Implementing Bounded Linear Programming and Analytical Network Process Fuzzy Models to Motivate Employees: a Case Study

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Abstract

In this research, the factors affectinguniversity employees' motivation and productivity are identified and classified in seven groups; the impact of each motivation factor on the productivity is presented by ANP fuzzy model.Eight universities in Iran were analyzed in this research work. The aim of this study is to explore the productivity of employees. This paper attempts to give new insights into designing the portfolio factors, motivating employees for productivity improvement by implementing BLP and ANP fuzzy models.The research results show that there is a positive and significant relationship among reward system, motivation factors, and human resources productivity. In addition, among the options of reward system, the factors of internal (inherent) reward, non-financial external reward, and financial external reward had the highest impact on increasing motivation and productivity factors. At the next stage, a BLP model is designed according to the importance and impact of each reward system option on motivation and productivity factors and organization limitations, including budget, facilities, and conditions to design portfolio factors motivating employees with the aim of improving productivity. The research results show that actualizing performance evaluation, receiving the feedback from the results of doing tasks by different ways, providing an opportunity for all employees to progress, coordination between job specifications and employees' abilities, and a manager competency are very critical for improving the organization productivity.

Keywords: ANP fuzzy; BLP;Reward system;Productivity; Motivation; University.

1. Introduction

Today, the main success of each organization and survival to achieve goals is to consider human power andimprove the productivity. Effective and efficient use of human power or, in other words, the productivity of human power is one of the major issues in each society (Tabarsa & Fallah, 2009; Stone, 2002). Human power is one of the strategic factors for an organization. The factors constituting this power are emotional and sensible creatures so that if they have enough motivation, they will employ their own talents and skills to serve the organization and achieve its goals.

With regard to the rich and profuse resources of raw materials as well as intelligent people prone to learning sciences, Iran society has an extensive possibility for being industrial and developed. However, despite all facilities and tools, our society has not been able to benefit from a special position in various world fields yet. The reason is low productivity and efficiency of human power. Certainly, in Iran, the efficiency of human power is insignificant, and this leads to the wastage of primary resources and delays the developmental goals of the country (Tarokh & Nazemi, 2006). Although, there are various factors for development lag, the most significant factors are the inadequate productivity of labor force and weakness of production process. Human resources management and domestic culture are the most important factors in the efficiency of human work force. By examining the statistics for work productivity in Iran and comparing it to other Asian countries, it shows that productivity index decreased about 5% at national levels during 2002-2008 (Tabarsa & Fallah, 2009). The lack of motivation in service and industrial sectors has decreased productivity range and opened an indecisive perspective for the managers in Iran.

Most of the labors in organizations do not have adequate motivation to do an efficient and effective activity, which leads to low productivity. Clearly, in order to achieve highly efficient performance, an organizational evolution for motivation and productivity is necessary. Managers must recognize the actual and potential capabilities of their own employees and strive to develop and expand them by identifying activities and jobs and determining the standards for each job. Managers must recognize their own employees' motivation well; while they create a suitable working environment, they must examine their personal requirements, financial and economic problems too. Hence, fulfilling motivation factors improves labor productivity. Due to improving productivity, management is able to increase total income with less cost and human labor. Management can control the behaviors of irresponsible employees by a strategic planning. By identifying the strengths of human resources provided in this research, management can have a valuable work force. This planning leads to the development and productivity of employees.

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According to the usefulness of fuzzy models, in this study,it is attempted to make use of ANP fuzzy model. The ANP, introduced by Saaty in 1996, is a generalization of the Analytic Hierarchy Process (AHP); AHP models are represented with unidirectional hierarchical relationships (Eydi et al., 2016). However, ANP models allow for complex inter-relationships among the decision levels and the attributes. The feedback mechanism in AHP replaces the hierarchical structure with a network structure where the relationships between levels are not simply represented as higher or lower, dominant or subordinate, direct or indirect (Vahdani et al., 2016). In other words, while the importance of the criteria determines the importance of the alternatives in a hierarchy, the importance of the alternatives may also have an effect on the importance of the criteria. AHP solves the problem of independence among the alternatives or criteria and ANP solves the problem of dependence among the alternatives or criteria by obtaining the composite weights (Ashghari and Nezhadali, 2016; Oygun et al., 2015).

The inability of ANP to deal with the imprecise or uncertain judgments has been remedied in fuzzy ANP; instead of a crisp value, fuzzy ANP applies a range of values to incorporate the DM's imprecise or uncertain judgments in the pairwise comparison process, so fuzzy model solves ANP problem with uncertain judgments (Nilashi et al., 2016). Due to advantages of fuzzy models, different types of them have been used in many fields (Ghasemi et al., 2015; Faezy Razy, 2015; Hossain et al., 2016; Makui et al., 2016). Also, recent applications of the fuzzy ANP are: Determining the importance of Hospital Information System (Nilashi et al., 2016); Selection of the optimal tourism site (Zarei et al., 2016); product development (Zaim et al., 2015); city logistics concept selection (Tadic et al., 2014); evaluation and selection of outsourcing provider for a telecommunication company (Oygun et al., 2015); evaluation of the airline industry (Sevkli et al., 2012); professional selection (Kabak et al., 2012); strategy prioritization (Babaesmailli et al., 2012), amongst others.

