



Scenario-based management of individual creativity



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ABSTRACT

When we consider the fiercely competitive environment in which modern companies operate, highly creative people can be considered strategic assets in furthering companies' competitiveness. This research provided a novel approach to creativity management through scenario analyses that applied the Bayesian network. This article focused particularly on perceptions of individual creativity and asked two questions: how do the processes of creative revelation—exploitation and exploration—contribute to building individual creativity, and how do environmental factors—task complexity, and bureaucratic and supportive cultures—affect individual creativity? The Bayesian network seems appropriate from this perspective because Bayesian network structure addresses the causal relationships between all variables. For the empirical test, we collected questionnaires and applied the Bayesian network to the survey data to extract a set of reliable causal relationships. By performing scenario-based simulations—both “what-if” and goal-seeking simulations—we found that individual creativity can be managed very effectively by adjusting the related variables in such a way as to maximize that quality.

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1. Introduction

For decades, companies have used many conventional management resources to build and exercise strategies more effectively in competitive markets. A key problem with this approach is that few tangible resources remain for companies to exploit further; intangible resources need to be found and applied to enhance the effectiveness of management. In this respect, creativity management has emerged as an important strategy. As a result, a number of people have insisted that it is necessary to strengthen employees' creative outcomes in order for an organization to achieve a competitive advantage. However, existing studies on creativity have been limited to discussing academic issues, most of which practitioners cannot adopt realistically. To overcome this, we employed scenario-based simulations applying the Bayesian network (BN) to provide a novel approach to the management of individual creativity.

Companies experience their greatest difficulty when faced with an uncertain management environment; scenario planning can be used to mitigate risk in such circumstances. Since the global financial crisis, scenario planning as a tool to analyze and forecast uncertain circumstances has attracted attention as a strategic method to prepare for unfavorable business environments. In fact,

scenario planning originated from army war games. It was used then as a method to establish strategy within the organization and also as a strong tool for organizational learning and change management.

A scenario deals with two worlds comprised of facts and perceptions, and it may be said that even though it explores the facts, it targets perceptual systems in the decision making process. It assists in redirecting an unbalanced perception by making one realize where reality leads without becoming preoccupied with contemporary stereotypes and beliefs. Therefore, through several scenarios, this study analyzed how to manage changes in the relationship between individual creativity and the various elements that affect it.

It is widely known that a variety of variables may affect creativity, ranging from organizational culture and leadership to individual level of knowledge. Over the past decade, research on creativity has proliferated (Shalley, Zhou, & Oldham, 2004). However, in order for practitioners to apply academic findings to the real issues of creativity management, extraction of causal relationships from among the set of variables relevant to creativity is necessary.

This research focused on perceptions of individual creativity and asked two questions: how do the processes of creative revelation—exploitation and exploration—contribute to building individual creativity, and how do environmental factors—task complexity, and bureaucratic and supportive cultures—affect individual creativity?

To investigate these questions, we adopted the methodology of the BN. The BN, also called the Bayesian belief network, is growing

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in popularity as a probabilistic modeling method to describe uncertain knowledge and causality (Daly, Shen, & Aitken, 2011). The useful feature of the BN is that it not only constructs a causal network among latent variables, but also helps in conducting comprehensive scenario-based simulations. Further, it has received attention as a complementary technique for structural equation modeling (SEM) in exploring causality from empirical data (Zheng & Pavlou, 2010). This is because SEM methods have three main limitations: lack of causality inference, restrictive model structure, and lack of nonlinearities (Lee, Barua, & Whinston, 1997). Thus, we investigated causal structures among variables that have direct and indirect effects on individual creativity and then conducted scenario-based simulations based on those structures.

Research on the BN began with the naïve Bayesian network (NBN), which in simple form, was highly accurate in classification issues (Langley & Holcomb, 1992). However, the NBN considers a class node (or dependent variable) as the special variable that differs from other nodes, while class node is also considered as one of the ordinary nodes in the general Bayesian network (GBN). That is, in the GBN, unlike other BN classifiers, even class node expresses the interdependency among all nodes as one BN, without distinguishing it from other nodes (Bouckaert, 1995). The GBN's strength lies in its ability to express the probabilistic causality (or interdependency) that exists among many variables that belong to a decision making problem. Therefore, the GBN was used in this research to consider creativity and the complexity among various elements that affect it.

The GBN has been applied successfully to the resolution of highly complicated decision making problems (Cheng & Greiner, 2001; Madden, 2009). With the GBN, we can simulate and experiment with variables using such varied techniques as “what-if” and goal-seeking analyses. By applying the GBN to survey data, we were successful in extracting causal relationships among exploration, exploitation, and other relevant factors affecting individual creativity.

