

FACTORS LEADING TO RADICAL INNOVATION IN ORGANIZATIONS

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SUMMARY: This study provides a short review of the individual, processes, and environmental dimensions that lead to radical innovation in organizations as complex adaptive systems. Based on a literature review of highly ranked peer-reviewed journals, a blueprint was developed to identify qualitative factors for each dimension while emphasizing their interdependency to overcome challenges toward radical innovation. The study has implications for both researchers and practitioners. It suggests a multidimensional understanding of radical innovation, demanding efforts from different perspectives. Furthermore, business leaders can promote exploration of strategic scenarios by combining some of the identified components.

Keywords: complexity theory; radical innovation; complex adaptive systems

Introduction

Radical innovation is a core component of economic sustainability and the survival of enterprises dependent on competition and development (Koberg et al., 2003). Hence, organizations and individuals need to find ways to adopt radical innovation activities. Radical innovation is also essential to governments as it contributes to countries' economic growth (Knošková, 2015). The integration of current information with new knowledge is linked to revolutionary innovation advancements, resulting in innovative products, services (Troilo et al., 2014), and new business opportunities. Accordingly, the advantages of radical innovation and its further impact on overall economic wellness are centered on entrepreneurship efforts (Schumpeter, 1934).

However, findings about radical innovation benefits from a macro-to a micro-level perspective are not conclusive in research (Marvel & Lumpkin, 2007). Outcomes vary significantly between countries, as they are dependent on many factors, such as those related to the individual and the environment (Koellinger, 2008). For instance, education level, employment, and self-confidence have been linked to innovation intensity associated with individuals. Furthermore, environmental and market forces have important effects in augmenting the individual adoption of innovation strategies as a source of competition (Chen, Liu & Cheng, 2014). Despite the obvious interaction demands, radical innovation is seldom examined as a complex and multidimensional activity driven by individual, process, and environmental dimensions in organizations. Thus, the purpose of this review is to identify the factors leading to radical innovation outcomes in organizations under the lens of complex systems theory, following some of the entrepreneurship dimensions suggested by Gartner (1985).

Methodology

The selected methodology consisted of retrieving investigations either from (1) peer-reviewed journals or (2) category of journals within a $Q1 - Q3$ based on SCImago Journal Rank (SJR), using the Boolean search operators AND/OR in the ABI/INFORMS Global database. This database is trustworthy because it contains publications from highly reputable sources (Zhang & Su, 2018). A review of studies consisting of a business context for different periods from 2001-2022 was performed. The search included keywords such as (1) radical innovation OR breakthrough innovation process, (2) radical innovation OR breakthrough innovation AND entrepreneurship, (3) radical innovation OR breakthrough innovation AND economic growth, (4) entrepreneurs in radical innovation OR breakthrough innovation, and (5) environmental factors AND radical innovation OR breakthrough innovation. A total of fifty-five articles were obtained from this initial screening. Based on the research title, abstract focus, and empirical evidence, twenty-seven articles were selected to develop this review of the factors leading to radical innovation in organizations.

To achieve the aims of this study, the review was devised as a challenging process in organizations based on (a) individual dimensions, (b) process dimensions, and (3) environmental dimensions to provide a nuanced perspective of radical innovation demands. In addition, the chosen structure enabled the development of a thorough business perspective on the patterns ascribed to radical innovation to increase wealth (Christensen, 1997).

Theoretical Framework

Complexity Theory

Complexity theory provides the framework for this study. Complexity is concerned with how systems change and evolve because of the nonlinear interaction of their parts. Complexity theory deals with reporting the present and seeing what can be changed (radical innovation), and obtaining the right inputs for certain outputs. Therefore, a complex approach combines assumptions and conditions in complicated systems while underscoring possible challenges.

Organizations are complex systems characterized by nonlinear dynamics and relations (Palmberg, 2009). Complexity theory allows for the understanding of these patterns that turn into a platform for innovation disruptions (Pierpaolo, 2011).

Radical Innovation

Radical innovation is a complex process that is based on opportunity recognition and exploitation emerging in different forms at any one time (Ucbasaran et al., 2001). Innovative or imitative business opportunities depend on environmental factors (e.g., technology, politics, and regulations), which vary across countries and industries that are willing to generate entrepreneurship opportunities (Koellinger, 2008). Since entrepreneurship's main focus is on the individual, different characteristics and behavior patterns may promote diverse entrepreneurs not necessarily guided by single events (Ucbasaran et al., 2001) but for many other reasons leading to breakthrough outcomes.