This paper attempts to give new insights into designing the portfolio factors motivating employees for productivity improvement by implementing BLP and ANP fuzzy models for eight major Iranian universities. The originality of this study is to explore the productivity of employees at the universities.

For this purpose, the paper is organized in three parts. In the first part, literature review is studied. In the second part, research methodology is discussed. In the third part, a case study is put into test. The main point of this part is to implement BLP and ANP fuzzy models for designing the portfolio factors to motivate employees at the universities of Iran. Finally, we present the conclusions of this analysis.

2. Background

Human resources are one of the most important factors affecting the success or failure of an organization(Tabarsa & Fallah, 2009; Goles & Kahya, 2007). Human resources can harm physical and material resources or make them flourished. Scientists treat human motivation as his driving motor, spurting and progressive force, and believe that for each success, the influences of endeavor and motivation are 20 percent and 80 percent, respectively (Tarokh & Nazemi, 2006; Yardakul, 2002). Today, the major problem and critical challenge for organizations are the lack of motivation and loss of accountability of employees. Irresponsible employees spoil the best plans, the most effective structures, and efficient resources. The basic question is "what are the reasons for this loss of motivation?", and "how can it be improved by considering the limitations of an organization?"

Contextual motivation theory has started from the beginning of recent century with the leading academic management of Taylor, Gilbert and Gaunt in 1974, and itwas developed by designing incentive models for increasing wages to create a working motivation (Tabarsa & Fallah, 2009; Liu & Shih, 2005). Then, movement for human relationships was emerged and followed by contextual models of Maslow, Herzberg and Alderfer. Much improvement was made by processing models being emerged. Recently, theories of justice (equality) have been addressed. Of course, there are additional theories for motivation, but the theories of equality have the most impact on the organizational behavior(Kazemzadeh & Hashemi 2009). Contextual theories clearly discuss the context of motivation by considering human basic needs. This theory was provided by the pyramid of Maslow's needs hierarchy (Hill & Maslow, 1984; Luthan, 1992;Baron, 1986; Lawrence, 1984)., Herzberg's motivation theory (Baron, 1986; Raghuvanshi, 2002; Armstrong, 1991; Robbins, 1991; Davis & Newstorn, 1989), McCalley triple needs theory(Mc Calley, 2006), Alderfer's human basic needs theory(Baron, 1986; Raghuvanshi, 2002; Hazaweyi & Samadi, 2005; Ruthankoon & Ogunlana, 2008), and gust's common needs theory (Armstrong, 1991). Processing theories are based on the principle of "maximum wage versus maximum work". This theory was provided by Vorum (Freedman & Philips, 1985), Porter &Louer paradigm for motivation (Latham& Yukle, 1978; Naeli, 2003; Broadbridg & Parsons, 2006), Latham & Locke theory for participation in goals determination (Ghasemi, 2006), reinforcement theory versus goal determination theory(Baron, 1986; Habibi, 2008; Morel, 2001),equality theory(Baron, 1986), document theory (Raghuvanshi, 2002), and Archamez's evaluation theory(Mc Calley, 2006; Hazaweyi& Samadi, 2005; Naeli, 2003).

By analyzing the results of Herzberg's questionnaire, Ruthankoon concluded that the nature of reasons for satisfaction or dissatisfaction provided by people is different (Ruthankoon & Ogunlana, 2003).

Baay et al. (2014) assessed the importance of self-control in the job search process. They compared it with motivation, which is important for people looking for jobs. In a research work, Angheleche (2015) identified possible correlations from different schools in Galati of Romania. Rawolle et al. (2016) conducted a research and developed a hypothesis between a person's implicit and

explicit motives. They discussed their findings considering the theoretical conceptualization of impaired intrinsic motivation because of motive incongruence. Recepoglu (2014) investigated job motivation level of high school teachers in Turkey. It was concluded that level of job motivation for teachers in high schools is significantly different in terms of age, tenure of office, and education level while motivation of teachers do not show a significant difference in terms of teachers' gender. Hosseini et al.(2015) applied fuzzy logic for performance evaluation of Yazd Regional Electricity Co.in Iran. There have been numerous Fuzzy logic studies in different fields (Wang et al., 2015; Uygun et al., 2015; Tadic et al., 2014).

In a research titled "Is Herzberg's theory powerful yet?", Johns& Lloyd, collecting more than 3200 questionnaires, concluded that according to Herzberg's theory, factors related to inner satisfaction play a more important role to create motivation.They stated that the theory still has plenty of applications for motivation discussions since the past 50 years (Bassett- Jones& Lloyd 2005).

Recently, many researchers have differentiated the internal and external aspects of various working beliefs and behaviors:internal values related to work (responsibility, attractiveness, and effectiveness),internal values resulting from work (position, job, and respect), external values resulting from work (jobsecurity,salary, premium), external values related to job (suitable working hours and environment),and external values related to the individual (good relationships with supervisors, colleagues and promotion)(Furnham et al., 2002).Many research articles have consideredjob satisfaction around the world; each of them has followed a different approach for this case and studied the factors affectingjob satisfaction by considering its working scope.Table 1 shows some research studies performed and factors affectingjob satisfaction; it illustrates how they affect, so that the last two columns show the influence of these factors and describe how these factors affect job satisfaction according to each research performed.

To validate motivation models, some researchers have used a statistical method, factor analysis with two explorative and confirmative goals. Explorative method is applied to find the factors affecting motivation; confirmative method is used to confirm theoretical models. To implement the model, statistical software, LISREL, was applied (Hair, 1995; Shah & Goldstein, 2006).

