Applying Logarithmic Fuzzy Preference Programming for Ranking of Effective Organizational Factors on Creativity: A Case Study

Mansour Momeni
Associated Professor
Faculty of Management
University of Tehran
Iran

Ali Sasani
M.A. Candidate of Entrepreneurship Management
University of Tehran
Iran

Mohammad Reza Fathi
M.A. Candidate of Industrial Management
University of Tehran
Iran

Ehsan Khanmohammadi
M.A. Candidate of Industrial Management
University of Tehran
Iran

Abstract

The main objectives of this research are identifying effective organizational factors on creativity of employees in five state organizations in Tehranand applying a new method to rank these factors. Proposed approach is based on Logarithmic fuzzy preference programming method. LFPP method is used in determining the weights of factors. According to result of this method, leader style (C4) is the most important factor that effecton Creativity.

Keywords: creativity, organizational factors, Logarithmic fuzzy preference programming (LFPP), Fuzzy set, Genetic algorithm

1. Introduction

Increasing global competition, coupled with rapidly changing technology and the shortening of the product life cycle, has made corporations more vulnerable to failure than at any time in the past. Therefore, it has become of the utmost importance of organizations to address issues creatively (Mostafa, 2005). Creativity is considered key for personal and social prosperity (Florida, 2002; Florida & Tinagli, 2004; Valtanen, Berki, Kampylis, & Theodorakopoulou, 2008).

Since overcoming these hurricanes demands a firm resolution on behalf of organizations managers, it is required that authorities pay attention to employees' creativity capabilities in a dynamic way as one of the useful and effectual ways to confront society current scientific and technological backwardness and conscious of the fact that interest in survey in the field of creativity has started from second half of twentieth century (Pirkhaefi,2005). Definitions of creativity focus on the nature of thought processes and intellectual activity used to generate new insights to problems (Mostafa, 2005). Other definitions focus on the personal characteristics and intellectual abilities of individuals, and still others focus on the product with regard to the different qualities and outcomes of creative attempts (Arad et al., 1997; Udwadia, 1990). In fact, the term creativity, used in a workplace context, has many definitions and interpretations (Mostafa, 2005).

Early studies in the area of creativity mainly focused on discovering and associating personality characteristics (MacKinnon, 1960, 1962) and cognitive abilities, such as linguistic ability and mental flexibility, with creative achievement (Mednick, 1962).Drawing on their work, this paper reviews relevant writings to address "how can organizations encourage creativity in their working environments?" and "what are the key factors that influence organizational creativity?".

The literature reveals that organizational support and evaluation of ideas are necessary in order to support creativity (Cummings, 1965; Kanter, 1983) and that rewards and bonuses are necessary to encourage creativity and support the creative work environment (Amabile et al., 1996). Researchers and practitioners have become increasingly interested in studying the environmental factors (e.g. social, emotional, intellectual development and work conditions) conducive to creativity (Amabile et al., 1996; Oldham and Cummings, 1996; Paulus and Yang, 2000; Shelley and Perry-Smoth, 2001). Results of this research suggest that creativity can be facilitated or stifled by on organizational factors. This current study has considered identification and ranking the effective organizational factors on creativity of employees in five state organizations in Tehran.

2. Literature review

Creativity involves the production of novel and useful ideas (Amabile, 1988). Sternberg and Lubart (1999) define creativity as "the ability to produce work that is both novel (i.e., original, unexpected) and appropriate (i.e., useful, adaptive concerning task constraints)" (p. 3). Although the measurement of creativity deserves a lot of attention, words associated with this definition of creativity include idea, invention, and breakthrough (McLean, 2005).

There is a consensus among researchers that creativity is a widely used but vague term and we face difficulties when required to put its meaning into words (e.g. Sawyer, 2006a). The definition of a creative strategy or solution varies by the field or job involved, but all creative behaviors result to some degree in identifying original and better ways to accomplish some purpose (Shalley et al., 2001).

Creativity in the workplace is not confined to jobs traditionally viewed as necessitating creativity (Madjar et al., 2002); rather, creative work can be generated by employees in any job at any level of any organization. Also, creativity is an ongoing process rather than an outcome (Amabile, 1988; Drazin et al., 1999).The most generally accepted definition is that creativity involves the production, conceptualization, or development of novel and useful ideas, processes, or procedures by an individual or by a group of individuals working together (Amabile, 1988; Shalley, 1991).

A large body of literature has focused on determining a set of personal characteristics and attributes associated with creative achievement (Barron and Harrington, 1981; Davis, 1989). These researches have examined personal characteristics ranging from biographical factors to measures of cognitive styles and intelligence (Amabile, 1983; Barron and Harrington, 1981; Davis, 1989; Hocevar and Bachelor, 1989; Woodman and Schoenfeldt, 1989). In general, these studies have demonstrated that a stable set of core personal characteristics, including broad interests, attraction to complexity, intuition, aesthetic sensitivity, toleration of ambiguity, and self-confidence, relate positively and consistently to measures of creative performance across a variety of domains (Barron and Harrington, 1981; Gough, 1979).

Most previous empirical work on creativity in organizational settings has focused mainly on identifying individual differences that distinguish highly creative individuals from their less creative peers (Ford, 1995).
Yet, the majority of the literature on creativity views it as an individualized phenomenon (Sternberg & Lubart, 1999). The major focus in creativity research has been on the individual creator and his or her personality, traits, abilities, experiences, and thought processes (Williams & Yang, 1999). However, it is important to study and understand the context in which the individual creator functions. The social environment can influence both the level and frequency of creative behavior (Amabile, Conti, Coon, Lazenby &Herron, 1996). This focus on individual differences has in some ways obscured a potentially more fruitful focus on how creativity emerges within complex social settings (Amabile, 1988; Ford & Gioia, 1995; King, 1990; Mumford & Gustafson, 1988; Sternberg, 1988). A few influential studies have examined the effect of organizational contexts on creative action (e.g., Amabile et al., 1996; Amabile & Gryskiewicz, 1987; Pelz & Andrews, 1966).

