments. The high velocity of changes in today's business and economic environments are causes for business firms to be creative. The business environment consists of new technologies, regulations and markets such as suppliers, customers and competitors. We often observe that market crises such as the 2008 subprime mortgage crisis cause firms to change (Park et al. 2013).

First, Whitehead (1929/1978) points out that "an actual entity feels as it does in order to be the actual entity which it is" (PR. P. 222). He then argues that an actual entity satisfies Spinoza's self-causation (*causa sui*). The self-cause implies that nothing comes from nothing. The firm's employees come from their own past and have innate drives (appetitive) to be creative (self-cause). This ontological principle in Whitehead elucidates the existence of the firm and explains its own existence.

Second, physical causality indicates that the past actualities are reasons for whatever happens. Employees in the firm also interact with each other, competitors, suppliers, customers, science communities, regulators and nature. Interactions with these entities imply that employees in the firm affect each other. These entities are interrelated (principle of relativity). Firms use raw materials, labor, capital and technology and discharge carbon dioxide into the atmosphere as they produce products. Air and water pollution are examples of the firm's interactions with nature. Physical interactions among these inputs elicit something new.

Third, people in the firm make changes to increase profits (final cause) or to supply what customers want. According to Shaviro (2009) Whitehead's ideal for final cause (teleology) is beauty and for him the beautiful is about harmony and proportion (Shaviro, p. 152). It is said that Apple's founder, Steve Jobs, stressed the importance of beauty in product design and simplicity of technology (Issacson, 2011). He worked with designers and engineers to bring about a beautiful and easy-to-use product. Visions of the firm are akin to the final cause in Whitehead and the firm's visions established by organizational members or leaders who provide guides for resource allocation decisions (choices) and these decisions help create new products and services. Therefore, the principle of process and final cause are working together in new product development. In other words, novelty is caused by the principle of process and final cause.

Creativity in psychology and sociology

Gibson's (1977) affordances are akin to structures in sociology and we discuss them together. Gibson (1977) argues that the environment constrains what the animal can do within its limits, and how the human animal can alter the affordances of environment. Structure in sociology (Giddens, 1979; Bourdieu, 1977) refers to constraints and enabling; it is like Plato's receptacle (Malvestiti, 2011). Glăveanu (2012, 2014) argues that creative action is distributed among multiple actors, creations, places and times. We may develop a creativity model incorporating social environment, affordances, structure and distributed creativity. Operationalizing Whitehead's creative imagination and creative advance may lay foundations for the creative economy. We may bring additional perspectives on creativity from psychology and sociology.

Psychology has provided several valuable perspectives on creativity. First, according to Gibson (1977), the affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill. Physical affordances of air and water enable the animal to breathe and swim. Whitehead (1933) also cites psychology's phraseology, "Every action is the

product of conditioned reflexes.” Environments are conditions. Firms likewise construct physical structures to enable their creative employees to be more creative. For example, The Apple Company is constructing a new facility designed to generate more social interactions or engagement among employees, because interactions have been found to be an important factor for creativity. Whitehead (1929, 1978) concurs that creativity is conditioned by physical environment (efficient cause); affordances are equivalent to factors of efficient causes in Whitehead. Water flows in a river and the banks constrain the flow of the river, but it can overflow because of flooding which relieves the constraint and becomes creative or changing. We often state that we can't cross the same water twice. This implies that the actuality continues to change.

Second, distributed creativity has become prominent for creativity discussions in psychology. Scholars in distributed creativity stress the importance of groups (Sawyer and DeZutter, 2012). They define “distributed creativity to refer to situations where collaborating groups of individuals collectively generate a shared product” (Sawyer and DeZutter, 2012, p. 82). According to Glăveanu (2012 and 2014), creativity is distributed among people, objects and places. He argues that it is important to recognize that the creating person does not create in isolation, and that creative action extends into the world of other people. Therefore, group creativity or creation as co-creation needs collaboration among creatives. Glăveanu (2014) indicates that social interaction has become an emergent process in co-creation, as collaboration requires both structure and openness for creative outcomes to be generated. Brainstorming and ideation have been the most prevalent structure in psychology. Park et al. (2013) illustrate how ideation facilitate the new idea generation.

Affordances in psychology, structure in sociology and creativity in Whitehead have some common elements. Structure in sociology has emerged as an important field of research in recent years (Bourdieu, 1977; Giddens, 1979). For Whitehead (1929, 1978), creativity is always social, involving many creatives who interact and relate to each other. Individuals choose collaborating groups and relationships. Structure in sociology and management is akin to the concept of physical affordance in psychology. Both structure in sociology and physical affordance in psychology deal with behaviors of human beings facing constraints in terms of individuals and groups. Structure in sociology involves the relationship between the structure and agents. Giddens (1979, 1984) refers to structures as rules and resources. He regards the rule of social interaction as “techniques or generalizable procedures applied in the enactment/reproductions of social practices” (1984, p. 21). He considers three dimensions of social structure in his structuration theory: signification, legitimation, and domination. (For detailed discussions on knowledge creation structures, readers may refer to Park's et al. (2015a) article on firms' knowledge creation structures.)

Structures can be both social and physical. Giddens' structure is social, whereas 3M Company, Pixar and Apple's new buildings and campuses which are built to be conducive for creativity are physical structures. Physical structure is an affordance for Gibson (1977). Structure involves an antinomy: It enacts and enables human agents on one aspect and constrains actions of the agent on the other aspect (Bourdieu, 1977, 1990). Addressing this antinomy requires careful design in structure and designers of the structure include elements of reflexivity in the structure (Park et al. 2015a). For example, The Pixar Company conducts postmortems to find out what went well and what went wrong in a new production of an animation picture (Catmull, 2008). This practice continues to improve the structure and avoid the same mistakes in the future. It can also mitigate the problems in antinomy of the structure. Amabile (1988) found that “freedom was the most prominent environmental promoter of creativity, and constraint was the second most prominent environmental inhibitor of creativity” (p. 148). She argues that structure requires a delicate balance between freedom and constraint. We have discussed what social and psychological conditions are favorable to creativity. The

organization needs to provide those conditions when designing the structure for creativity. We construct a creativity model by putting together relevant abstractions on creativity in philosophy, psychology and sociology.

CREATIVITY MODEL

As discussed above, creativity in Whitehead originates from creative imagination. For Whitehead (1929/1978), creative imagination is stemming from physical conditions and corporeal experiences are sources of mental experience. His primordial proposition is that creativity is conditioned on negation or destruction of given data. **The negation of the given** is the fundamental proposition of creativity in Whitehead. This point is well practiced by Toyota. Toyota Company is known to ask customers about what the problems in their new products are rather than just how good their products are. This has become a practice in automobile industry. When they know what is not good they can make changes. Wonder is the beginning of thinking “creatively.” This proposition may be akin to critical thinking in today’s creativity discussions. Sociology and psychology offer factors that are requisite for the creative structure. The creative model ought to involve creative imagination of creatives and creative organizational structure. We present factors in creative imagination and creative structure in Figure 1. We propose a five Cs model based on ideas from philosophy, psychology and sociology discussed above: three Cs from the creative imagination of creatives and two Cs from the creative structure in creativity. Creatives or creative individuals draw creativity from creative imagination, and the organization creates an environment for creatives to enact creatively. Creativity is the raw material for innovation. Entrepreneurs innovate products, processes and services with the raw materials (creativity and knowledge).