In this research, radical innovation is defined as a complex process that demands the nonlinear dynamics of individuals, processes, and environmental dimensions affecting radical innovation outcomes in organizations, including new business creation.

Literature Review

Individual Dimension

Complexity theory states that organizations are complex adaptive systems (CAS), as they show the need for interdependent parts, allowing for business evolution and adaptability to learn (Lissack, 1999). Human capital is associated with radical innovation outcomes, whereas interaction is related to these results (Marvel, 2007). Furthermore, complexity theory establishes that cognitive structures dictate individual behaviors (Anderson, 1999). Therefore, if personal understanding of the unique factors for radical innovation increases, the opportunities and willingness of the breakthrough interaction process also increase.

Leadership

Leadership is an important influence in the approval or rejection of project priorities. However, individual leaders may have different attitudes toward radical innovation adoption, increasing the situation complexity. While clear objectives and orientations are needed, environmental dynamics complicate the cognitive structure. Complexity theory sustains the evolution of schemata resulting from agent (individual) interaction, which is influenced by its perception of the environment.

Individuals may have specific situation rules, but in highly uncertain situations, integration of previous schemes is needed for the emergence and identification of new opportunities. Empirical studies confirm the influence of leadership in different industrial sectors (Isada & Isada, 2017). First, flexible leadership in small and medium-sized enterprises positively impacts radical innovation. Second, the importance of individual capabilities highlighted for originality and technical orientations within the growth phase environment. Accordingly, individuals with high levels of leadership and empowerment denote a positive influence on radical innovation activities (Domínguez-Escrig, et al., 2021).

Emotional Stability

Emotional stability is an essential trait in leaders aiming for radical innovation (Aronson et al., 2008). Radical innovation challenges imply the need to deal with uncertainty and high-risk situations. Therefore, emotional experiences may influence innovation outcomes (Swart-Opperman et al., 2021). Thus, an emotionally stable leader provides support through experimentation and external interaction to facilitate radical innovation (Domínguez et al., 2016). Furthermore, complexity theory states the ways in which changes manifest themselves (Anderson, 1999). As such, emotionally stable individuals will support the frequent and nonlinear dimensions within the complex process of radical innovation, which is unpredictable and will enable managers to cope with the challenges of radical innovation.

Formal Education

Formal education represents opportunities to foster radical innovation, as it is derived from personal knowledge and initiative (Marvel, 2007). Complexity theory refers to individual evolution, which is linked to the accumulation of skills, experiences, and knowledge generated by exclusive life experiences (Anderson, 1999). Therefore, the likelihood of radical innovation will be increased by combining a person's stock of information and skills, and facilitating the identification of opportunities from a context and process. Marvel's (2007) study investigated the specific human capital related to radical innovation and confirmed that higher levels of formal education are linked to higher levels of innovation radicalness based on a sample of technology entrepreneurs. Hence, different human capital accumulations may contribute to different radical innovation outcomes (Marvel, 2007) urging tailored strategies in human cognition development. For example, considerations should be given to alternative methods like training to promote creativity and innovation in individuals to increase the opportunities for radical innovation outcomes (Rampa & Agoué, 2021).

Technological Knowledge

Technological knowledge and its importance in radical innovation are clearly described in the literature. While technology is complex by itself due to the many interacting subcomponents (Frenken, 2006), it is through technological breakthroughs that radical innovation results in strategic changes to products and markets (Koberg et al., 2003) fulfilling unsatisfied needs. Furthermore, technological innovation is a collective process in which individuals cooperate towards mutual learning (Frenken, 2006). Thus, previous technological expertise and experience provide resources to manage particular demands, making organizations more competitive. In particular, technology and mindset integration lead to different business capabilities and levels of innovation (Ringberg et al., 2019).

Process Dimension

An important contribution of complexity theory relates to modeling highly complex interactions (Frenken, 2006). For instance, organizational processes such as improvisation, experimentation, and transitioning can be arranged according to scope and scale in a progressive hierarchy of ascending order. The complexity includes the number of business steps to solve problems encountered during the process, calling for the most efficient methods and resources.