Recent studies have found that perceptions of work environments do influence creative performance (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Oldham & Cummings, 1996).

In order for an organization to remain relevant and to compete in pursuit of its mission, management of organizations must pay attention to both ends of the process, generating creative ideas frequently and utilizing its innovation process to realize the potential value of those ideas (McLean, 2005). The focus here, particularly in the context of an organization, is on taking a creative idea and bringing it to fruition.

Prior research also examined organizational factors, such as job complexity and supervision style that facilitate creative performance (Amabile, 1988; Amabile et al., 1996). Mott's (1972) comparative research showed that effective organizations are simultaneously efficient and creative. Efficiency means optimizing, stabilizing, and polishing current methods and routines for highest quantity, quality, and customer satisfaction at the lowest cost possible (Mostafa, 2005).

Amabile et al., (1996) identified six support scales that they hypothesized would differentiate between high-creativity climates and low-creativity climates, including (a) organizational encouragement, (b) supervisory encouragement, (c) work group supports, (d) freedom, (e) sufficient resources, and (f) challenge.

Tesluk et al., (1997) identified five dimensions of organizational climate that influence creativity, including goal emphasis, means emphasis, reward orientation, task support, and socioemotional support.

Woodman, Sawyer, and Griffin (1993) explained that effective organizational characteristics on creativity consist of organizational culture, resources, rewards, strategy, structure, and focus on technology.

Many of the concepts and factors identified by these authors and others are related. The following is a synthesis of these concepts recognized which are the most important factors that enhance creativity in a work environment:

- **Organizational Structure**

  Amabile (1998) proposes that creativity is truly enhanced when the entire organization supports it. Cook (1998) proposes organizational structure and systems are about both formal and informal processes within the company. Handzic and Chaimungkalanont (2003) found that informal socialization had a stronger positive effect on creativity than organized socialization (i.e. based on a rigid formal structure). These findings imply that changes in organizational structure (e.g. from hierarchical to more flat structures) create a positive environment for creativity due to the increased communication between co-workers (politis, 2005).

  Brand (1998) notes that creative organizations should adopt a flat structure since this will allow for important decisions to be made at all levels. Also particularly relevant to creativity and its relationship to organizational culture is the concept of an organic organization (Burns & Stalker, 1961). By definition, an organic organization supportsopen communication flows, power on the basis of expertise instead of position, and decision-making authority is decentralized (Angle, 1989). Angle concluded that an organic organization (as opposed to a mechanistic one) enables greater organizational innovation in environments of dynamic change. Kimberly (1981) found that in relatively stable environments, some formalization and centralization of decision-making can lead to freeing up time for employees to focus on more creative/innovative endeavors.

- **Organizational Encouragement**

  Sternberg et al. (1997) also highlight the fact that to some extent, employees' thinking-style preferences follow the reward structure of their environment. In other words, employees prefer styles that get rewarded. A series of studies by Amabile (1979, 1983, and 1990) suggest that ill-considered evaluation and the use of extrinsic rewards can suppress creativity.

  Amabile et al., (1996) has revealed that "organizational encouragement" encompasses several aspects, including encouragement of risk taking and idea generation, supportive evaluation of ideas, collaborative idea flow, and participative management and decision making. Amabile (1998) proposes that organizations that aim to support the value of creativity within their environments should consistently reward creativity, but at the same time they should avoid using money to "bribe" people to come up with innovative ideas. Leaders can support creativity by encouraging information exchange and collaboration and by minimizing politics within the organization.

Informational and helpful feedback encourages employees to learn and improve results in higher levels of creativity (Zhou, 2003). Supportive supervisors also encourage employees to voice their concerns and are caring about employees' needs (Deci and Ryan, 1987). Amabile and Gryskiewicz (1989) found a positive relationship between employee ratings of supervisory encouragement and employee creativity. Supervisory encouragement includes clarity of team goals, supervisory support of the team's work and ideas, and an environment where open interactions are supported (Amabile et al., 1996).

Coworkers pose another organizational factor with the potential to impact employee creativity (Woodman et al., 1993). Amabile et al., (1996) demonstrated that coworkers could positively influence creativity via encouragement, open communication and informational feedback.

- **Organizational Resources**

Organizational creativity also requires companies to make strategic chokes with regard to their human resources. Cook (1998) suggests that creative organizations must explicitly strive towards the attraction, development and retention of creative talent, if they want to remain competitive. Amabile (1998) argues that the two main resources that affect creativity are time and money. She stresses explicitly the importance of the quantity of time and money that should be given to employees, since they can either support or constrain creativity.

When it comes to time, not giving enough can lead to distrust and burnout (Amabile, 1998). However, giving too much time can take away from the sense of challenge and decrease creative performance (McLean, 2005).

In addition, Amabile (1998) points out that managers must decide on the funding, people, and other resources that a team legitimately requires to complete a project. She suggests that there is a "threshold of sufficiency", and when resources are added above this threshold, creativity is notenhanced. Below that threshold a restriction of resources can limit creativity since employees will be more occupied with finding additional resources and not with actually developing new products or services.

Leadership Style There is a consensus that a democratic participative leadership style is conductive to creativity (Nystrom, 1979), whereas more autocratic styles are likely to diminish it. Bouwen and Fry (1988) suggest that in managing novelty effectively it is not enough simply to avoid the practices and procedures that inhabit it; there is a need to actively attend to the management of ideas. The leader's vision is therefore a key factor when managing creative individuals (Locke and Kirkpatrick, 1995). Cook (1998) propose that leaders must effectively communicate a vision conductive to creativity through any available formal and informal channel of communication and constantly encourage employees to think and act beyond current wisdom. This vision must be communicated from the highest to the lowest levels of management (Delbecq and Mills, 1985; Kimberly and Evanisko, 1981).