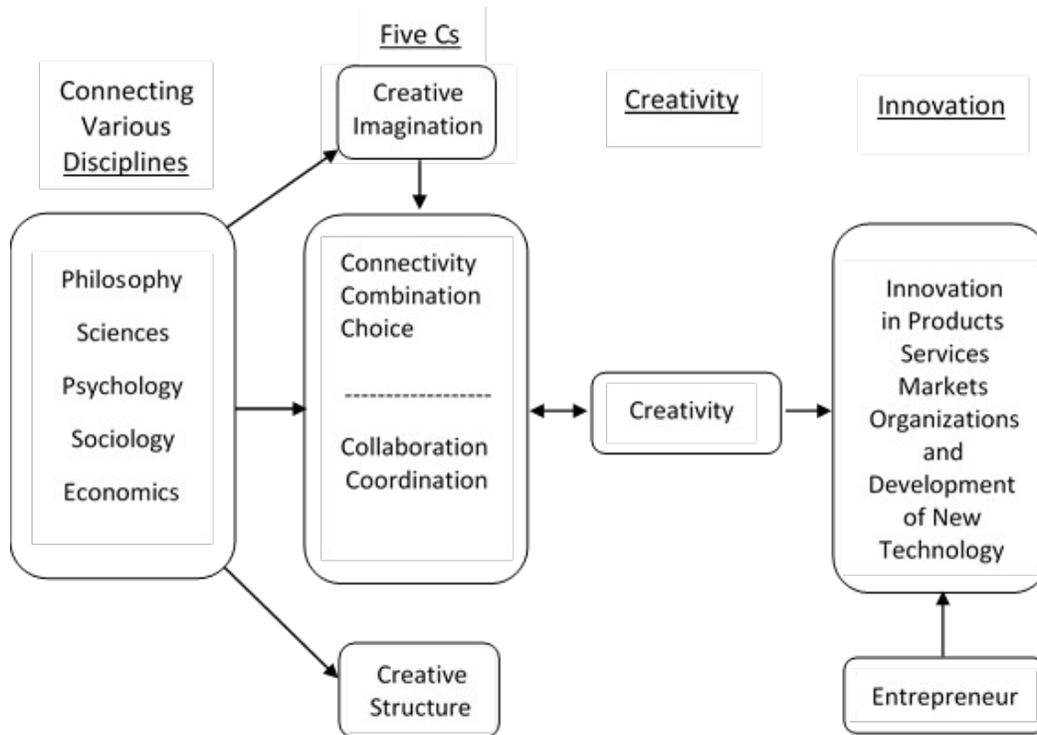


Figure 1: Creativity and Innovation

Five Cs creativity model

Stengers (2008) points out that the task of philosophy, according to Whitehead (1978), is engineering relevant abstractions. A creativity model needs to engineer relevant abstractions for creativity. We engineer relevant abstractions from philosophy, psychology and sociology in constructing our creativity model, which is called the combination or the hybrid (Halewood and Michael, 2008). Halewood and Michael argue that “in the actual occasion of academic practice, completion or satisfaction is reached when sufficient examples are collected to establish the multiplicity manifested in the poly-ingression of eternal objects and their interplay with actual entities” (p. 51). The multiplicity in novelty emerges in the interplay of such entities and eternal objects (Halewood and Michael, 2008). We will first engineer relevant abstractions and then provide a few practical examples to support the model. For Whitehead (1929/1978), creativity is actualization of possibilities (real and pure potentials). Perhaps, we can say that creativity is all about “C.”

Creativity	Creative imagination:	Connectivity Combination Choice
	Creative structure:	Collaboration Coordination

We propose that creativity in organizations can be thought of from two broad perspectives: creative imagination and creative structure. Creative imagination involves creatives, and members of the organization creates a structure or affordance in the organization. Twohill (2012) points out that good ideas sell products, while great ideas change lives. Creativity is about creating great new ideas. The Google Company, for example, sees creativity as a way of solving problems, large and small. As stated in our earlier discussions on Whitehead, Deleuze and Popper, ideas are requisite for solving problems. Traits of creatives include having curiosity and wonder in their chosen field (Whitehead, 1929/1978, Twohill, 2012). Twohill argues that curiosity and creativity are never apart and creatives are genuinely interested in discovering something new for solving the problems humans face. The ability to create is the ability to solve problems creatively. Creativity is the raw material of innovation (Lombardo and Roddy, 2010) and entrepreneurs carry out innovation (Drucker, 1985). In human history, entrepreneurs have solved most of the problems that we have faced. We argue that creativity then is all about “C”: Connectivity, Combination, Choice, Collaboration and Coordination. This Five C’s framework is comparable to ideas in the four P’s framework in Rhodes (1961) and the five A’s framework in Glăveanu (2012). We draw relevant abstracts for creative imagination from Whitehead and for creative structure from Glăveanu (2012) and Giddens (1979).

First, **connectivity** in creativity is connecting dots among what, at first glance, might appear to be unrelated activity or data (Lombardo and Roddy, 2010). Csikszentmihalyi (1996) states that creative people love to make connections with adjacent areas of knowledge. Whitehead’s connexity is one of the important aspects in creativity. For Whitehead, everything in the universe is interconnected and relational (1929/1978, 1938). Events are concrescing. Information and communications technology (ICT) has made the connection easier and inexpensive. Numerous new businesses are formed by connecting different fields that are seemingly not connected and ICT connects them with ease. We can see creativity in process in philosophy; biology and physics likewise are connected in terms of the emergence of something new. Several examples demonstrate these processes. Whitehead’s (1929, 1978) novelty involves connecting the past, present and the future.

Whitehead's fusion or connection between subject and object, physical and mental poles are creativity. When we come to have deeper understanding on becoming we may develop our foresights on creativity (Whitehead, 1933). Mesle (2008) points out that Whitehead's imagination is basing on the facts of our own experience. Mesle states that we remember our past, anticipate our future, and are experiencing our present. We interact with economic environments in purposeful ways and make choices to solve problems we are facing at the present. The anticipated future outcomes will depend on the choices we make when we face problems. We are engaging in the process of creativity during the present. We reason and imagine various connections based on the facts or our experiences. We test our imagination based on the facts of experiences. Integration of reason and experience is Whitehead's (1929, 1978) creativity. We can surmise that Newton imagined various possible reasons on his experience when the apple fell on his head. Whitehead states that "all productive thought has proceeded either by the poetic insight of artist, or by the imaginative elaboration of schemes of thought capable of utilization as logical premises (PR, p. 9)."

There are many experiences arising in each new moment and Whitehead's (1929, 1978) novelty involves connecting the past, present and future. For Whitehead, the present is duration and not a moment in time. For example, the director of design at Etienne Aigner Company takes her team to art museums, to movies, traveling, and even to a pottery class. She is offering experiences to her creative team for a duration of time and has them connect their experiences of those various activities in designing new products. Lehrer (2012) provides examples for connecting the dots for creativity among scientists and artists. Nike's advertising agent, Dan Wieden, was known for coming up with his most successful ad campaign tagline, "Just Do It," from the last words of a convicted murderer, Gary Gilmore, who said "Let's Do It" as he was waiting for his execution to commence. Hedge fund manager, George Soros (2008) professes that he took a philosophy class from Karl Popper during his senior year in college and learned fallibility of knowledge. He developed hedging on his position in investment since his knowledge (fund position) is fallible. Lately, the Enterprise Immune System in the Darkface Corporation connects the human immune system to cyber security. The Darkface Corporation (2017) developed a cyber security system and referred to it as the Enterprise Immune System that connects the human immune system to cyber security. According to the Darkface Corporation their cyber security system works like the human immune system by learning about what is normal for the body, identifying and neutralizing outliers that do not fit that evolving pattern of normality. The Enterprise Immune System can see threats as they are happening by combination of AI (artificial-intelligence) techniques such as machine learning. These examples connect dots among unrelated fields.

The most pronounced example of connectivity in economics may be the evolutionary theory of economic change. Applications of evolution in biology to economic change and firm competence originate from Alfred Marshall (1949), Nelson and Winter's (1982) evolutionary change of economic change presents a coherent theory connecting biology and economics. The competence perspective of the firm theory stemming from the evolution in biology has become the main stream research in theories of the firm. The creativity model we are proposing connects philosophy, psychology, sociology, management and economics.

Second, creativity **combines** diverse ideas and knowledge. Creatives working together benefit from diversity in education, gender and specialties, because more combinations can be generated when the creative team members are diverse. Diversity offers potential for numerous combinations of ideas. Creative and innovative companies such as 3M, Apple, Google and Dow Chemical purposefully hire their new employees from many different universities and backgrounds, as diverse experiences offer better insights on reality which is a noumenon. A noumenon can be better understood by observing from diverse perspectives. Diversities become sources of creativity. Nonaka and Takeuch (1995) propose combinations as creativity in

their knowledge creation model and combinations of various ideas and explicit knowledge create new ideas and knowledge.