By considering the general research literature review, motivation factors extracted from the theories can be summarized into ten instructions:

1. To ensure coordination between employees' motivation and values, and the jobs appointed.
2. To make jobs attractive and consistent with employees' motivations and values.
3. To define the goals as clear, challenging, attractive, achievable and measurable.
4. To provide material and personal resources required to facilitate the effectiveness and efficiency of employee's activities.

5. To improve employees' performance by in-serving education.
6. To evaluate the performance and feedback for the results of operations practically.
7. To provide an opportunity for all employees to progress.
8. To provide a salary, wage and reward system proportional to the performance.
9. To achieve the goals and realize the processes between the individuals and groups.
10. To coordinate and integrate all above rules in the social system.

However, with regard to the importance of employees' serving motivation in all management levels of organizations, it is necessary to study the factors affecting employees' serving motivation on the basis of provided scientific theories in order that managers can consider them for retaining and improving employees' serving motivation, planning and in their own intelligent management behavior. This research has been performed to examine the reasons for increasing or decreasing employees' serving motivation and discuss the approaches of increasing the motivation being effective in productivity.

Table 1
Summary of included studies regarding related factors of job satisfaction

Factors	Influence
Education: [28] [29] [30] [31]	-
	+
	(?)
Job stress[29] [30] [31]	-
work schedule[30]	+
	(?)
group cohesion[30] [32]	+
Gender(psychological empowerment= Demographic[30] [31] [32] [33]	+
	+(max)
	(?)
Pay(salary) [30] [31] [34]	+
	(?)
	+(min)
	+(max)
Promotion[29] [30] [31]	+
Superior(Leadership style) [29] [30] [31]	+
	(?)
Fringe benefits, Praise and recognition[29] [30] [31]	+
Work environment[30]	+
Commitment[29] [30]	+
Professional	+
status(experienced) [30] [31]	+-
Job security[29] [30]	+
hardiness[30]	+
Autonomy[29] [31] [32] [34]	+-
	+
Ambiguity[29] [32] [34]	–
Conflict[29] [31] [34]	-
	(?)
Interaction(Relationships with patients, co-workers, managers) [29] [33]	+
Working conditions[29]	(?)

+ Positive, -: negative, +- : no significant, (?): Further
 research needed to determine the correlation of individual
 factors and job satisfaction,
(Max): strongest factors;   (Min): weakest factors
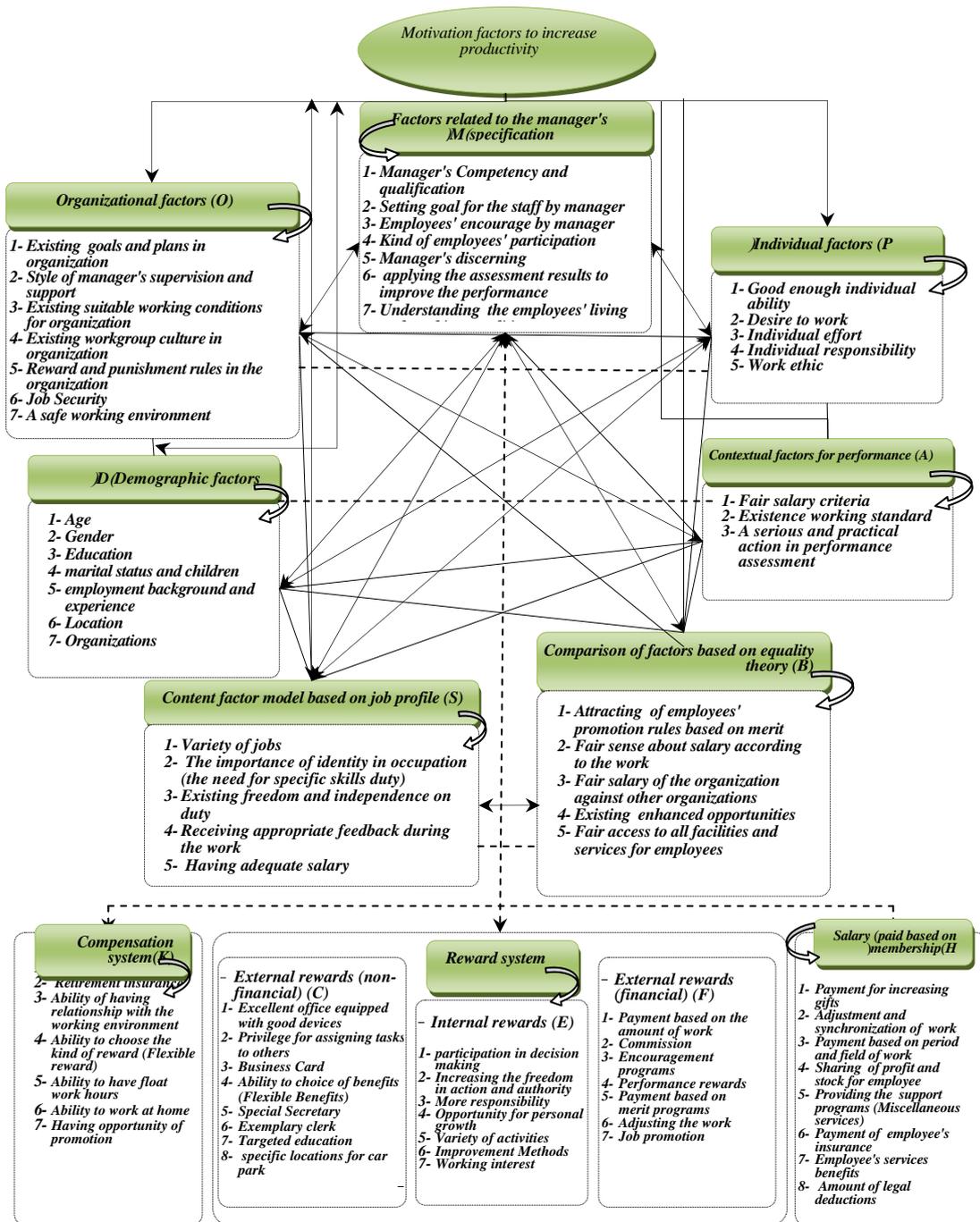
Fig. 1. Interaction of factors and effective options in productivity of the organization.