Transformational leadership, in particular, can be expected to encourage a more adaptive or developmental culture by emphasizing employee innovation, problem solving and empowerment (Avolio and Gibbson, 1988; Bass 1985). Developmental cultures are associated with a focus on the organization, flexibility, adaptability and readiness, growth, and resource acquisition (Quinn and Rohrbaugh 1981). Transformational leaders increase their followers intrinsic motivation to perform their duties (Jung, Chow, and Wu, 2003; Park and Rainey, 2008; Moynihan, Pandey and Wright, 2009). Intrinsic motivation, in turn, has been found to increase creativity (Amabile et al., 1996; Shin and Zhou, 2003; Zhou 1998) perhaps because such motivation helps employees overcome the fear of taking risks or challenging status quo (Moynihan, Pandey and Wright, 2009). Studies have found that transformational leadership increases creativity and innovation (Jung, Chow and Wu, 2003; Shin and Zhou, 2003; Sosik, Kahai and Avolio, 1998).

- **Freedom and autonomy**

Several researchers and theorists have suggested that creativity and innovation are fostered by allowing a considerable degree of freedom or autonomy in the conduct of one's work (Amabile & S. Gruskiewicz, 1987; Andrews & Farris, 1967; Ekvall, 1983; King & West, 1985; Pelz & Andrews, 1966; Paolillo & Brown, 1978; Siegel & Kaemmerer, 1978; West, 1986).

Freedom and autonomy here are related to granting and allowing freedom and autonomy to employees for determining the means by which to achieve a goal (Amabile, 1998), not necessarily autonomy for selecting what goals to go after. "In fact, clearly specified strategic goals often enhance people's creativity" (Amabile, 1998).

An organizational culture that supports autonomy in achieving clearly communicated goals will likely be more successful in terms of creativity and innovation than an organization that does not. An environment of freedom and autonomy is more likely to tap into the intrinsic motivation of its employees, which has been a key factor in promoting creativity in organizations (McLean, 2005).

- **Organizational Culture**

Organizational culture has been defined as the deepest level of basic values, assumptions and beliefs, which are shared by the organization's members and are manifested by actions especially from leaders and managers (Locke and Kirkpatrick, 1995; Morgan, 1991; Johnson and Scholes, 1984; Cook 1998).

According to Martin, culture is about deeply held assumptions, meaning, and beliefs. If we look at Schein's (1992) iceberg model, this would include all of the elements of the iceberg that appear "under the waterline" or remain invisible for the most part. It is culture that creates the parameters for what behavior is desirable and will be encouraged and what behavior is unacceptable and will be censured (McLean, 2005).

Robinson and Stern (1997) also propose that a creative culture should encourage self-initiated activity, where individuals and teams own problems and their solutions, so that intrinsic motivation is enhanced. Shalley and Gilson (2004) highlight that creative behavior will depend on both a person's predisposition to risk (an individual factor) and the organizational culture where that person works (the Organizational Context factor).

In this part, according to referred cases in research literature, a conceptual framework, on its basis research assumptions takes form, is dealt.

Figure1: Conceptual Model

3. Research Methodology

This research in terms of objective is practical and in terms of methods is descriptive and analytical. The study involved a survey of employees in five state organizations in Tehran. Data were collected in November 2011 using the drop-off, pick-up method (Craig and Douglas, 1999), a method frequently used in the Middle East because of the difficulties of conducting research (Parnell and Hatem, 1999). Such difficulties include obtaining random samples because of the lack of sampling frames and the lack of the population's familiarity with research studies (Mostafa, 2005).

A total of 150 questionnaires were dropped off and 128 usable questionnaires were collected after 8 days. The response rate was 79%. The respondents were primarily male (81%), and most (61%) were aged between 24 and 40. The self-completion questionnaire incorporates the Schwartz Value Survey (SVS) (Schwartz, 1994) to measure values and builds upon the work of Amabile and her colleagues as well as other researchers for the measurement of Employee Creative Behavior and Organizational Context (Mostafa, 2005). The dependent variable, Employee Creative Behavior (ECB) comprises nine scale items selected based on the literature. The six groups of variables representing different aspects of Organizational Context were measured using Likert scales.
The rest of the paper is organized as follows: The following section presents a concise treatment of the basic concepts of fuzzy set theory, fuzzy numbers and fuzzy linguistic variables. Section 3.4 presents the methodology of Logarithmic fuzzy preference programming. Section 3.5 describes the basics of the Genetic Algorithms .The application of the proposed framework is addressed in Section 4. Finally, conclusions are provided in Section 5.

3.1. Fuzzy Set Theory

Fuzzy set theory was first developed in 1965 by Zadeh; he was attempting to solve fuzzy phenomenon problems, including problems with uncertain, incomplete, unspecific, or fuzzy situations. Fuzzy set theory is more advantageous than traditional set theory when describing set concepts in human language. It allows us to address unspecific and fuzzy characteristics by using a membership function that partitions a fuzzy set into subsets of members that ''incompletely belong to" or ''incompletely do not belong to" a given subset.