Third, creativity in the organization is enhanced as creatives **choose** their own projects or have leeway to engage in their own projects. Freedom to choose unleashes their hidden talents and empowers creatives to create something new and better. Creative firms also allow employees freedom to allocate their time. This provides intrinsic incentives. Whitehead (1978) understood novelty as inherently involving freedom of choice. Mesle (2008) points out that Whitehead's freedom means cutting off one possibility and choosing the other. Novelty depends on the choices of individuals and the organizational leaders who make them. Creativity is the process of making these choices (Whitehead, 1929/1978), an important factor in creativity, as the outcomes of creativity depend on the creative process. Choices can be individuals' freedom to make a choice in work arrangement, team and relationship with members in the organization. Whitehead's eternal objects discussed above imply alternatives, contingencies, and situations that could have been otherwise (Shaviro, 2009). According to Whitehead, "each actual entity creates itself, in a process of decision, by making a selection among potentialities offered to it by eternal objects" (Shaviro, 2009, p. 42). Potentialities play a transcendental, quasi-causal role in the constitution of the actual world. Therefore, individual choices are important determinants of creativity and choice problems span many regions. One important aspect is making a work arrangement choice. Individuals create a team arrangement and creativity may depend on the nature of the arrangements. Human experiences offer evidences that connections and choices can be erroneous. We need to learn from our errors. Amabile (1988) found freedom (choice) is the most prominent promoter of creativity. Freedom to choose your own project and the type of possibilities to be actualized are crucial in creativity.

Fourth, **collaboration** involves both internal and external aspects of creativity. Today, major creativity is accomplished by teamwork. As creativity is a process (Csikszentmihalyi, 1996), the question is how to assure that team members collaborate. The Apple CEO Tim Cook (Rose, 2014) points out that team members need to interact; these interactions can take place in a physical or virtual space. Steve Jobs (Isaacson, 2011; Catmull, 2008) was known for his emphasis on interactions, and he designed physical facilities in Apple and Pixar (Rose, 2014; Catmull, 2008) to be conducive for casual encounters among all levels of employees. Brainstorming and ideation have been predominant practices in bringing out ideas from employees. Though brainstorming encourages bringing out ideas, it has failed to contribute significantly to creativity if there is a lack of employees' critical interactions (Lehrer, 2012). Critical interactions cause to result in discords among team members which generate more intensive interactions. As members of a creative team interact more intensively, outcomes may become more creative. Tim Cook (Rose, 2014) argues that discords are requisite in creativity team. The organization needs to structure employees' interactions. Creatives with diversities in skill sets, education and specialties must interact with each other with respect, trust and honesty. Cook (Rose, 2014) argues that intrinsic incentives that help solve human problems drive The Apple Company's creativity. However, Twohill (2012) argues that creatives sharing their imagination ultimately require shared ownership of the company's brand. The organization needs to design a hybrid incentive structure including intrinsic and extrinsic incentives, as well as individual and group roles and rewards, to realize the potential of individuals and teams. The question in an organization is how to build organizational capabilities to uncover possibilities, unlock capabilities that are uncovered, and unleash the capabilities to enable collaborative and cohesive effort (Lombardo and Roddy, 2010).

External collaborations have become increasingly important as new business practices. The Apple Company is known to have nine million registered developers (Rose, 2014), and The Google Company has Creative Commons (Twohill, 2012). The Dow Chemical Company has Idea Central to mobilize creative ideas internally and scouting departments in all fields of new

product development to collaborate with external stakeholders (Park et al., 2015a; Whiteman, 2013). Creative firms foster an incredible momentum of creative energy all over the world by creating structures for external collaboration (Twohill, 2012; Rose, 2014). Collaboration also encourages and engages the firm's creatives to connect with customers, suppliers and other stakeholders. Collaboration fosters co-creation, and this collaboration is an actualization of Whitehead's concrescence for creating new products and services in business organizations (Whitehead, 1929/1978). Park et al. (2015a) list factors that are requisite for the organizational structure in eliciting knowledge from individuals; those factors may be relevant to the structure in our creativity model. **Interactions** and sharing ideas among creatives are known to create energy in the organization (Whitehead, 1929/1978; Argote and Miron-Spektor, 2011; Park et al. 2015a). Energy in the living organism is a driving force for change and innovation. ITC reduces collaboration cost and foster global collaboration (Park et al. 2015b).

We must be reminded that for Whitehead, systems, firms and governments are abstractions incapable of creativity and only individuals constituting those organizations are creatives in the final sense. However, individuals create themselves out of their relationships. As we change those relationships, we have more creative between ourselves and each other. The construction of structure is crucial because it can cause different relationships among creatives. We do act differently in different systems and structures because those descriptions point to different kinds of actual relationships between actual individuals. Therefore, when individuals creatively choose to create themselves and their relationships with each other in certain kinds of novel ways, new possibilities for creative choice and relationships are actualized.

Fifth, **coordination** in creativity is about coordinating creative activities in an organization. Since creativity is distributed (Sawyer and DeZutter, 2009; Glăveanu, 2014), coordination is requisite. Tim Cook (Rose, 2014) points out that the leader in a creative firm needs to control noise in corporate meetings for creative interactions among creatives. All creative team members need to work for the same goal. He argues that the goal should be intrinsic in nature. The Apple Company pursues elegance and simplicity in their designs of new products, because improving the lives of consumers is the company's goal. Twohill (2012) points out that creativity is most powerful when it has a purpose. The focused purpose of the firm drives employees to innovate, and this purpose is the final cause for Whitehead (1929/1978). As stated before there is a positive relationship between the efficient cause and final cause. Control management is traditionally used to direct the firm to profit maximization. However, control tends to dull intrinsic drives and creativity of organizational members.

Creatives and creative structures

The research question in this study is what the relationships between creatives and creative structures are. Structure and agent in sociology is about subject and object in Whitehead. The study of the social is the study of subjects and objects (Halewood, 2008). We get to choose subjects and objects. Creatives are subjects and structures are objects. The structure in sociology is a social structure (Giddens, 1979, 1984), and the structure in psychology (Gibson, 1977) is a physical structure (physical affordance). Halewood (2008) states that structures cause different kinds of agents (subjects) and agents cause different kinds of structures. Bourdieu (1977) argues that structures are enabling and constraining agents. This is his antinomy of the structure and this antinomy has been addressed by making changes based on reflexivity (Those who want see the detailed discussions on this may refer to Park et al., 2015a). Whitehead (1927) makes a similar point:

The art of free society consists first in the maintenance of symbolic code; and secondly in the fearless revision, to secure that the code serves those purposes which satisfy an

enlightened reason. Those societies which cannot combine reverence to their symbols with freedom of revision, must ultimately decay either from anarchy, or from the slow atrophy of a life stifled by useless shadows. (Whitehead, 1927, p. 93).

This statement does not directly address issues involved in structural changes, but it does indicate the valorization of the reverence to structure and freedom of revision. There are two issues regarding the structure: 1) the design of structure that is conducive for creativity; 2) innovation in structure as agents experience that the structure is a source of undue constraints. Designing a proper context-specific structure is necessary in the process of creativity. For Whitehead, the structure needs to be conducive for interactions among creatives and conditional to environmental changes and social relationships. It is possible that creatives may create different relationships each time they involve in creative events under the same structure as Weber (2016) points out: "Actual processes are never twice the same because they depend on their environment and because this environment is always changing."

Shaviro (2009) argues that physics, genetics and biotechnology are changing rapidly and require us to abandon everything we think we know, and make singular judgements that cannot be subsumed under preexisting criteria. Shaviro's questions on the new categories to comprehend the new biology seems relevant here.

The question we should be asking, therefore, is not: How can we establish valid criteria and standards? But rather: How can we get away from such criteria and standards, which work only to block innovation and change? (Shaviro, 2009, p. 16).

Similarly, we can ask: How can we get away from such structure which works only to block innovation and change in business organizations? We need to constantly ask this question and address the problems in antinomy of structure. We examine a few business creative structures in the top creative firms in the U.S.

The Five C model in industry practices

To examine the practices employed by the most innovative and creative firms in the 21st century, 3M, Google and Apple, we will analyze each firm's practices to illustrate the five C's model.