3. Research Methodology and Phases

This research is a descriptive-analytical survey. In order to design portfolio motivation factors affecting organizational productivity, eight universities in Iran have been selected as the survey population. The analyzed universities for this research include Yazd University, Amirkabir University, Semnan University, Mashhad University, Tabriz University, Zahedan University, Kashan University, and Ahwaz University. To determine a sample from the survey population, 25 up to75 persons were selected randomly from each university and various units. The total number of

population being studied was about 3000 persons and 345 samples were selected.

For data collection, a questionnaire in three parts was developed. The first part contained employees' demographic information including office location, job background, education, marriage status, gender and salary. The second part, including motivation factors affecting productivity, was developed using the studies being performed about motivation theories and also considering ten instructions resulted from the research literature review. By considering the studies being performed, meeting the factors and objectives of the study and Likert's measure, the number of

questions for this questionnaire was determined by fuzzy variables. The third part consisted of the options for reward, salary and premium system, and compensation system affecting employees' motivation. The questionnaire justifiability was ensured by the related experts and its stability was assured by the method (r = 87%, Cronbach's alpha = 85%). Then, the questionnaire was copied and utilized. Figure 1 illustrates interaction of factors and

effective options on productivity of the organization ANP fuzzy model has been applied to evaluate the impact of each motivation factor on the productivity and that of of each option of reward, salary and premium system and compensation system on motivation factors in this research. Figure 1 illustrates the interaction of these factors and options on the productivity (Hazaweyi & Samadi, 2005).

Table 2
Demographic characteristics and standard deviation

University	Participants	Age	Male	Female	Single	Married	Background	Education (Diploma)	Education (BS)	Education (MS)	Monthly Income
	%	Year	%	%	%	%	Year	%	%	%	(Million Rials)
Yazd	47	43.8	25	22	1	46	18.5	8	36	3	6.5
S. D.	0.136	10.5	0.14	0.13	0.05	0.14	3.25	0.15	0.13	0.14	3.10
Amirkabir	58	41.7	31	27	2	56	19.75	10	45	3	6.4
S. D.	0.168	7.4	0.18	0.16	0.10	0.17	5.45	0.19	0.17	0.14	3.60
Semnan	26	40.5	14	12	1	25	17.6	3	20	3	5.2
S. D.	0.075	5.1	0.08	0.07	0.05	0.08	2.27	0.06	0.07	0.14	2.40
Mashhad	54	39.8	25	29	5	49	18.6	15	34	5	6.1
S. D.	0.156	4.2	0.14	0.17	0.25	0.15	4.8	0.28	0.13	0.23	2.70
Tabriz	65	45.1	31	34	2	63	17.2	14	48	3	5.1
S. D.	0.188	7.8	0.18	0.20	0.10	0.19	4.35	0.26	0.18	0.14	2.90
Zahedan	32	38.9	17	15	4	28	16.5	1	29	2	6.7
S. D.	0.093	9.2	0.10	0.09	0.20	0.09	3.78	0.02	0.11	0.09	3.40
Kashan	28	36.2	14	14	3	25	12.7	0	27	1	6.4
S. D.	0.081	7.1	0.08	0.08	0.15	0.08	2.41	0.00	0.10	0.05	3.30
Ahwaz	35	42.7	17	18	2	33	15.8	2	31	2	6.1
S. D.	0.101	6.9	0.10	0.11	0.10	0.10	4.7	0.04	0.11	0.09	3.80
Total	345	41.5	174	171	20	325	16.5	53	270	22	6.53
S. D.	100	8.5	0.51	0.49	0.06	0.94	3.65	0.15	0.78	0.7	3.17

4. Case Study

The total number participants in this study was345 executive employees working in eight universities of Iran from eight different areas. The results and findings of analysis are illustrated briefly in Fig. 1. The employees participating in this study from the eight universities included: 47 persons from Yazd University, 58 persons from Amirkabir University, 26 persons from Semnan University, 54 persons from Mashhad University, 65 persons from Tabriz University, 32 persons from Zahedan University, 28 persons from Kashan University, and 35 persons from Ahwaz University. In this research, the average age of employees was 41.5 years.Of the total participants, 174 men and 171 womenwere present and among them, there were 325 married persons and 20 single persons.Table 2 illustrates the frequency and educational state of people participatingin this study. There were 22 persons having MS degree, 270 persons having BS degree, and 53 persons having pre-graduate degree.In addition, the average of working backgroundwas 16.5 years.