3.2. Fuzzy Numbers

We order the Universe of Discourse such that U is a collection of targets, where each target in the Universe of Discourse is called an element. Fuzzy number $\widetilde{A}$ is mapped onto U such that a random $x \rightarrow U$ is appointed a real number, $\mu_{\widetilde{A}}(x) \rightarrow [0,1]$. If another element in U is greater than x, we call that element under A.
The universe of real numbers R is a triangular fuzzy number (TFN)$\widetilde{A}$, which means that for $x \in R$, $\mu_{\widetilde{A}}(x) \in [0,1]$, and

$$\mu_{\widetilde{A}}(x) = \begin{cases} (x - L)/(M - L), & L \leq x \leq M, \\ (U - x)/(U - M), & M \leq x \leq U, \\ 0, \quad \text{otherwise}, \end{cases}$$

Note that $\widetilde{A} = (L, M, U)$, where L and U represent fuzzy probability between the lower and upper boundaries, respectively, as in Fig. 2. Assume two fuzzy numbers $\widetilde{A}_1 = (L_1, M_1, U_1)$, and $\widetilde{A}_2 = (L_2, M_2, U_2)$; then,

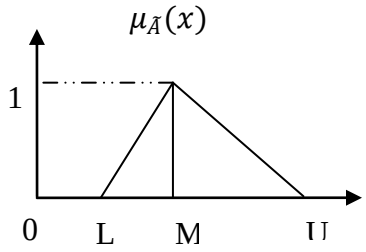

Figure 2: Triangular fuzzy number

$$(1)\widetilde{A}_1 \oplus \widetilde{A}_2 = (L_1, M_1, U_1) \oplus (L_2, M_2, U_2) = (L_1 + L_2, M_1 + M_2, U_1 + U_2)$$
$$(2)\widetilde{A}_1 \otimes \widetilde{A}_2 = (L_1, M_1, U_1) \otimes (L_2, M_2, U_2) = (L_1 L_2, M_1 M_2, U_1 U_2), L_i > 0, M_i > 0, U_i > 0$$
$$(3)\widetilde{A}_1 - \widetilde{A}_2 = (L_1, M_1, U_1) - (L_2, M_2, U_2) = (L_1 - L_2, M_1 - M_2, U_1 - U_2)$$
$$(4)\widetilde{A}_1 \div \widetilde{A}_2 = (L_1, M_1, U_1) \div (L_2, M_2, U_2) = \left(\frac{L_1}{L_2}, \frac{M_1}{M_2}, \frac{U_1}{U_2}\right), L_i > 0, M_i > 0, U_i > 0$$
$$(5)\ \widetilde{A}_1^{-1} = (L_1, M_1, U_1)^{-1} = \left(\frac{1}{U_1}, \frac{1}{M_1}, \frac{1}{L_1}\right), L_i > 0, M_i > 0, U_i > 0$$

3.3. Fuzzy Linguistic Variables

The fuzzy linguistic variable is a variable that reflects different aspects of human language. Its value represents the range from natural to artificial language. When the values or meanings of a linguistic factor are being reflected, the resulting variable must also reflect appropriate modes of change for that linguistic factor. Moreover, variables describing a human word or sentence can be divided into numerous linguistic criteria, such as equally important, moderately important, strongly important, very strongly important, and extremely important. For the purposes of the present study, the 5-point scale (equally important, moderately important, strongly important, very strongly important and extremely important) is used.

3.4. The LFPP-based nonlinear priority method

In this method for the fuzzy pair wise comparison matrix, Wang *et al*., (2011) took its logarithm by the following approximate equation:

$$\ln \tilde{a} = (\ln l_{ij}, \ln m_{ij}, \ln lu_{ij}), \qquad i,j = 1\ldots,n \qquad (6)$$

That is, the logarithm of a triangular fuzzy judgment a_{ij} can still be seen as an approximate triangular fuzzy number, whose membership function can accordingly be defined as

$$\mu_{ij}\left(\ln\left(\frac{w_i}{w_j}\right)\right) = \begin{cases} \dfrac{\ln\left(\frac{w_i}{w_j}\right) - \ln l_{ij}}{\ln m_{ij} - \ln l_{ij}}, & \ln\left(\frac{w_i}{w_j}\right) \le \ln m_{ij}, \\ \dfrac{\ln u_{ij} - \ln\left(\frac{w_i}{w_j}\right)}{\ln u_{ij} - \ln m_{ij}}, & \ln\left(\frac{w_i}{w_j}\right) \ge \ln m_{ij}, \end{cases} \qquad (7)$$

Where $\mu_{ij}\left(\ln\left(\frac{w_i}{w_j}\right)\right)$ is the membership degree of $\ln\left(\frac{w_i}{w_j}\right)$ belonging to the approximate triangular fuzzy judgment $\ln \tilde{a} = (\ln l_{ij}, \ln m_{ij}, \ln lu_{ij})$. It is very natural that we hope to find a crisp priority vector to maximize the minimum membership degree $\lambda = \min \{\mu_{ij}\left(\ln\left(\frac{w_i}{w_j}\right)\right) \mid i=1,\ldots,n-1 ;\ j=i+1,\ldots, n\}$. The resultant model can be constructed (Wang et al, 2011) as

$$\text{Maximize} \quad \lambda$$
$$\text{Subject to} \quad \begin{Bmatrix} \mu_{ij}\left(\ln\left(\frac{w_i}{w_j}\right)\right) \ge \lambda, i = 1, \ldots, n-1; j = i+1, \ldots, n, \\ w_i \ge 0, i = 1, \ldots, n, \end{Bmatrix} \qquad (8)$$

Or as

$$\text{Maximize} \quad 1 - \lambda$$
$$\text{Subject to} \quad \begin{Bmatrix} \ln w_i - \ln w_j - \lambda \ln\left(\frac{m_{ij}}{l_{ij}}\right) \ge \ln l_{ij}, i = 1, \ldots, n-1; j = i+1, \ldots, n, \\ -\ln w_i + \ln w_j - \lambda \ln\left(\frac{u_{ij}}{m_{ij}}\right) \ge -\ln u_{ij}, i = 1, \ldots, n; j = i+1, \ldots, n, \end{Bmatrix} \qquad (9)$$