The 3M Company

Founded in 1902, 3M launched the 15 percent program in 1948; employees could use 15 percent of their paid time to chase rainbows and hatch their own ideas. Though it seemed radical, this idea has produced many of the company's best-selling products, and is now the key to 3M's business strategy. Today 3M Company produces five thousand products with five thousand employees (Lehrer 2012), and the 15 percent time is now extended to every employee of the company. "Innovate or die" has become an ethos of the 21st century company; 3M's practices illustrate the five C's model.

Practice	Description
Connectivity	Creative people like to make connections among disparate but related knowledge. Workers discover things or come up with ideas in their usual course of work, something that may be used to solve problems by enhancing the current product, streamlining the current manufacturing procedure, or even creating new products. Previously, workers often did not pursue their discoveries or ideas because they lacked time, or the ideas or discoveries

	were not directly related to their current work, or might not be related to each other. Ideas often came and went, and might reappear again, but seldom led to concrete ideas that could be used to solve problems; if they languished, they might eventually be forgotten and never bear fruit. With the 15 percent time, creative workers will bring out their findings and discuss the relevance to their current work by connecting their findings to their work.
Combination	The allocated 15 percent of an employee's time is not just for scientists, but for every employee in 3M. This allows people with diverse education backgrounds, gender, and specialties to work together to combine their ideas for innovation. 3M has an annual gathering with hundreds of employees from dozens of divisions presenting their ideas and discoveries in a poster session. They share feedback, suggestions, and often find future collaborators who many times bring in fresh ideas. Sometimes, they do not get appropriate feedback right away; one worker held an idea for 15 years with no productive feedback, then 15 years later got different feedback that eventually led to a successful product. Many of the current 3M products stem from the activities during 15 percent time.
Choice	Workers at 3M are not constrained to work on any specific products or projects in their 15 percent time, and 3M essentially offers freedom to employees so that they can exercise their creative and innovative idea, which further softens boundaries between where ideas come from and how they take root.
Collaboration	Most 3M products from 15 percent time have come from group work. The annual poster session works as a vehicle to connect people with inspiring and groundbreaking ideas.
Coordination	3M did not simply offer 15 percent time to all employees to freely exercise their mental curiosity. Many good ideas remain locked in one's head and left unexploited because people think their ideas are not good enough, or they feel shy about their findings or discoveries. When 3M organized poster sessions to guide and coordinate interactions among employees, this encouraged employees to come out and take action, providing an environment for collaboration and connecting the dots. The company's physical facilities are like college campuses and offer an atmosphere for creatives to imagine or daydream (Lehrer, 2012). 3M creates a structure for employees to interact, share and collaborate.

The Google Company

Since its IPO in 2004, Google has grown beyond a simple search engine company, and is now considered one of the most innovating and non-conventional IT companies in the world. Google has been continuously innovating by encouraging interactions between employees and tapping their creative ideas to percolate up. Google also has a 20 percent time policy similar to 3M's 15 percent program, allowing workers to spend 20% of their work week on projects that most interest them.

Practice	Description
Connectivity	Google provides multiple channels to encourage interactions among employees within and across teams. The channels include Google Café, direct emails to any of the company's leaders, Google Moderators, and Google+ conversations, among others. These channels allow people to ask questions,

	and post ideas or suggestions. Other people can discover these questions, ideas, and suggestions, and organize meetings or events to discuss them, and possibly work on them in their 20% time.
Combination	Google values different ideas from different people, and the 20 percent time policy includes everybody working for the company. Google Café is designed to encourage not only employees within teams, but across teams, to meet with diverse employees and to spark conversations about their work and ideas. Google introduced the 70/20/10 rule, which allows employees to devote 70 percent of their time to their core business, 20 percent on related projects, and 10 percent to learning new skills and working on unrelated projects. This model allows employees to keep their focus on core needs, while encouraging them to explore new and related areas with other employees.
Choice	According to the 70/20/10 rule, 10 percent of the projects are unrelated to the current projects, and employees have freedom to choose their own projects. Google employees can spend their 20% of time on the 10% unrelated projects. Some of those projects can become their 70% projects in the future. These freedoms of choice have led to innovative ideas like driverless cars, Google Glass, Google Maps, and Google Docs.
Collaboration	Google Café is designed to encourage interactions between employees within and across teams. Google has a flexible work space called Google Garage, a big space with lots of tables with computers, whiteboards, 3D printers, cool tools (or toys), chairs, and couches, and it essentially works as a playground for Googlers (Google employees). Everything in the place can be moved around and reconfigured, and employees can come and join with other people to learn, design, create, make, and share ideas and have fun. This kind of collaboration provides an ultimate flexible and functional workspace, improves productivity, and helps people work together better.
Coordination	Google Moderator is an innovation management tool that organizes and coordinates questions, ideas, and suggestions submitted by employees. It provides management with feedback from many people, who can vote for questions they think should be posed from a pool of questions submitted by others, or submit their own questions to be asked and voted on. The process aims to ensure that every question is considered, lets the audience see others' questions, and helps the moderator of a team or event address the questions that the audience most cares about.

The Apple and Pixar Company

Apple is the number one innovative company in the world. Since their very first Apple Computer in 1976 and Macintosh in 1984, to the current iPod, iTunes, iPhone, iPad, and iMac, Apple has been different kinds of companies with a different view of the world, but has always delivered innovative products with elegance, style, simplicity, and beauty. Pixar, also created by Steve Jobs while he was ousted from Apple, is considered a pioneer and one of the most successful and innovative companies in 3D computer animation. Now, Apple leads the ICT business in hardware, software, and entertainment, and the Boston Consulting Group ranked Apple as the world's most innovative company in a report it issued in December 2015. While running both Apple and Pixar, Jobs was known to be more relaxed and less harsh and critical of the employees in Pixar than in Apple, but still there are many common attributes that led to the success of both companies. As Jobs was the CEO and creative leader for both Apple and Pixar, we present the creativity model using examples of both companies.

Practice	Description
Connectivity	According to Isaacson (2011), Apple's founder, Steve Jobs, applied imagination to technology and business. He was known for connecting hardware, software and services, the business model of The Apple Company (Rose, 2014). Jobs preferred face-to-face meetings over email, chatting, or video conference, because he believed different, spontaneous, and creative ideas come from different people meeting face-to-face. The Pixar building has been designed to promote unplanned encounters and collaborations among people from different departments with different skill levels –from software programmers to designers, marketing staff, and retail employees. Jobs said, "If a building doesn't encourage that, you'll lose a lot of innovation and the magic that's sparked by serendipity."
Combination	Creativity involves many people from different disciplines working together effectively to solve a great many problems. In Pixar, Technology, combined with Art, creates magic. Jobs was always surrounded by great engineers, scientists, designers and artists, but he was the one who wired them together to produce innovative products that served humanity well. Under the current leadership from Tim Cook, Apple promotes diverse employee backgrounds and perspectives to spark innovation and create opportunities for the next generation. The most interesting, creative, and innovative ideas come from these combinations of diverse perspectives.
Choice	In Pixar, enormous leeway decisions and control every state of idea development. In Pixar, all of the stories, worlds, and characters were created internally by their community of artists, not bought from outside. Without freedom to unleash their creativity and ingeniousness, they may have been less successful.
Collaboration	In Pixar, everyone is encouraged to freely communicate with everyone. Members of any department can directly approach anyone in another department to solve problems, and employees share their work with peers who provide candid feedback. Apple is building a new headquarters, called Apple Campus, in Cupertino, California, which will house more than 13,000 employees in one building. The building is circular shaped (spaceship-like) and the proximity and adjacency of different departments have been considered very carefully so that people in different departments can work together easily. In the middle is a 1000 seat underground auditorium for events and presentations. The building also has a Café for Apple employees to discuss work in a secure and private area. Apple collaborates not only within the company, but with many external companies (156 companies in a 2012 study) of different sizes, including Cisco, Intel, IBM, Google, and Microsoft; many Apple products are the result not only of the genius of the late Steve Jobs and his A-team of engineers, but of many alliances and collaborations.