4.1. Identifying, classifying and calculating the weight of motivation factors

In this research, important (major and minor) motivation factors being effective in the organizational productivity have been identified, classified and supplemented employing some experts and using a questionnaire method. Then, the methods being effective in reinforcing motivation factors have also been identified, classified, and completed. To acquire knowledge about motivation factors affecting the organizational productivity, some interviews were made with some experts in several organizations. To collect and supplement data, a questionnaire was designed and provided to the experts.Based on Likert scale, the experts selected one of the options listed in table 3 and figure 2 for each factor.

Table 3
Weight of factors and measures

Option	Character	Weight
Extremely important	***E***	***(0.75 ,1.00, 1.00)***
Very important	***G***	***(0.50, 0.75, 1.00)***
Important	***F***	***(0.25, 0.50, 0.75)***
Less important	***P***	***(0.00, 0.25, 0.50)***
Not important	***V***	***(0.00, 0.00, 0.25)***
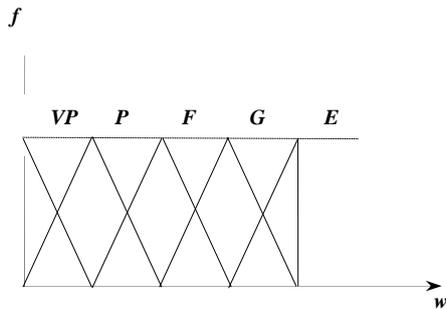
Fig. 2.   Presentation of fuzzy numbers

The experts were also asked to add the measures not being mentioned to the end of the table. At the second phase, the added measures were put in the questionnaire; it was again provided to the experts in order to acquire the view of all experts about the necessity and importance of all factors. Of 345 distributed questionnaires, 324 questionnaires were filled. Figure 1 lists these measures and factors. By calculating the weighted mean of experts' viewsfor each factor and measure, their impact on motivation and productivity improvement was calculated.These weights were normalized to be applied in ANP.

To calculate the weight of motivation factors, in this research, a combination of questionnaire and ANP fuzzy was used. Saaty discussed analytical Network Process (ANP) in 1980 for the first time (Saaty, 1980). This process is one of the comprehensive methods for decision-making by multiple measures. Then, the weights of measures and factors must be identified; in fact, the measures and factors must be compared with each other as pairs. To calculate these weights, the matrix of pair comparison was formed for various network levels by group interaction among the experts.By dividing gained weight of each factor of the questionnaire $\left(\frac{W_i}{W_i}\right)$, all elements of each level were compared to each other and a pair comparison matrix was formed on resulting preferences.

Final weight for each measure, sub-measure, major and minor options was calculated as follows:
1- To calculate the weights of main measures for motivation factors:

This vector is as a column matrix [7×1] and shown by W_1.

2- To calculate the internal correlation matrix between main measures for motivation factors:
This matrix is as [7×7] and shown by W_3.

3- To prioritize main measures for motivation factors by considering internal correlation among them to improve the productivity:
This matrix [7×1] is produced by $W_c = W_3 \times W_1$.

4- To calculate the weight for each main option of reward system to main measures:
This matrix is [3×7] and shown by W_2.

5- To calculate internal correlation matrix among main options:
This matrix is as [3×3] and shown by W_4.

6- To prioritize the main options by considering internal correlation among them to improve each main measure:
This matrix [3×7] is produced by $W_A = W_4 \times W_2$.

7- To define the final priority for each main option to improve motivation factors:
This matrix [3×1] is produced by $W_P = W_A \times W_C$.

8- To calculate the weight of each sub-measure to main measure (i):
This matrix for a main measure is as $[n_i, 1]$ and shown by W_{i1}.

9- To calculate internal correlation matrix for the sub-measures resulted from main measure (i):
This matrix for main measure i is as $[n_i, n_i]$ and shown by W_{i3}.

10- To prioritize minor sub-measures by considering internal correlation to improve main measure i:
This matrix is produced by $W_{Ci} = W_{i3} \times W_{i1}$ as $[n_i, 1]$.

11- To prioritize each minor sub-measure to improve motivation and productivity:
This matrix is produced by multiplying a main measure in W_{ci} $[n_i, 1]$.

12- To calculate the weight of each minor sub-measure to main option j:
This matrix for each main option is as $[m_j, 1]$ and shown by W_{j2}.

13- To calculate internal correlation matrix for sub-options resulted from main option j:
This matrix for main option j is as $[m_j, m_j]$ and shown by W_{j4}.

14- To prioritize minor sub-measures by considering their internal correlation to main option j:
This matrix is produced by $W_{Aj} = W_{j4} \times W_{j2}$.

15- To prioritize each minor sub-measure to improve motivation factors and productivity:
This matrix is produced by multiplying the weight of main option j in W_{Aj} $[m_j, 1]$.

The final weightfor each fuzzy motivation factor and method is illustrated in Table 4.

Table 4
Final weight for each fuzzy motivation factor and method.