It is seen that the normalization constraint $\sum_{i=1}^{n} w_i = 1$ is not included in the above two equivalent models. This is because the models will become computationally complicated if the normalization constraint is included. Before normalization, without loss of generality, we can assume $w_i \geq 1$ for all $i = 1, \ldots, n$ such that $\ln w_i \geq 0$for $i = 1, \ldots, n$. Note that the nonnegative assumption for $\ln w_i \geq 0$ (i = 1,. . . ,n) is not essential. The reason for producing a negative value for λ is that there are no weights that can meet all the fuzzy judgments in $\tilde{A}$within their support intervals. That is to say, not all the inequalities $\ln w_i - \ln w_j - \lambda \ln\left(\frac{m_{ij}}{l_{ij}}\right) \geq \ln l_{ij}$ or$-\ln w_i + \ln w_j - \lambda \ln\left(\frac{u_{ij}}{m_{ij}}\right) \geq -\ln u_{ij}$ can hold at the same time. To avoid k from taking a negative value, Wang et al (2011) introduced nonnegative deviation variables δ_{ij} andη_{ij} for $i = 1, \ldots, n-1; j = i+1, \ldots, n,$ such that they meet the following inequalities:

$$\ln w_i - \ln w_j - \lambda \ln\left(\frac{m_{ij}}{l_{ij}}\right) \geq \ln l_{ij}\ , i = 1, \ldots, n-1; j = i+1, \ldots, n$$
$$-\ln w_i + \ln w_j - \lambda \ln\left(\frac{u_{ij}}{m_{ij}}\right) \geq -\ln u_{ij}\ , i = 1, \ldots, n; j = i+1, \ldots, n \quad (10)$$

It is the most desirable that the values of the deviation variables are the smaller the better. Wang *et al.*, (2011) thus proposed the following LFPP-based nonlinear priority model for fuzzy AHP weight derivation:

Minimize J= $(1-\lambda)^2$+M.$\sum_{i=1}^{n-1} \sum_{j=i+1}^{n} (\delta_{ij}^2 + \eta_{ij}^2)$

$$\text{Subject to} \begin{cases} x_i - x_j - \lambda \ln\left(\frac{m_{ij}}{l_{ij}}\right) + \delta_{ij} \geq \ln l_{ij}\ , i = 1, \ldots, n-1; j = i+1, \ldots, n, \\ -x_i + x_j - \lambda \ln\left(\frac{u_{ij}}{m_{ij}}\right) + \eta_{ij} \geq -\ln u_{ij}\ , i = 1, \ldots, n; j = i+1, \ldots, n, \\ \lambda, x_i \geq 0, i = 1, \ldots, n \\ \delta_{ij}, \eta_{ij} \geq 0, i = 1, \ldots, n-1; j = i+1, \ldots, n \end{cases} \quad (11)$$

Where $x_i = \ln w_i$ for i = 1,. . . ,n and M is a specified sufficiently large constant such as M = 10^3. The main purpose of introducing a big constant M into the above model is to find the weights within the support intervals of fuzzy judgments without violations or with as little violations as possible.The next section briefly describes the basics of the Genetic Algorithms (Rao, 2007).

3.5. Genetic Algorithms

Over the last decade, genetic algorithms (GAs) have been extensively used as search and optimization tools in various problem domains, including the sciences, commerce, and engineering. The primary reasons for their success are their broad applicability, ease of use, robustness and global perspective (Goldberg 1989; Mitchell, 1996; Gen and Cheng, 1997; Vose, 1999; Deb, 2002). The genetic algorithms are inspired by Darwin's theory evolution. The algorithm is started with a set of solution (represented by chromosomes) called a population. Solutions from one population are used to form a new population. This is motivated by that the new population will be better than the old one. Solutions to forming new solutions (offsprings) are selected according to their fitness. The more suitable they are, the more chances they have of reproducing. The iteration is stopped after the completion of maximal number of iterations (generations) or on the attainment of the best result. The decision variables of multiple objective, multiple variable, constrained or unconstrained optimization problems solved by GAs may be represented by either binary coding or real coding. GAs employ three important genetic operators for solving optimization problems, and these operators are briefly described below.

Reproduction or selection operator: GA begins with a set of solutions called population (represented by chromosomes or strings). The primary objective of the reproduction operator is to make duplicates of good solutions, and eliminate bad solutions in a population, while keeping the population size constant. This is achieved by identifying good solutions in a population, making multiple copies of good solutions, and eliminating bad solutions from the population so that multiple copies of good solutions can be placed in the population.

Crossover operator: This operator is applied to the strings of the mating pool after the reproduction operator has been applied. The latter cannot create any new solutions in the population, and it only makes more copies of good solutions at the expense of not-so-good solutions. The creation of new solutions is performed by the crossover operator. In crossover operation, two strings are randomly selected from the mating pool, and some portions of the strings are exchanged between strings to create new strings.

Mutation operator: The crossover operator is mainly responsible for the search aspect of genetic algorithms, even though the mutation operator is also used for this purpose. Mutation is intended to prevent all solutions in the population being concentrated into a local optimum of the solved problem. The bitwise mutation operator changes a 1 into 0, and vice versa, with a small mutation probability. The need for mutation is to maintain diversity in the population.

The three GA operators reproduction or selection, crossover, and mutation, are simple and straight-forward. The reproduction operator selects good strings, while the crossover operator recombines good substrings from two good strings to hopefully form a better spring. The mutation operator alters a string locally to hopefully create a better string. The basic genetic algorithm is outlined below:

1. [Start] Choose a coding to represent problem decision variables, a reproduction or selection operator, a crossover operator, and a mutation operator. Choose population size n, crossover probability p_c, and mutation probability p_m. Initialize a random population of strings of size's'. Choose a maximum allowable generation (*i.e.*, iteration) number t_{max}. Set t=0
2. [Fitness] Evaluate the fitness function of each string in the population
3. [New population] Create a new population by repeating the following steps until the new population is complete
   [Reproduction or selection] Select two parent strings from a population according to their fitness (the better fitness, the bigger the chance of being selected)
   [Crossover] Crossover the parents to form new offspring (children). If no crossover is performed, then the offspring are the exact copy of parents.
   [Mutation] Mutate the new offspring at each locus (position in string).
   [Accepting] Place the new offspring in the new population
4. [Replace] Use the newly generated population for a further run of the algorithm
5. [Test] If $t > t_{max}$, or other termination criteria, are satisfied, then terminate and return the best solution in current population
6. [Loop] Go to step 2

The above procedure is repeated until an optimum solution is reached. More details on the genetic algorithms and their applications can be found in literature (Goldberg 1989, Mitchell 1996, Gen and Cheng 1997, Vose 1999, Deb 2002).