Coordination	While many creatives in Pixar have freedom to make their own decisions and exercise their creativity, it is the leaders who sort through the mass of ideas to find the ones that fit into a coherent whole. In Apple, employees are often encouraged to make suggestions to improve current products or to choose directions for the future. Each year, Steve Jobs took his “top 100” people on a retreat and asked, “What are the 10 things we should be doing next?” Many suggestions were made, but it was Steve Jobs who finally determined the best three. He filtered out distractions and focused on core services and products that Apple could do best. Pixar is creating an environment conducive for creativity. The Pixar Company values employees and instills the idea that the whole is greater than the sum of the parts, creating an environment where employees respect and trust each other and provide honest feedback (Catmull, 2008).
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These examples are supportive of the five C model.

CREATIVITY AND ENTREPRENEURSHIP

Ideas shape actions (Mesle, 2008, p. 3) and ideas generated by creative imagination shape actions of entrepreneurs. Therefore, no idea is inadequate and all ideas are respected in the process of creativity. Diversity is valued in firms where people design organizational structures to generate diversity (Park et. al 2015a). Knowledge is relevant to Kirznerian entrepreneurs, and creativity is relevant to Schumpeterian entrepreneurs. We describe them here in detail. Gurteen (1998) points out that creativity and innovation concern the process of creating and applying new knowledge. As stated before, knowledge and creativity are the raw materials of innovation that are carried out by entrepreneurs.

Creativity and Schumpeterian entrepreneurship

Casson (2014) argues that entrepreneurship researchers need to give greater attention to information processing, a very important step for the new entrepreneur. Information on density of the same type of business in the area, newly emerging technology and new regulations provide sources for new entrepreneurship. Cognition of knowledge flow (Schiuma, 2009) offers entrepreneurial opportunities to potential entrepreneurs. Information processing may lead to better understanding the universe. As stated by Whitehead the universe consists of vast epochs. Whitehead (1933) argues that when we examine the structure of the epoch of the universe the structure exhibits successive layers of types of order (p. 199). The percipient (entrepreneur) may grasp the order of some larger environment. The order in this larger environment may offer entrepreneurial opportunities. The dominant identity of character pervading the concrete connexity of the many occasions is of value to creative entrepreneurs. For Whitehead, actualities of the universe are processes of experience and the whole universe is advancing assemblage of these processes.

As we have discussed, creative imagination is a key source of entrepreneurial opportunities. and Rentscheler (2010) argue that creativity enables entrepreneurs to act on opportunities in ways that can result in competitive advantage for the organization. Schumpeter advocated the same point in his book, *Theory of Economic Development* (1934); the Schumpeterian entrepreneur (Schumpeter 1934, 1942, 2008) generates surplus profits by breaking circular flow. Schumpeter defines this concept of circular flow in his book, *The Theory of Economic Development* (1934):

Under the assumption of constant conditions, consumers' and producers' goods of the same kind and quantity would be produced and consumed in every successive period because of the fact that in practice people act in accordance with well-tryed experience, and that in theory we regard them as acting in accordance with a knowledge of the best combination of present means under the given conditions. But there is also another connection between how the successive period operates with goods which an earlier period prepared for it, and in every period goods are produced for use in the next (Schumpeter, 1934, pp. 41, 42).

Goods would be bought and sold at the same prices year after year in this circular flow, which is a description of the concept of Walrasian general equilibrium. Every business firm finds that its selling price exactly equals its cost of production; there is no surplus profit and no economic growth in the circular flow. Breaking this circular flow is the function of the entrepreneur.

For Schumpeter (1934), economic development is spontaneous, and discontinuous change in the channels of the flow, the disturbance of equilibrium, forever alters and displaces the equilibrium state previously existing. The entrepreneur carries out new combinations and contributes to economic development. These entrepreneurial actions are then the main mechanism in the process of economic development:

This concept covers the following five cases: (1) The introduction of a new good – that is one which consumers are not yet familiar with – or of a new quality of a good. (2) The introduction of a new method of production, that is, one not yet tested by experience in the branch of manufacture concerned, which need not be founded upon a discovery scientifically new, but can also exist in a new way of handling a commodity commercially. (3) The opening of a new market, which is a market in which the particular branch of manufacture of the country in question has not previously entered, whether or not this market has existed before. (4) The conquest of a new source or supply of raw materials or half-manufactured goods, again irrespective of whether this source already exists or whether it first has to be created. (5) The carrying out of new organization of any industry, like the creation of a monopoly position (for example through trustification) or breaking up a monopoly position (Schumpeter, 1934, p. 66).

Schumpeter's (1942) later work links these cases with creative destruction. He argues that "the opening up of new markets, foreign or domestic, and organizational development from craft shop to new organization illustrate the process of mutation that incessantly revolutionizes the economic structure from within, incessantly destroys the old one, incessantly creates a new one" (p. 83). He refers to this process as the process of creative destruction.

This fact bears upon our problem in two ways: (1) In the process, every element takes considerable time in revealing its true features and ultimate effects, so we must judge its performance over time; (2) Every piece of business strategy acquires its true significance only against the background of that process and within the situation created by it. It must be in its role in the perennial gale of creative destruction; it cannot be understood irrespective of it or, in fact, on the hypothesis that there is a perennial lull (pp. 83, 84). Thus, Schumpeter (1934) explains economic development from the creative destruction perspective:

Development in our sense is a distinct phenomenon, entirely foreign to what may be observed in circular flow or in the tendency towards equilibrium. It is a spontaneous and discontinuous state previously existing. Our theory of development is nothing but a treatment of this phenomenon and the process incident to it (p. 64).

For Schumpeter (1947), gradual or routine adaptive response to changes in data is not entrepreneurial, but creative response to changes in data is entrepreneurial. Creative response is something that is outside of existing practice. According to him, a study of creative response in business becomes coterminous with a study of entrepreneurship. Therefore, the Schumpeterian entrepreneur is a creative entrepreneur, compared to a Kirznerian alert entrepreneur. Carrying out new combinations is referred to as *enterprise*. Schumpeterian entrepreneurs are individuals whose function is to carry out the new combination. In contrast, managers merely operate an established business or direct routine daily tasks in circular flow and do not receive profit, though they receive wages. Ryle's know-how (1946) and creativity are sources of Schumpeterian entrepreneurs. There are different grades of know-how; the higher grade provides better products and services for consumers, and entrepreneurs with a higher grade of know-how obtain profits. Creativity is the raw material for innovation, and Schumpeterian entrepreneurs carry out innovation and gain surplus profits.

Who are the entrepreneurs? According to Shane and Venkataraman (2000), entrepreneurs are the set of individuals who discover, evaluate and exploit opportunities. Schumpeter (1934) characterizes three corresponding pairs of opposites in characterizing the entrepreneur: (1) opposition of two real processes: the circular flow or the tendency towards equilibrium on the one hand, vs. a change in the channels of economic routine or a spontaneous change in economic data arising within the system, on the other; (2) opposition of two theoretical apparatuses: statics and dynamics; and (3) opposition of two types of conduct: mere managers vs. entrepreneurs. Entrepreneurs respond creatively to a spontaneous change in economic and environmental data and work under a dynamic theoretical framework. Schumpeter argues that entrepreneurs are motivated by the psychology of a non-hedonistic character. First, there is the dream and the will to found a private kingdom, usually, though not necessarily, also a dynasty. Second, there is the will to conquer, the impulse to fight, to prove one-self superior to others, to succeed for the sake of, not the fruits of success, but success itself. Third, there is the joy of creating, of getting things done, or simply of exercising one's energy and ingenuity (p. 93). The Schumpeterian entrepreneur is bold, self-confident, creative and innovative (Kirzner, 2008).

For Schumpeter, entrepreneurs do not bear risk, because new combinations are financed by capitalists, although entrepreneurs may own capital in some cases. Schumpeter carefully distinguished the entrepreneur from the capitalist (Foss and Klein, 2005). New combinations – new products, production methods, markets, sources of supply, or industrial combinations – are financed by banks that bear the financial risk. Schumpeter points out that interest is paid to the capitalist out of surplus values created by the entrepreneur. Today, venture capital firms finance most new combinations. A variety of funding sources have emerged in entrepreneurship: venture capital firms, corporate venture capital, angel funding and crowd funding.