A(0.1)	O(0.1)	M(0.2)	P(0.1)
A1= (0.25,0.3,0.35)	O1= (0.05,0.1,0.15)	M1= (0.25,0.3,0.35)	P1= (0.05,0.1,0.15)
A2= (0.25,0.3,0.35)	O2= (0.05,0.1,0.15)	M2= (0.05,0.1,0.15)	P2= (0.05,0.1,0.15)
A3= (0.35,0.4,0.45)	O3= (0.05,0.1,0.15)	M3= (0.05,0.1,0.15)	P3= (0.25,0.3,0.35)
	O4= (0.05,0.1,0.15)	M4= (0.05,0.1,0.15)	P4= (0.15,0.2,0.25)
	O5= (0.15,0.2,0.25)	M5= (0.05,0.1,0.15)	P5= (0.25,0.3,0.35)
	O6= (0.15,0.2,0.25)	M6= (0.15,0.2,0.25)	
	O7= (0.15,0.2,0.25)	M7=(0.05,0.1,0.15)	

H(0.1)	S(0.2)	B(0.2)	D(0.1)
H1= (0.05,0.1,0.15)	S1= (0.05,0.1,0.15)	B1= (0.05,0.1,0.15)	D1= (0.0,0.05,0.1)
H2= (0.05,0.1,0.15)	S2= (0.2,0.25,0.3)	B2= (0.25,0.3,0.35)	D2= (0.1,0.15,0.2)
H3= (0.1,0.15,0.20)	S3= (0.1,0.15,0.2)	B3= (0.2,0.25,0.3)	D3= (0.15,0.2,0.25)
H4= (0.15,0.2,0.25)	S4= (0.2,0.25,0.3)	B4= (0.2,0.25,0.3)	D4= (0.1,0.15,0.2)
H5= (0.05,0.1,0.15)	S5= (0.2,0.25,0.3)	B5= (0.05,0.1,0.15)	D5= (0.3,0.35,0.4)
H6= (0.05,0.1,0.15)			D6= (0.0,0.0,0.05,0.1)
H7= (0.1,0.15,0.20)			D7= (0.0,0.05,0.1)
H8= (0.05,0.1,0.15)			

K(0.1)	F(0.25)	E(0.3)	C(0.25)
K1= (0.15,0.2,0.25)	F1= (0.05,0.1,0.15)	E1= (0.2,0.25,0.3)	C1= (0.25,0.3,0.35)
K2= (0.05,0.1,0.15)	F2= (0.15,0.2,0.25)	E2= (0.15,0.2,0.25)	C2= (0.0,0.0,0.05,0.1)
K3= (0.1,0.15,0.2)	F3= (0.05,0.1,0.15)	E3= (0.05,0.1,0.15)	C3= (0.1,0.15,0.2)
K4= (0.05,0.1,0.15)	F4= (0.05,0.1,0.15)	E4= (0.15,0.2,0.25)	C4= (0.1,0.15,0.2)
K5= (0.1,0.15,0.2)	F5= (0.05,0.1,0.15)	E5= (0.05,0.1,0.15)	C5= (0.15,0.2,0.25)
K6= (0.05,0.1,0.15)	F6= (0.05,0.1,0.15)	E6= (0.0,0.05,0.1)	C6= (0.0,0.05,0.1)
K7= (0.15,0.2,0.25)	F7= (0.15,0.2,0.25)	E7= (0.05,0.1,0.15)	C7=(0.05,0.1,0.15)
	F8=(0.05,0.1,0.15)		

4.2. Analysis of ANP Fuzzy results

Table 4 illustratesthe analyses and results for implementing ANP to design portfolio motivation factors to improve the productivity.Some results are as follows:

Among the context factors for performance, the measures for paying fairly salary, premium and reward (A1), working standards (A2) and serious, practical actions to evaluate an organization (A3) have a higher priority.

To study the contextual factors based on the model for job specifications, the measures for receiving feedback about the results of undertaken tasks (S4) have the most impact on improving employees' working motivation.

In addition, examining the comparative factors based on equality theory with working motivation shows that providing an opportunity for all employees to progress in a working environment (B4) has the highest priority.

Studying the factors related to a manager's feature shows that the measure of practical evaluation (M6) has the highest priority. These specifications lead to the fairness of salary, wage, and reward.

Among demographic factors, age (P1) has no impact on motivation. Women have more working motivation than men (P2); the married have more working motivation than the single (P4).

4.3. Linear planning model with bounded variables (BLP)

In this part, with regard to the importance and impact of each option for reward system and motivation factor on improving the productivity and considering the limitation of financial resources and the possibility of improving each option for reward system and motivation factor, a BLP model has been implemented to design portfolio factors for motivation and reward system to improve the productivity.To identify the expense of each option for reward system, motivation factor,and the possibility of improving each of them, expert views were collected and analyzed. Table 5 illustrates the expense for implementing each option of reward system and motivation factor and the possibility of improving each of them by considering the limitations of rules and regulations, available human power, implementation time and expense, usable space, etc. For example, A2= 0.45(0.8), the expense for developing proper standard to perform each work has the weight of 0.45. The maximum expense for improving other motivation factors, considering budget, organizational facilities, and conditions, is 80% of works which could be standardized. These tables have beendesigned by Delphi method and surveying the experts. For this purpose, five-pointLikert scalespectrum having options as very high, high, medium, low, and very low has been used to compare expenses and their possibility with each other.