Changes in Routines and Beliefs

Changes in routines and beliefs affect employees' adoption of changes in their usual processes (Yang et al., 2014). Complexity theory suggests that rules should not control individuals as part of an adaptive process (Anderson, 1999). Through changes in routines and beliefs, new knowledge can be acquired and processed, and enterprises can develop flexibility in responding to the instabilities of the environment (Yang et al., 2014). Evidence suggests a positive effect of changes in routines and beliefs in radical innovation, although it changes adoption difficulties. Moreover, organizational unlearning activities denote a positive and direct influence in radical innovation and indirectly via knowledge strategies (Zhang et al., 2022).

Knowledge Constraints

Knowledge constraints relate to the problems an organization cannot overcome due to its dependency on routines (Keupp & Gassman, 2013). CAS are notable for knowledge evolution (Anderson, 1999), while knowledge constraints promote the need to explore additional and novel knowledge to further generate new solutions (Keupp et al., 2013). Hence, the proper management of learning solutions may positively impact radically innovative business outcomes, which includes knowledge acquisition (Thneibat et al., 2022).

Resource Allocation

Resource allocation is influenced by an individual's tendency toward exploration activities that affect radical innovation results (Visser & Faems, 2015). Resources can be tangible (e.g., materials) or intangible (e.g., knowledge) (Woschke et al., 2017).

Incremental innovation refers to the allocation of available resources to improvements in products or processes (Koberg et al., 2003). The effect of the individual cognitive and mental models on incremental innovation resource allocation negatively affects increased opportunities for radical innovation (Visser et al., 2015). Enhanced products, manufacturing processes, and services require leaders to allocate scarce resources effectively and efficiently into revolutionary innovation strategies. Hence, resource synchronization in an organization may lead to different innovation outcomes depending on leveraging strategies (Carnes et al., 2021).

Experimentation

Experimentation implies an individual's ability to gather information to anticipate the future, and to see present unexpected opportunities while shifting strategies in response to market competition (Koberg et al., 2003). Experimentation is a common organizational learning capability (Domínguez et al., 2016) while CAS explores the interaction of ideas and initiatives to strengthen the organization. For instance, individuals promoting experimentation are more likely to obtain radical innovation outcomes during the process, finding new methods as they go. In this sense, Rampa et al. (2021) suggest the combination of tools in employee training to increase willingness to deal with the unknown.

Discretionary Slack

Discretionary slack refers to non-committed and available resources (Troilo et al., 2014). Since radical innovation is knowledge-dependent, discretionary slack may contribute to dealing with the uncertainties and adaptations generated by the breakthrough process.

For example, discretionary slack may be employed to search for novel ideas to be developed, alleviating the drain on resources devoted to routine activities while mitigating the organization's risks (Troilo et al., 2014). CAS, like organizations, requires resources to explain findings and enhance possibilities for aggregation. Discretionary slack could be utilized against this challenge, with a positive influence on the outcome. Moreover, high-discretionary slack together with innovation capabilities promotes business competitiveness (Bao et al., 2020).

Environmental Dimension

Complexity theory states that new sources of energy influence organizations (e.g., partners and suppliers), increasing procedural challenges (Anderson, 1999). Uncertainty is an important factor in decision-making, and much of the organization's complexity deals with these concerns. While radical innovation positively affects the organization, uncertainty pervades most real-world decisions toward this type of innovation adoption. When planned and organized systems collapse, uncertainty becomes more certain. Therefore, complex systems need less structured levels and inertia, allowing opportunity creation for radical innovation (Yi et al., 2012).

Dynamism

Dynamism refers to information flows from the environment (Koberg et al., 2003). Complexity theory refers to the cognitive structure of how external inputs are perceived at a specific time (Anderson, 1999). Hence, radical innovation may be the result of individual perceptions derived from environmental dynamism and firm linkages (Koberg et al., 2003). Furthermore, the domestic and foreign partners in a firm's radical innovation highlight the importance of these relations leading to increased opportunities for radical innovation (Hsieh et al., 2017).