A FORMAL MODEL FOR ENTREPRENEURSHIP: ENTREPRENEURSHIP AS GETTING PUZZLE PIECES TO FIT TOGETHER

Entrepreneurial opportunities by themselves do not produce any new products or services. Entrepreneurs have the power to make new products and make changes in existing products for profits. Producing a new product or service requires several puzzle pieces (Park et al. 2015a). If they do not fit together well or entrepreneurs miss pieces of a puzzle, the entrepreneurs may not succeed.

Puzzle pieces need to be identified:

Demand side

1. Kirznerian perspective – identifying opportunities from market disruption, discovering opportunities from the hidden business reality, knowledge.
2. Schumpeterian perspective – creativity, new products, processes, markets, organization.
3. New technology perspective – new industry.

Supply side

1. Human capital – Education, training and experience.
2. Finance – Bank, venture capital, corporate venture capital, angel funding, crowd funding.
3. Operation – Competitive cost.
4. Market – Market channel.
5. Conducive culture for entrepreneurship.

Casson (1982) developed a theory of the market for entrepreneurs; Freeman-Peck et al. (1998) apply this market analysis for entrepreneurs in their study on entrepreneurs and business performance. According to Freeman-Peck et al. (1998), “the demand for entrepreneurship is derived from their productivity and depends upon the opportunities presented by the economy” (p. 239). Entrepreneurs need to discover the opportunities presented by the economy. They may feel the quality of changes in the air and quantify it and process information to discover and identify entrepreneurial opportunities. Casson (1982, 2014), therefore, argues that information processing is important in today’s entrepreneurship study. Entrepreneurs can find the density of the business in the local they are studying for the potential start-up business. Big data processing has become a new business practice which provides the discovery of entrepreneurial opportunities. Entrepreneurs can afford to find the patterns of changes in consumers’ preferences and emergence of new demand.

Entrepreneurship research differentiates entrepreneurship and intrapreneurship. Entrepreneurs create new business enterprises, whereas intrapreneurs create new products, processes, organizations and markets from existing firms. The demand for entrepreneurs in this paper includes both types. When market disruptions such as the subprime mortgage crisis take place, the demand for entrepreneurs increases. New technology generates the demand for entrepreneurs. For instance, information and communications technologies have increased the demand for entrepreneurs and they are likely to contribute to increasing demand for entrepreneurs in connection with newly emerging technologies such as artificial intelligence (AI) and IoT (Internet of Things). Lately, the demand for cyber security offers ample opportunities for new startup businesses.

The demand curve for entrepreneurs is downward sloping, because there are diminishing returns to entrepreneurs as more entrepreneurs are added to the economy or the firm. Rewards for entrepreneurs are profits. When entrepreneurial opportunities increase, the demand for entrepreneurs will likewise increase, and the demand curve for entrepreneurs will shift to the right (see Figure 2). Determining factors of demand are opportunities for entrepreneurship, the emergence of new technologies and creativity. We can draw a few examples for entrepreneurial opportunities. First, disequilibrium of a market, such as the bursting of the housing bubble and disruption of the financial market, provides opportunities for entrepreneurship. Prices of housing fell drastically in 2008; entrepreneurs bought those houses at cheap prices, then made profits by reselling them as the prices of houses recovered. Second, knowledge and creativity, the raw materials of innovation, will cause the demand curve to shift to the right. Third, the emergence of new technology can open entrepreneurial opportunities and likewise cause the demand curve to shift to the right. For instance, the emergence of information and communications technology (ICT) offered abundant entrepreneurial opportunities and formed a new industry. 3D printing and

carbon fiber technologies are relatively new and they offer entrepreneurial opportunities. In our industrial history, the demand for entrepreneurs has increased as new industries emerged. When we examine the ICT industry we recognize that the ICT created enormous entrepreneurial opportunities throughout its development and IBM, Hewlett-Packard, Microsoft, Apple, Google, Amazon and Facebook are dominant companies in the world. Today, artificial intelligence (AI) is emerging as a new technology that has a potential for ample new opportunities for entrepreneurship by connecting the new technology to the ICT. The ICT can be connected to various fields. Again, creativity is the raw material for innovation and innovation is carried out by entrepreneurs. Changes in products, processes and markets also offer entrepreneurial opportunities.

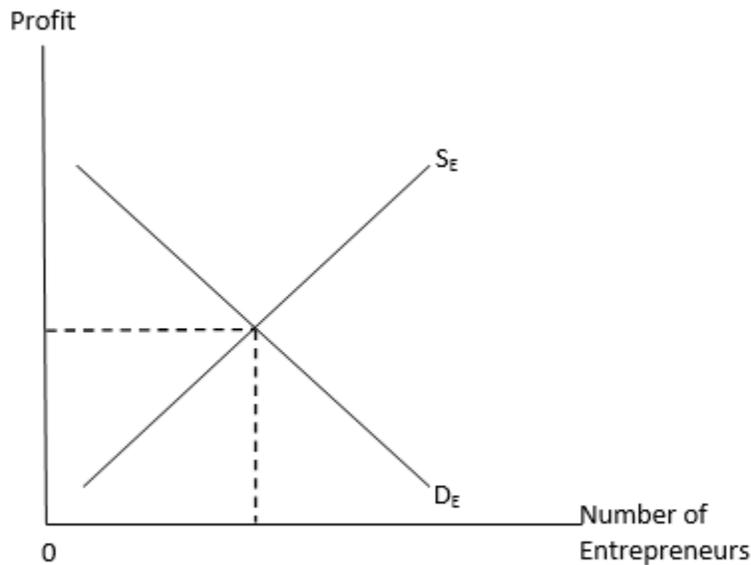


Figure 2: The demand and supply of entrepreneurs

The supply of entrepreneurs comes from those who have capabilities in the field. The supply of entrepreneurs has a positive relationship with profit, as seen in Figure 2. The number of entrepreneurs will increase as the profit in the field increases. The determining factors of the supply of entrepreneurs are training, education, culture and experience of potential entrepreneurs. Costs of new ventures will affect the supply of entrepreneurs. Shifting factors of the supply curve of entrepreneurs are costs in financing and operations and accessibility of market channels. When costs in financing, operations and marketing fall, the supply curve of entrepreneurs shifts downward, increasing the supply of entrepreneurs. Baumol (1990), however, states that this can generate more entrepreneurial opportunities and shift the demand curve for entrepreneurs to the right, increasing profits for entrepreneurs. Interactions between the demand and supply of entrepreneurs may increase the number of entrepreneurs. The supply of entrepreneurs originates from forming new business ventures or making changes in existing firms (intrapreneurs). Freeman-Peck et al. (1998) argue that “other things being equal, the larger a country’s supply of entrepreneurial risk-takers, the better the economy will perform” (p. 240).

We now analyze the market for entrepreneurs in the information and communications technology (ICT) industry. Adventure of imagination and exploration in information and communication technologies opened immeasurable opportunities for entrepreneurs in the field. Demand for entrepreneur increases as entrepreneurial opportunities stemming from the new information and communications technology (ICT) improve. Information and communications

technology has opened huge entrepreneurial opportunities. ICTs continue to evolve and spread globally. These ICTs have created new industry and demand for entrepreneurs. They have been leading sources of entrepreneurship for the last three decades. Lately artificial intelligence is emerging as a new technology and it offers opportunities for entrepreneurship by combining it with the ICT.

Consider the example of the Internet, the global system of interconnected mainframe, personal and wireless computer networks that use the Internet protocol suite (TCP/IP) to link billions of devices worldwide. An early form of computer networks was developed in the early 1960s. The DOD (Department of Defense) supported the development of ARPANET in late 1960s, and four sites (UCLA, UCSB, University of Utah, and Augmentation Research Center, now SRI) were connected in 1969. Subsequently, ARPANET supported E-mail, File transfer, and Voice traffic throughout the 1970s. The modern day of the Internet started in the early 1980s with the inclusion of regional academic institutions and the worldwide proliferation of interconnected networks. The Internet rapidly expanded in Europe, Australia, and Asia through the late 1980s and early 1990s. ARPANET was decommissioned in 1990.