In the social dimension of creativity, research has found that different social effects and environments exercise different influences on individuals. Thus, we must take social variables into account when we consider individual creativity. In this context, Ryhammar and Smith (1999) considered organizational structure, culture, and work pressures to be important factors influencing creativity. They also tried to determine the relationship between personal attributes and environment. Therefore, this research also considered the influences of environmental factors on creativity. Empirical findings revealed that by taking advantage of the flexible structure and inference capabilities supported by the BN, a balance between exploration and exploitation can be obtained effectively by adjusting related factors such as task complexity, and bureaucratic and supportive cultures.

2. Literature review

2.1. Individual creativity

We confirmed from the existing literature that the concept of creativity has expanded into diversified fields, including the arts, sciences, and business disciplines. In general, creativity has been defined as the degree of novelty and usefulness of a concept. Considering this concept of creativity at the individual level, creativity is defined as the development of fresh and relevant ideas, products, processes and solutions (Shalley, 1995). Creativity is a complex concept that researchers have defined in different ways (Shalley, Gilson, & Blum, 2000). It can be defined as any process used to generate creative outcomes based on the ability to produce something new (Amabile, 1988). This definition has been cited in later conceptual models and in various studies.

Guilford (1950) argued that creativity is a continuous trait in all people and that those individuals with recognized creative talent simply have “more of what all of us have”. Since Guilford's study, research has centered primarily on “individual” creativity. In particular, much research has been conducted in the field of psychology, and has focused on factors at the individual level and those contextual factors that surround individuals. Also, researchers in the field of sociology have focused on broader issues, such as the effect of the environment on creativity (Pirola-Merlo & Mann, 2004).

Early creativity research focused on creativity as a personal characteristic, but over time, the focus has shifted to how contextual characteristics can affect an individual's creative activity. The relationship between supervisors or coworkers (e.g., George & Zhou, 2002; Zhou, 2003), evaluation (e.g., Shalley & Perry-Smith, 2001), rewards (e.g., Eisenberger & Rhoades, 2001), and job complexity (e.g., Farmer, Tierney, & Kung-McIntyre, 2003; Tierney & Farmer, 2004) are examples of contextual characteristics. Many researchers studying creativity have recognized the organizational environment as an important factor and, in this context, Sternberg (1999) argued that people behave more creatively when they work in a stable, nontraditional, challenging, and cooperative atmosphere. Amabile (1996) concluded logically that the organizational environment affects the creative process directly.

2.2. Exploitation and exploration

The concepts of exploitation and exploration proposed by March (1991) have been applied to various fields, including organizational learning, technological innovation, decisions on organizational structure, and the competitive advantage creation process (e.g., Raisch, Birkinshaw, Probst, & Tushman, 2009; Sidhu, Commandeur, & Volberda, 2007; Siggelkow & Rivkin, 2006). Such applications in various fields actually led to differences in the conceptualization of exploitation and exploration. For instance, some researchers defined exploitation and exploration as a company's capability for innovation (Taylor & Greve, 2006) and others defined them as important activities related to learning (Lin, Yang, & Demirkan, 2007). In this research, we regarded exploitation and exploration as one kind of creativity revelation process, and therefore followed the concept that Audia and Goncalo (2007) studied, in which exploitation indicates continuity with existing solutions, improvement through modification, and the generation of ideas within an established framework, whereas exploration is the search for knowledge that departs from an established direction or the potential generation of a completely new principle. The distinction between these two broad types of behaviors parallels the distinction between divergent and incremental creativity as developed in the creativity literature (e.g., Audia & Goncalo, 2007; Sternberg, Kaufman, & Pretz, 2003).

March (1991) stressed that management performance could differ depending on how exploitation and exploration, which have trade-off characteristics, are applied. For example, Katila and Ahuja (2002) showed that pursuing exploitation and exploration at the same time actually had a positive effect on new product development. He and Wong (2004) also showed that using an innovation strategy that focused on exploitation and exploration together positively affected sales growth.

However, unlike the research results above, some research has shown that pursuing exploitation and exploration at the same time had a negative influence on business performance. For example, Uotila, Maula, Keil, and Zahra (2009) showed that the effect of exploitation and exploration on performance was not a linear relationship but a curvilinear one. By using 15 years of longitudinal data from 279 manufacturing firms, they showed that because of the trade-off relationship between exploitation and exploration, the optimal balance between them depends on environmental

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