Customer Collaboration

Customer collaboration supports the enhancement of firms' products (Hsieh et al., 2017). It is a complementary asset promoting business and innovation strategies (Onufrey & Bergek, 2021). Since radical innovation mostly responds to unsatisfied needs, enterprises require the involvement of customers. Furthermore, complexity theory suggests the need for interdependence of knowledge from the subsystems through a feedback loop to identify novel ideas. For example, with customer ties, firms can gather more information from markets, leading to radical innovation (Chen et al., 2014). Therefore, customer collaboration may enhance inbound activities that promote business-specific capabilities toward radical innovation.

Financial Resources

Financial resource availability refers to a firm's constraints for starting an innovation project (Woschke et al., 2017). Radical innovation projects demand continuous investments in research activities promoting financial difficulties (Shen et al., 2019). While firms seek positive profits, the route to 'maximum profits' is a complex process. Profits can be increased through improvements or the creation of new products. Therefore, even though financial resource disposition may be a market growth limitation, radical innovation projects should be financially supported more readily (Yi et al., 2012) based on potential economic benefits. However, this depends on the company size, type of innovation (Woschke et al., 2017), firm resource-based, and the breadth of products range (Sorescu et al., 2003).

Figure 1 denotes the dimensional perspective leading to radical innovation in organizations and the component interaction derived from this review. The lack of understanding of this interaction could result in major constraints and obstacles to radical outcomes in business.

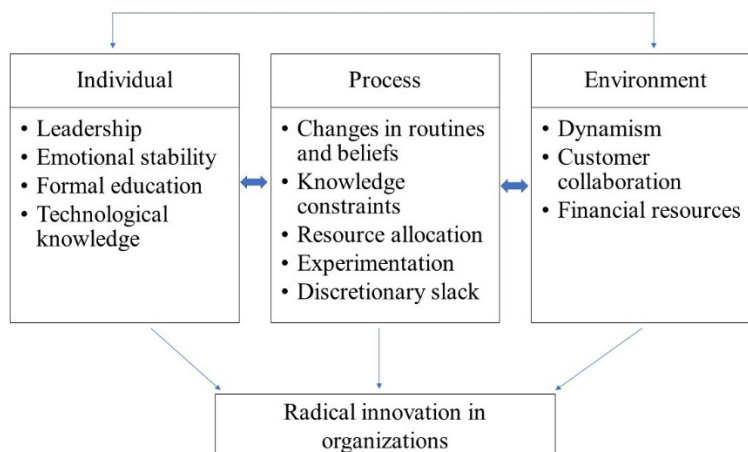


Figure 1: Multidimensional model of radical innovation (author’s elaboration)

Conclusions

This research presents a short review of the individual, process, and environmental factors influencing radical innovation in organizations. The study employed complexity theory to sketch the interactions between dimensions and components, allowing for (1) the combination of rational and instability behaviors, (2) identification of the multidimensional factors in radical innovation, and (3) the organizational conditions that may affect innovation outcomes.

This study provides several insights for Academia and business leaders. It identifies the qualitative factors that lead to the achievement of radical innovation. While the literature usually focuses on the individual and the environment as the influential components in radical innovation, this review used the process dimension to encompass such activities. Moreover, the research suggests a multidimensional understanding of radical innovation, demanding efforts from different perspectives. Additionally, it suggests the significance of building expertise and knowledge through cognitive and capabilities skills when dealing with limited resources.

This study presents an overview of business as a CAS that supports radical innovation outcomes in different ways. It provides for the development of strategies intended to reinforce individual behaviors toward radical innovation. In addition, it provides a blueprint for managers to support radical innovation in organizations to stimulate internal and external collaboration that impacts entrepreneurship. Moreover, identifying these factors strengthens management direction and increases opportunities to stay competitive in markets even within complex adaptive environments. Managers can promote the exploration of strategic scenarios by combining some of the identified components. Hence, radical innovation strategies based on a complex approach are essential for the successful implementation and continuity of business while dealing with uncertain environments and unpredictable conditions.

This study has some limitations regarding the number of research available analyzing radical innovation as a multidimensional complex process. Also, radical innovation factors should be properly tailored to specific business strategies. However, the study provides future avenues for

quantitative studies using the dimensions and factors based on different business contexts. Furthermore, studies analyzing the organizational dimension and components that promote radical innovation outcomes should be undertaken.

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