This model has been designed for motivation factors affecting productivity. Coefficients for the target function in this model have been taken from table 4 and the limits of variables and expense coefficients have been adopted from table 5. In order to use target coefficients (table 4), defuzzification was performed using formula $\frac{a+4b+c}{6}$; then, it was applied in linear planning model. This model has 42 limited variables and one expense limitation for implementing motivation factors. The implementation expense of this plan is equal to 0.5% of organizational budget. Similarly, this model has been also implemented for the options of reward system affecting motivation factors.

The responses for either linear planning or bounded variables are shown in table 6. In this model, X_{ij} is the impact of minor motivation factor (j) in the group of major factor (i) to improve productivity, (i:P, M, O, A, D, B, S) and (j:1, 2, …, n).

Table 5
Expense for implementing each option of reward system and motivation factor

A(0.1)	O(0.1)	(0.2)	P(0.1)
A1= 0.4(0.9)	O1= 0.2(0.7)	M1= 0.3(0.7)	P1= 0.3(0.5)
A2= 0.45(0.8)	O2= 0.25(0.5)	M2= 0.3(0.8)	P2= 0.3(0.3)
A3= 0.5(0.9)	O3= 0.35(0.6)	M3= 0.25(0.21)	P3= 0.6(0.2)
	O4= 0.31(0.67)	M4= 0.25(0.5)	P4= 0.4(0.3)
	O5= 0.2(0.6)	M5= 0.3(0.75)	P5= 0.2(0.6)
	O6= 0.2(0.5)	M6= 0.25(0.85)	
	O7= 0.3(0.51)	M7= 0.3(0.5)	
H(0.1)	**S(0.2)**	**B(0.2)**	**D(0.1)**
H1= 0.2(0.7)	S1= 0.11(0.25)	B1= 0.2(0.8)	D1= 0.16(0.1)
0.6)(H2= 0.25	S2= 0.35(0.7)	B2= 0.35(0.7)	D2= 0.32(0.2)
H3= 0.3(0.75)	S3= 0.15(0.65)	B3= 0.35(0.8)	D3= 0.4(0.3)
H4= 0.42(0.9)	S4= 0.45(0.81)	B4= 0.37(0.9)	D4= 0.3(0.8)
H5= 0.15(0.75)	S5= 0.35(0.75)	B5= 0.15(0.65)	D5= 0.51(0.5)
H6= 0.15(0.95)			D6= 0.14(0.1)
H7= 0.36(0.85)			D7= 0.15(0.1)
H8= 0.2(0.8)			
(0.1)	**F(0.25)**	**E(0.3)**	**(0.25)**
K1= 0.3(0.85)	F1= 0.15(0.25)	E1= 0.25(0.75)	C1= 0.35(0.7)
K2= 0.15(0.75)	F2= 0.3(0.2)	E2= 0.2(0.8)	C2= 0.17(0.4)
K3= 0.2(0.5)	F3= 0.15(0.5)	E3= 0.2(0.7)	C3= 0.15(0.7)
K4= 0.16(0.75)	F4= 0.25(0.5)	E4= 0.31(0.65)	C4= 0.25(0.8)
K5= 0.21(0.5)	F5= 0.21(0.2)	E5= 0.15(0.25)	C5= 0.2(0.5)
K6= 0.11(0.5)	F6= 0.25(0.2)	E6= 0.1(0.25)	C6= 0.11(0.7)
K7=0.27(0.6)	F7= 0.4(0.5)	E7= 0.2(0.6)	C7=0.2(0.9)
	F8= 0.15(0.2)		

Target function for BLP model:

$$MaxZ= 0.1(0.1X_{P1} + 0.1X_{P2} + 0.3X_{P3} + 0.2X_{P4} + 0.3X_{P5}) + 0.2(0.3X_{M1} + 0.1X_{M2} + 0.1X_{M3} + 0.1X_{M4} + 0.1X_{M5} + 0.2X_{M6} + 0.1X_{M7})$$
$$+ 0.1(0.1X_{O1} + 0.1X_{O2} + 0.1X_{O3} + 0.1X_{O4} + 0.2X_{O5} + 0.2X_{O6} + 0.2X_{O7}) + 0.1(0.3X_{A1} + 0.3X_{A2} + 0.4X_{A3})$$
$$+ 0.1(0.05X_{D1} + 0.15X_{D2} + 0.2X_{D3} + 0.15X_{D4} + 0.35X_{D5} + 0.05X_{D6} + 0.05X_{D7}) + 0.2(0.1X_{B1} + 0.3X_{B2} + 0.25X_{B3} + 0.25X_{B4} + 0.1X_{B5})$$
$$+ 0.2(0.1X_{S1} + 0.25X_{S2} + 0.15X_{S3} + 0.25X_{S4} + 0.25X_{S5})$$

Limitations for BLP model:

$$0.3X_{P1} + 0.3X_{P2} + 0.6X_{P3} + 0.4X_{P4} + 0.2X_{P5} + 0.3X_{M1} + 0.3X_{M2} + 0.25X_{M3} + 0.25X_{M4} + 0.3X_{M5} + 0.25X_{M6} + 0.3X_{M7}$$
$$+ 0.2X_{O1} + 0.25X_{O2} + 0.35X_{O3} + 0.31X_{O4} + 0.2X_{O5} + 0.2X_{O6} + 0.3X_{O7} + 0.4X_{A1} + 0.45X_{A2} + 0.5X_{A3}$$
$$+ 0.16X_{D1} + 0.32X_{D2} + 0.4X_{D3} + 0.3X_{D4} + 0.51X_{D5} + 0.14X_{D6} + 0.15X_{D7} + 0.2X_{B1} + 0.35X_{B2} + 0.35X_{B3} + 0.37X_{B4} + 0.15X_{B5})$$
$$+ 0.11X_{S1} + 0.35X_{S2} + 0.15X_{S3} + 0.45X_{S4} + 0.35X_{S5} \leq 10$$