Until the late 1980s, the use of computer networks was limited to researchers, scientists, higher education, and big corporations, and was not widely accessible to the public. Then Tim Berners-Lee at CERN developed the World Wide Web (WWW) in 1989, which allowed documents and other web resources to be accessed by URLs, and in 1993 Marc Andreessen developed a GUI (Graphical User Interface) WWW browser called Mosaic. Mosaic was later changed to Netscape in 1994. Commercial Internet Service Providers (ISPs) began their service in the early 1990s, and with the easy use of WWW browsers, the mid-1990s usage of the Internet exploded in the commercial and public sectors and in home use. The WWW, GUI browser, and expansion of networks in both speed and bandwidths opened a wide door to many IT companies for hardware and software development for the Internet. Many new firms, such as Google (1996), Amazon (1994), Yahoo (1994), and Netflix (1997) emerged during the '90s; they applied Internet technology in starting their new businesses. These companies used the Internet to connect suppliers and consumers, and numerous new business companies emerged. Stiroh's (2002) study found that IT-producing and IT-using industries account for all the productivity revival after 1995. We have seen that the IT-producing and IT-using industries have created an increasingly large demand for entrepreneurs and entrepreneurial opportunities ever since the '90s.

Entrepreneurs in the information and communications technology (ICT) industries are those who majored in computer and information systems and acquired capabilities from real job experiences. Today cloud computing reduces costs in infrastructure for new ventures in the ICT industries. As more cloud-computing firms compete to lower the costs of computing and storage of information, there will be an increase in entrepreneurs. Therefore, the emergence of cloud computing firms will shift the supply curve of entrepreneurs to the right. Shifting factors of this supply curve are costs in financing and operations and accessibility of market channels. As the Kauffman Foundation Research Series indicates (Hathaway, 2013), "the high-tech sector and the information and communications technology segment of high-tech are important contributors to entrepreneurship in the U.S. economy" (p. 2). Hathaway's study reports that "ten of the fourteen high-tech industries can be classified as information and communications technology (ICT), while the remaining four are in disparate fields of pharmaceuticals, aerospace, engineering services, and scientific research and development" (p. 3).

Information and communications technology (ICT) has helped expand connectivity and collaboration exponentially in recent years. Bughin's et al. (2013) study on the ten IT-enabled business trends for the decade ahead reports that four of the trends described reflect IT, and "The Internet of All Things" connects and engages all stakeholders: employees, customers, suppliers and business partners. This **connectivity** leads to co-creativity and new

entrepreneurs. Thus, ICT facilitates connection of producers, suppliers and users, and user-driven innovation (Park et al. 2015b). Social technologies connect many organizations internally and increasingly reach outside their borders.

ITC also improves **collaboration** among employees within the organization and partner organizations globally. Bughin et al. (2013) argue that “The Cloud,” with its ability to deliver digital power at low cost and in small increments, is not only changing the profile of corporate IT departments, but also helping to spawn a range of new business models by shifting the economics of “rent versus buy” trade-off for companies and consumers. Renting business to business (B 2 B) has been increasing and more new businesses are formed to serve the renting needs. These factors shift the demand curve for entrepreneurs to the right. Therefore, the demand for entrepreneurs stemming from ICT is likely to grow exponentially in the foreseeable future. Recently, social media is connecting billions of people in the world and new business models are emerging from this connectivity. Airbnb and Uber, for example, have emerged with new connectivity between demand and supply of rooms and car rentals with the help of ITCs. This type of business model has expanded globally.

DISCUSSION

We argue that creativity is the raw material of Schumpeterian entrepreneurs. We propose a five C’s theory of creativity: Connectivity, Combination, Choice, Collaboration and Coordination. We then examine practices of creative firms considering our proposed five C’s theory. The ever-evolving ITCs expand connectivity and collaboration beyond the boundaries of the firm and the nation, which helps organizations be creative and entrepreneurial.

Information and communications technology (ICT) in hardware, software and services opened many entrepreneurial opportunities in the ‘90s and those firms are highly valued today. We have examined 3M, Google and Apple/Pixar in our study. Numerous new entrepreneurial opportunities will continue to emerge in the ICT industry with development of Cloud computing. We have proposed the five C’s theory for creativity and the market for entrepreneurs in the ICT industry. These novel approaches in creativity and entrepreneurship are interesting and promising, but require further study.

CONCLUSION

Entrepreneurship is essential in the fast-moving global economy. Entrepreneurship studies the discoveries and the creation of entrepreneurial opportunities. Entrepreneurs generate new ideas and use them for innovation and new business formation. Great ideas stemming from creativity are the raw materials of innovation and entrepreneurs carry out innovation. This paper proposed a new theory of creativity and examined industry practices of creativity and innovation from this new perspective. The study also examined the market analysis of entrepreneurs from the creativity perspective. Adventure of imagination in information and communications technology (ICT) and exploration in hardware, software and services opened plenty of new entrepreneurial opportunities in the ‘90s and those firms are highly valued today.

We analyzed the market for entrepreneurs in the ICT industry. We believe that both the five C theory and the market for entrepreneurs are novel approaches. They make sense in our view and offer insights on the theory of today’s entrepreneurship. We need to provide more empirical evidence to validate these novel approaches.

REFERENCES

- Amabile, T. M. (1988). A model of creativity and innovation in organizations. *Research in Organizational Behavior*, 10, 123-167.
- Argote, L. and Miron-Spektor, E. (2011). Organizational learning: From experience to knowledge. *Organizational Science*, 22 (5), 1123-1137.
- Baumol, W.J., 1990. Entrepreneurship: Productive, Unproductive and Destructive. *Journal of Political Economy*, 98 (5), 893–921.
- Bourdieu, P. (1977). *Outline of a Theory of Practice* (trans. by R. Nice). Cambridge, UK: Cambridge University Press.
- Bourdieu, P. (1990). *The Logic of Practice* (trans. by R. Nice). Stanford: Stanford University Press.
- Bughin, J., Chui, M. & Manyika, J. (2013). Ten IT-enabled business trends for the decade ahead. *McKinsey Quarterly*, McKinsey & Company.
- Casson, M. (1982). *The Entrepreneur: An Economic Theory*. Oxford: Martin Robertson.
- Casson, M. (1998). *An Entrepreneurial Theory of the Firm*. Department of Economics, University of Reading, Reading, UK.
- Casson, M. (2014). Entrepreneurship: A personal view. *International Journal of the Economics of Business*, 21 (1), 7-12.
- Catmull, E. (2008). How Pixar fosters collective creativity. *Harvard Business Review*, September, 2008.
- Coase, R. (1937). The nature of the firm. *Economica*, 4(16), 356-405.
- Csikszentmihalyi, M. (1996). *Creativity: Flow and the Psychology of Discovery and Invention*. New York: Harper Perennial Modern Classics.
- Darkface Corporation (2017). <https://www.darkface.com/technology/>
- Deleuze, G. (1994). *Difference and Repetition*, Trans. Paul Patton. New York: Columbia University Press.
- Drucker, P. (1985). *Innovation and Entrepreneurship*. New York: Harper & Row Publishers, Inc.
- Fetz, R. L. (1990). Creativity: A new transcendental? *Whitehead's Metaphysics of Creativity*, F. Rapp and R. Wiehl (eds.). Albany: State University of New York Press, 189-208.
- Fillis, I. & Rentscher, R. (2010). The role of creativity in entrepreneurship. *Journal of Enterprising Culture*, 18 (1). DOI: 1142/S0218495810000501