4. Application of Proposed Method

This study has been conducted for employees in five state organizations in Tehran. In this case, we want to prioritize effective organizational factors on creativity using of Logarithmic fuzzy preference programming. These factors are including: organizational structure (C_1), organizational encouragement (C_2), organizational resources (C_3), leadership style (C_4), freedom and autonomy (C_5) and, organizational culture (C_6). In LFPP method, we determine the weights of each factor by utilizing pair-wise comparison matrixes. We compare each factor with respect to other factors. You can see the pair-wise comparison matrix for ranking of these factors in Table 1.

Table 1.Comparison matrix

	C_1	C_2	C_3	C_4	C_5	C_6
C_1	(1,1,1)	(6,7,8)	(3,4,5)	(.20,.25,.33)	(6,7,8)	(.50,1.5,2.5)
C_2	(.13,.14,.17)	(1,1,1)	(1,2,3)	(4,5,6)	(.17,.20,.25)	(1,2,3)
C_3	(.20,25,.33)	(.33,.5,1)	(1,1,1)	(5,6,7)	(4,5,6)	(.11,.13,.14)
C_4	(3,4,5)	(.17,.20,.25)	(.14,.17,.20)	(1,1,1)	(4,5,6)	(6,7,8)
C_5	(.13,.14,.17)	(4,5,6)	(.17,.20,.25)	(.17,.20,.25)	(1,1,1)	(3,4,5)
C_6	(.4,.67,2)	(.33,.5,1)	(7,8,9)	(.13,.14,.17)	(.20,.25,.33)	(1,1,1)

According to Table 1, we formulate the model (11) for the comparison matrix and we solve this problem using of Genetic algorithm. In order to employ Genetic algorithm, we use the MATLAB toolbox. Some settings that are used: Population Size equal to 1000 and crossover fraction equal to 0.8.The results obtained from solving non linerprogramming using of Genetic algorithm are presented in Table 2.

Table 2:The weight of factor

Factor	C_1	C_2	C_3	C_4	C_5	C_6
Weight	0.207055	0.179459	0.201009	0.219562	0.098242	0.094673

According to Table 2, leadership style (C_4) is the most important factor that effect on creativity.Other factors ranked as follow: $C_4 > C_1 > C_3 > C_2 > C_5 > C_6$.

5. Conclusion

According to literature, contextual factors of work environments can influence individuals' creative behavior (e.g., Amabile, 1988; Shalley, 1991, 1995; Woodman et al., 1993), and recent studies have found that perceptions of work environments do influence creative performance (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Oldham & Cummings, 1996).Consistently, certain aspects of work environments have been found to have positive effects on individuals' creativity (e.g., Amabile et al., 1996; Woodman et al., 1993).

The aim of this study is identifying the effective organizational factors on creativity using of Logarithmic fuzzy preference programming method. The LFPP method evaluates factors and prioritizes them. According to LFPP result, leadership style (C_4) is the most important factor that effect on creativity.

References

Amabile, T.M. (1983), The Social Psychology of Creativity., Springer-Verlag, New York, NY.

Amabile, T.M. (1988), "A model of creativity and innovation in organizations", in Staw, B.M. and Cummings, L.L. (Eds), Research in Organizational Behavior, JAI Press, Greenwich, CTVol.10, pp.123-67.

Amabile, T.M. (1997), "Motivating creativity in organizations: on doing what you love and loving what you do", California Management Review, Vol. 40 No.1, pp. 39-58.

Amabile, T.M. (1998), "How to kill creativity", Harvard Business Review, September/ October, pp.76-87.

Amabile, T.M., Conti, R., Coon, H., Lazenby, J. and Herron, M. (1996), "Assessing the work environment for creativity", Acad.emy of Management Journal, Vol 39, pp.1154-84.

Amabile, T.M. and Gryskiewicz, S.S. (1987), Creativity in R&D Laboratory, Technical report No. 30, Center for Creative Leadership, NC.

Amabile, T.M. and Gryskiewicz, S.S. (1989), "The creative environment scales: the work environment inventory", Creativity Research Journal, Vol. 2, pp.231-54.

Amabile, T.M. (1990), "Within you, without you: the social psychology of creativity and

Beyond", in Runco, MA. and Albert, R.S. (Eds), Theories In Creativity, Sage, Newbury Park, CA.

Andrews, F.M., & Farris, G.F. (1967). "Supervisory practices and innovation in scientific teams." Personnel Psychology.

Angle, H. L. (1989). Psychology and organizational innovation. In A. H. Van deVen, H. L.

Arad, S., Hanson, M. and Schneider, R. (1997), "A framework for the study of relationships between organizational characteristics and organization innovation", Journal of Creative Behavior, Vol. 31, pp. 42-58.

Avolio, B. J., & Gibbons, T. C. (1988), Developing transformational leaders: A life span approach. In J. A. Conger & R. N. Kanungo (Eds.), Charismatic leadership: The elusive factor in organizational effectiveness, San Francisco, CA: Jossey-Bass, pp.276-308.

Barron, F. and Harrington, D. (1981), "Creativity, intelligence, and personality", Annual Review of Psychology, Vol. 32, pp. 439-76.

Bass, B. M. (1985), Leadership and Performance Beyond Expectations. New York: Free Press.

Bouwen, R. and Fry, R. (1988), "An agenda for managing organizational innovation and development in the 1990s", in Lambrecht (Ed.), Corporate Revival, Catholic University Press, Leuven, Belgium.

Brand, A. (1998), "Knowledge management and innovation at 3M", Journal of Knowledge Management, Vol. 2, No.1, pp.17-22.

Burns,T.,&Stalker, G. M.(1961). The management of innovation. London:Tavistock.

Cook, P. (1998), "The creativity advantage-is your organization the leader of the pack?", Industrial and Commercial Training, Vol. 30, No. 5, pp.179-84.

Craig CS, Douglas SP. (1999), International marketing research. Second edition. Indianapolis' John Wiley & Sons.

Cummings, L.L. (1965), "Organisational climates for creativity", Journal of the Academy of Management, Vol. 3, pp. 220-7.

Davis, G. (1989), "Testing for creative potential", Contemporary Educational Psychology, Vol. 14, pp. 257-74.

Deb, K . (2002), Multi-objective optimization using evolutionary algorithms. Wiley, Singapore.
Deci EL, Ryan RM. (1987), The support of autonomy and the control of behavior. J Pers SocPsychol; Vol.53, pp.1024– 37.
Delbecq, A.L. and Mills, P.K. (1985), "Managerial practices and enhanced innovation", Organisational Dynamics, Vol. 14 No. 1, pp. 24-34.
Drazin R, Glynn MA, Kazanjian RK. (1999), Multilevel theorizing about creativity in organizations: a sensemaking perspective. Acad Manage Rev; Vol.24, No.2, pp. 286– 307.
Ekvall, G. (1983). Climate, structure, and innovativeness of organizations: A theoretical framework and an experiment. Report 1, The Swedish Council for Management and Organizational Behavior.
Florida, R. L. (2002). The rise of the creative class: And how it's transforming work, leisure community and everyday life. New York, NY: Basic Books.
Florida, R. L., & Tinagli, I. (2004). Europe in the creative age. London: DEMOS.
Ford, C. M. (1995), Creativity is a mystery: Clues from the investigators' notebooks. In C. M.
Ford, C. M., & Gioia, D. A. (1995), Creative action in organizations: Ivory tower visions and real world voices. Newbury Park, CA: Sage Publications.
Gen, M., Cheng, R .(1997), Genetic algorithms and engineering design. Wiley, New York
Goldberg, DE. (1989), Genetic algorithms for search, optimization and machine learning. Addison-Wesley, Reading, MA
Gough, H. (1979), "A creative personality scale for the adjective check list", Journal of Personality and Social Psychology, Vol. 37, pp. 1398-405.
Handzic M. and Chaimungkalanont M. (2003) "The Impact of Socialisation on Organisational Creativity", Proceedings of the European Conference on Knowledge Management (ECKM 2003), Oxford, September, pp.18-19.
Hocevar, D. and Bachelor, P. (1989), Handbook of Creativity, Plenum Press, New York, NY.
Johnson, G. and Scholes, K. (1984), Exploring Corporate Strategy, Prentice-Hall, Englewood Cliffs, NJ.
Jung, D.I., C. Chow and A. Wu. (2003), The role of transformational leadership in enhancingorganizational innovation: Hypotheses and some preliminary findings. The LeadershipQuarterly, Vol.14, No.4-5, pp.525-44.
Kanter, R.M. (1983), The Change Masters, Simon and Schuster, New York, NY.
Kimberly, J. R. (1981). Managerial innovation. In P. C. Nystrom&W. H. Starbuck (Eds.), Handbook of organizational design. Oxford, UK: Oxford University Press.
Kimberly, J. and Evanisko, M. (1981), "Organizational innovation: the influence of individual, organizational and contextual factors on hospital adoption of technological and administrative innovations", Academy of Management Journal, Vol. 24, pp. 689-713.
King, N. (1990), Innovation at work: the research literature. In M. A. West & J. L. Farr (Eds.), Innovation and creativity at work, Chichester, England: Wiley, pp.15–59.
King, N., & West, M.A. (1985). "Experiences of innovation at work." SAPU Memo No.772, University of Sheffield, Sheffield, England.
Locke, E.A. and Kirkpatrick, S.A. (1995), "Promoting creativity in organizations", in Ford, C.M. and Gioia, D.A. (Eds), Creative Action in Organizations: Ivory Tower Visions and Real World Voices, Sage Puplications, Newbury Park, CA.
MacKinnon, D.W. (1960), "Genvs architectvs creator varietas americanvs", AIA Journal, September, pp.31-5.
MacKinnon, D.W. (1962), "The nature and nurture of creative talent", American Psychologist, Vol. 17, pp.484-95.
Madjar N, Oldham GR, Pratt MG. (2002), There's no place like home? The contributions of work and nonwork creativity support to employees' creative performance. Acad Manage, Vol.45, No.4, pp.757– 67.
McLean, L.D. (2005), "Organizational culture's influence on creativity and innovation: a review of the literature and implications for human resource development", Advances in Developing Human Resources, Vol. 7 No. 2, pp. 226-47.
Mednick, S.A. (1962), "The associative basis of the creative process", Psychological Review, Vol. 69, pp.220-32.
Mitchell, M . (1996), Introduction to genetic algorithms. MIT Press, Ann Arbor, MI
Mostafa, M. (2005). Factors affecting organisational creativity and innovativeness in Egyptian business organisations: An empirical investigation. The Journal of Management Development, Vol.24, No1-2), pp.7-33.
Morgan, G. (1991), Image of Organizationa, Sage, Beverly Hills, CA.
Mott, P. (1972), The Characteristics of Effective Organizations, Harper & Row, New York, NY.
Moynihan, D. P., Pandey, S. K., & Wright, B. E. (2009). Leadership and reform: Mapping the causal pathways of performance information use. Paper presented at the 10th Public Management Research Conference, Columbus, OH.
Mumford, M., & Gustafson, S. 1988. Creativity syndrome: integration, application, and innovation. Psychological Bulletin, Vol.103, pp. 27–43.
Nystrom, H. (1979), Image of Organization, Sage, Beverly Hills, CA.
Paolillo, J.G., & Brown, W.B. (1978). "How organizational factors affect R&D innovation." Research Management, Vol.21, pp.12-15.
Paulus PB, Yang HC. (2000), Idea generation in groups: a basis for creativity in organizations. Organ. Behav. Hum. Decis. Process, Vol.82, No.1, pp.76–87
Park, S.M. and H.G. Rainey. (2008), Leadership and public service motivation in U.S. federal agencies. International Public Management Journal, Vol.11, No.1, pp.109-142.