-
- Fischer, G. (2005). Creativity and distributed intelligence. <http://www.cs.umd.edu/hcil/CST>
- Foss, N. (1999). Networks, capabilities, and competitive advantage. *Scandinavian Journal of Management*, 15 (1), 1-15.
- Foss, N.J. & Mahnke, V. (2000). *Competence, Governance, and Entrepreneurship*. Oxford University Press, Oxford, U.K.
- Foss, N. J. & Klein, P.G. (2005). Entrepreneurship and the economic theory of the firm: Any gains from Trade? *Handbook of Entrepreneurship Research: Interdisciplinary Perspectives*, Alvarez, S.A., Agarwal, R. & Sorenson, O. (eds.), New York: Springer, Inc., 55-80.
- Foss, N. J. & Klein, P. G. (2010). Alertness, action and the antecedents of entrepreneurship. *The Journal of Private Enterprise*, 25 (2), 145-164.
- Freman-Peck, J., Boccaletti, E. & Nicholas, T. (1998). Entrepreneurs and business performance in nineteenth century France. *European Review of Economic History*, 2 (3), 235-262.
- Gibson, J. J. (1977). The theory of affordances. In R. Shaw & J. Bransford, (eds.). *Perceiving, Acting, and Knowing*. Hillsdale, N.J.: Lawrence Erlbaum Associates.
- Giddens, A. (1979). *Central Problems in Social Theory*. Berkeley: University of California Press.
- Giddens, A. (1984). *The Constitution of Society*. Berkeley: University of California Press.
- Glăveanu, V. P. (2014). *Distributed Creativity: Thinking Outside the Box of the Creative Individuals*. Heidelberg: Springer.
- Glăveanu, V.P. (2012). Rewriting the language of creativity: The five A's framework. *Review of General Psychology*. Advance online publication. DOI: 10.1037/a0029528.
- Griffin, D. R. (2007). *Whitehead's Radically Different Postmodern Philosophy: An Argument for its Contemporary Relevance*. Albany, NY: State University of New York Press.
- Griffin, D. R. (1988). *The Reenchantment of Science: Postmodern Proposal*. Albany, NY: State University of New York Press.
- Gurteen, D. (1998). Knowledge, creativity and innovation. *Journal of Knowledge Management*, 2(1), 5-13.
- Halewood, M. (2014). *Rethinking the Social through Durkheim, Marx, Weber and Whitehead*. New York: Anthem Press, 134-135.
- Halewood, M. & Peden, C. (1981). *Whitehead's View of Reality*. Pilgrim Press.

-
- Hartshorne, D. (1998). Knowledge, creativity and innovation. *Journal of Knowledge Management*, 2(1), 5-13.
- Hathaway, I. (2013). Tech Starts: High-technology Business Formation and Job Creation in the United States. *Kauffman Foundation Research Series: Firm Formation and Economic Growth*.
- Heidegger, M. (1959). *An Introduction to Metaphysics*. New Haven: Yale University Press, 7-8.
- Holcombe, R. G. (2003). The origin of entrepreneurial opportunities. *The Review of Austrian Economics*, 16(1), 25-43.
- Hosinski, T. E. (1993). *Stubborn Fact and Creative Advance: An Introduction of the Metaphysics of Alfred North Whitehead*. Lanham: Rowman & Littlefield Publishers, Inc.
- Isaacson, W. (2011). *Steve Jobs*. New York: Simon & Schuster.
- Kauffman, S. A. (1993). *The origin of Order: Self-organization and Selection in Evolution*. New York and Oxford: Oxford University Press.
- Kirzner, I. M. (1999). Creativity and/or alertness: A Reconsideration of Schumpeterian entrepreneur. *Review of Austrian Economics*, 11, 5-17.
- Kirzner, I. M. (2008). The Alert and Creative Entrepreneur: A Clarification. IFN Working Paper No. 760.
- Kogut, B. and Zander U. (1992). Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. *Organization Science*, Vol. 3, Issue 3, p. 383-397 1992.
- Langström, H., Harirchi, G. & Astrom, F. (2012). Entrepreneurship: Exploring the knowledge base. *Research Policy*, 41(2012), 1154-1181.
- Lehrer, J. (2012). *Imagine How Creativity Works*. Boston: Houghton Mifflin Harcourt.
- Lombardo, B. J. & Roddy, D. J. (2010). *Cultivating organizational creativity in an age of complexity*. Executive Report. New York: IBM Global Business Services.
- Marshall, A. (1949). *The Principles of Economics*, 8th edition (1st edition 1890). London: Macmillan.
- Malvestiti, M. (2011). Plato's receptacle in the Timaeus: Towards a theory of matter, Working Paper, Department of Moral Philosophy. University of St. Andrews, St. Andrews, U.K.
- Mesle, C.R. (2008). *Process-Relational Philosophy*. West Conshohocken, PA: Templeton Press.

-
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company*. Oxford, UK: Oxford University Press.
- Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, Vol. 5, No. 1 (Feb., 1994), pp. 14-37.
- Park, H. Y., Shinn, G. C., Jung, S. & Park, Y. S. (2013). Changes in economic environment. Learning, and dynamic capabilities in Korean firms. *Change Management: An International Journal*, 12, 19-39.
- Park, H. Y., Chang, H. & Park, Y. (2015a). Firms' knowledge creation structure and new product development. *Cogent Business & Management*, 2: 1023507.
- Park, H. Y., Cho, I., Jung, S., & Main, D. (2015b). Information technology and user knowledge-driven innovation in services. *Cogent Business & Management*, 2: 1078869.
- Popper, K. (1982). Of clocks and clouds. In H.C. Plotkin (ed). *Learning, Development and Culture*. New York: John Wiley & Sons, Inc. 109-119.
- Rose, C. (2014). Charlie Rose interview with Tim Cook (Apple CEO), PBS, September 14, 2014.
- Rhodes, M. (1961). An analysis of creativity. *Phi Delta Kappan*, 42, 205-210.
- Ryle, G. (1946). Knowing how and knowing that. *Proceedings of the Aristotelian Society*, XLVI, vol. 2, 212-225.
- Sawyer, R. K. & DeZutter, S. (2009). Distributed creativity: How collective creations emerge from collaboration. *Psychology of Aesthetics, Creativity, and the Arts*, 3(2), 81-92.
- Shane, S. & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25(1), 217-226.
- Shapiro, S. (2009). *Without Criteria: Kant, Whitehead, Deleuze, and Aesthetics*. The MIT Press.
- Schiama, G. (2009). The managerial foundations of knowledge assets dynamics. *Knowledge Management Research & Practice*, 7(4), 290-299.
- Schumpeter, J. A. (1934). *The Theory of Economic Development*. New York: Oxford University Press.
- Schumpeter, J. A. (1942). *Capitalism, Socialism and Democracy*. New York: Harper & Brothers.
- Schumpeter, J. A. (1947). The creative response in economic history. *Journal of Economic History*, 7(2), 149-159.

Schumpeter, J. A. (2008). *Essays on Entrepreneurs, Innovations, Business Cycles, and the Evolution of Capitalism*, R. V. Clemence, (ed.). New Brunswick: Transaction Publishers.

Soros, G. (2008). *The new paradigm for financial markets: The credit crisis of 2008 and what it means*. Philadelphia: Perseus Books Group.

Stengers, I. (2008). A constructivist reading of Process and Reality. *Theory, Culture & Society*, 25(4), 91-110.

Stengers I. (2011). *Thinking with Whitehead: A Free and Wild Creation of Concepts* (Translated by Michael Chase). Cambridge, MA: Harvard University Press.

Stiroh, K. J. (2002). Information Technology and the U.S. Productivity Revival: What Do the Industry Data Say?. *American Economic Review*, 92(5): 1559-1576.

Twohill, L. (2012). The curious case of creativity, Think with Google: <https://www.thinkwithgoogle.com/marketing-resources/the-curious-case-of-creativity/>

Wallack, F. B. (1980). *The Epochal Nature of Process in Whitehead's Metaphysics*. Albany, NY: State University of New York Press.

Weber, M. (2016). Symbolism, its meaning and effect: The universal algebra of culture. *The Journal of Natural and Social Philosophy*, 12 (1), 350-377.

Wieman N. N. (1946). *The Source of Human Good*. Southern Illinois University Press, London and Amsterdam: Pfeffer & Simon, Inc.

Whitehead, A. N. (1927). *Symbolism: Its Meaning and Effect*. New York: Capricorn Books.

Whitehead, A. N. (1929/1978). *Process and Reality*. New York: Free Press.

Whitehead, A. N. (1933). Foresight, Chapter VI in the *Adventures of Ideas*. New York: The Free Press, 87-99.

Whitehead, A. N. (1938/1968). *Modes of Thought*. New York: Macmillan.

Whiteman, M. (2013). Collaboration to develop new business ideas, Dow Chemical Company, Midland, Michigan.

Williamson, O. E. (1975). *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: Free Press.

Williamson, O. E. (1985). *The Economic Institution of Capitalism*. New York: Free Press.

Williamson, O. E. (2008). Outsourcing: Transactions cost economics and supply chain management. *Journal of Supply Chain Management*. 44 (2), 5-16.

Young, J. G. (1985). What is creativity?. *Journal of Creative Behavior*, 19(2), 77-87.