Parnell JA, Hatem T. (1999), Cultural antecedents of behavioral differences betweenAmerican and Egyptian managers. J Manag Stud, Vol.36, pp.399– 419.

Pelz, D.C., & Andrews, F.M. (1966). Scientists in Organizations. New York: Wiley.

Pirkhaefi, Alireza. (2005), "Creativity (principles and methods of breeding)",Tehran, Publishing Ghoghnus Millennium, first edition.

Politis, J.D. (2005), "Dispersed leadership predictor of the work environment for creativity and productivity", European Journal of Innovation Management, Vol. 8 No. 2, pp. 182-204.

Oldham, G. R., & Cummings, A. (1996), Employee creativity: Personal and contextual factors at work. Academy of Management Journal, Vol.39, pp.607-34.

Quinn, R.E. & Rohrbaugh, J. (1981), A competing values approach to organizationaleffectiveness. Public Productivity Review, pp.122-40.

Rao, RV. (2007), Decision making in the manufacturing environment: using graph theory and fuzzy multiple attribute decision making methods. Springer, London.

Robinson, A.G. and Stern, S. (1997), Corporate Creativity, Berrett, Koehler Publishers, San Francisco, CA.

Sawyer, R. K. (2006). Educating for Innovation. Thinking Skills and Creativity, Vol.1, No.1, pp. 41-8.

Schein, E. H. (1992), Organizational culture and leadership (2nd ed.). San Francisco: Jossey-Bass.

Schwartz SH. (1994), Are there universal aspects in the structure and contents of human values? J Soc Issues, Vol.50, No.4, pp.19 – 45.

Shalley, C.E. (1991), Effects of productivity goals, creativity goals, and personal discretion on individual creativity. Journal of Applied Psychology, Vol.76, pp.179-85.

Shalley C.E, Gilson LL. (2004), What leaders need to know: a review of social and contextual factors that can foster or hinder creativity. Leadersh Q,Vol.15, pp.33–53.

Shalley, C.E, Perry-Smith JE. (2001), Effects of social–psychological factors on creative performance: the role of informational and controlling expected evaluation and modeling experience. Org Behav Human Decis Process, Vol.84, pp.1–22.

Shin , S.J. and J. Zhou. (2003), Transformational leadership, conservation, and creativity:

Evidence from Korea. Academy of Management Journal, Vol.46, No.6, pp.703-14.

Siegel, S.M., & Kaemmerer, W.F. (1978). " Measuring the perceived support for innovation in organizations." Journal of applied Psychology, Vol.63, pp. 553-62.

Sosik, J.J., S.S. Kahai and B.J. Avolio. (1998), Transformational leadership and dimensions ofcreativity: Motivating idea generation in computer-mediated groups. Creativity ResearchJournal, Vol.11, No.2, pp.111-22.

Sternberg, R. J. (1988), The nature of creativity. New York: Cambridge.

Sternberg, R. J., Lubart, T. I. (1999). The concept of creativity: Prospects and paradigms. In R. J. Sternberg (Ed.), Handbook of creativity, Cambridge, UK: Cambridge University Press, pp. 3-15.

Sternberg, R.J., O'Hara, L.A. and Lubart, T.I., (1997), "Creativity ac investment", California Management Review, Vol.40, No.1, pp.8-21.

Tesluk, P. E., Farr, J. L,&Klein, S. A. (1997). Influences of organizational culture and climate on individual creativity. Journal of Creative Behavior, Vol.31, No.1, pp.27-41.

Udwadia, F. (1990), "Creativity and innovation in organizations: two models and managerial implications", Technological Forecasting and Social Change, Vol. 38, pp. 65-80.

Valtanen, J., Berki, E., Kampylis, P., & Theodorakopoulou, M. (2008). Manifold thinking and distributed problem-based learning: Is there potential for ICT support? In Proceedings of the IADIS international conference e-learning 2008 Amsterdam, Netherlands.

Vose, MD .1999. Simple genetic algorithm, foundation and theory. MIT Press, Ann Arbor.

Wang, Y., Chin.,K. (2011), Fuzzy analytic hierarchy process: A logarithmic fuzzy preference Programming methodology, International Journal of Approximate Reasoning, Vol.52, pp.541–53.

West, M.A. (1986). Role innovation in the world of work. Memo no. 670, MRC/ESRC Social and Applied Psychology Unit. University of Sheffield, Sheffield, England.

Williams,W. M.,&Yang, L. T. (1999). Organizational creativity. In R. J. Sternberg (Ed.), Handbook of creativity, Cambridge, UK: Cambridge University Press, pp. 373-91.

Woodman RW, Sawyer JE, Griffin RW. (1993), Toward a theory of organizational creativity. Acad Manage Rev, Vol.18, No.2, pp.293– 321.

Woodman, P. and Schoenfeldt, L. (1989), "Individual differences in creativity: an interactionist perspective", in Glover, J.A. et al. (Eds), Handbook of Creativity, Plenum, New York, NY, pp.77-92.

Zadeh, L. A. (1965), Fuzzy sets. Information and Control, Vol.8, No.3, pp.338–53.

Zhou, J. (1998), Feedback valence, feedback style, task autonomy, and achievement orientation:Interactive effects on creative performance. Journal of Applied Psychology, Vol.83, No.2, pp.261-76.

Zhou J. (2003), When the presence of creative coworkers is related to creativity: role of supervisor close monitoring, developmental feedback and creative personality. J Appl Psychol, Vol.88, No.3, pp.413– 22.