$0 \leq X_{P1} \leq 0.5$	$0 \leq X_{M1} \leq 0.7$	$0 \leq X_{O1} \leq 0.7$	$0 \leq X_{A1} \leq 0.9$	$0 \leq X_{D1} \leq 0.1$	$0 \leq X_{B1} \leq 0.8$	$0 \leq X_{S1} \leq 0.25$
$0 \leq X_{P2} \leq 0.3$	$0 \leq X_{M2} \leq 0.8$	$0 \leq X_{O2} \leq 0.5$	$0 \leq X_{A2} \leq 0.8$	$0 \leq X_{D2} \leq 0.1$	$0 \leq X_{B2} \leq 0.7$	$0 \leq X_{S2} \leq 0.5$
$0 \leq X_{P3} \leq 0.2$	$0 \leq X_{M3} \leq 0.21$	$0 \leq X_{O3} \leq 0.6$	$0 \leq X_{A3} \leq 0.9$	$0 \leq X_{D3} \leq 0.3$	$0 \leq X_{B3} \leq 0.8$	$0 \leq X_{S1} \leq 0.5$
$0 \leq X_{P4} \leq 0.3$	$0 \leq X_{M4} \leq 0.5$	$0 \leq X_{O4} \leq 0.67$		$0 \leq X_{D4} \leq 0.8$	$0 \leq X_{B4} \leq 0.9$	$0 \leq X_{S4} \leq 0.81$
$0 \leq X_{P5} \leq 0.6$	$0 \leq X_{M5} \leq 0.75$	$0 \leq X_{O5} \leq 0.6$		$0 \leq X_{D5} \leq 0.5$	$0 \leq X_{B5} \leq 0.65$	$0 \leq X_{S5} \leq 0.75$
	$0 \leq X_{M6} \leq 0.85$	$0 \leq X_{O6} \leq 0.5$		$0 \leq X_{D6} \leq 0.1$		
	$0 \leq X_{M7} \leq 0.5$	$0 \leq X_{O7} \leq 0.51$		$0 \leq X_{D7} \leq 0.1$		

Table 6
Response of each method of motivation factors for productivity

(0.1)	O(0.1)	(0.2)	(0.1)
A1= 0.8 A2= 0.75 A3= 0.85	O1= 0.15 O2= 0.15 O3= 0.4 O4= 0.25 O5= 0.5 O6= 0.4 O7= 0.45	M1= 0.3 M2= 0.15 M3= 0.2 M4= 0.25 M5= 0.05 M6= 0.8 M7= 0.1	P1= 0.05 P2= 0.05 P3= 0.1 P4= 0.1 P5= 0.5
H(0.1)	S(0.2)	B(0.2)	D(0.1)
H1= 0.58 H2= 0.55 H3= 0.6 H4= 0.45 H5= 0.25 H6= 0.15 H7= 0.2 H8= 0.2	S1= 0.25 S2= 0.35 S3= 0.55 S4= 0.75 S5= 0.7	B1= 0.7 B2= 0.7 B3= 0.75 B4= 0.8 B5= 0.6	D1= 0.03 D2= 0.15 D3= 0.3 D4= 0.15 D5= 0.5 D6= 0.02 D7= 0.01
(0.1)	(0.25)	E(0.3)	(0.25)
K1= 0.75 K2= 0.3 K3= 0.4 K4= 0.2 K5= 0.25 K6= 0.2 K7= 0.5	F1= 0.2 F2= 0.2 F3= 0.2 F4= 0.25 F5= 0.15 F6= 0.2 F7= 0.5 F8= 0.15	E1= 0.6 E2= 0.45 E3= 0.35 E4= 0.55 E5= 0.2 E6= 0.2 E7= 0.3	C1= 0.7 C2= 0.2 C3= 0.6 C4= 0.7 C5= 0.7 C6= 0.2 C7= 0.75

Response for BLP model is illustrated in Table 6. For example, A2=0.75 means that the developing standards of sex motivation factors have the weight of 0.75 among other contextual factors for performance.

4.4. Comparing and analyzing research results

Analyzing the findings of this study indicates the following results being summarized in table 7.

4.5. Calculating productivity improvement results

By implementing ANP model based on the coefficients listed in table 7, organizational productivity is improved 20% due to spending 0.5% of budget. Right number indicates the first limitation of BLP being equal to 0.5% of organizational budget. The mean of numbers listed in table 7 illustrates a 20% improvement for motivation factors and productivity. If the expense for motivation factors is increased, productivity will increase too.

If the numbers listed in table 7 are put in ANP chart, then total measure percentage placed at the highest level of the chart would be equal to 20 percent.

This operation has been performed in one of the universities being studied for one year and led to:

- Decreasing employees' dissatisfaction;
- Complaints against supervisors and managers;
- Not employing new employees;
- Replacing human power being released due to productivity improvement with new power;
- Increasing the satisfaction of professors and students;
- Increasing speed for doing works,
- Free time for managers and supervisors to respond to dissatisfied employees, professors and students;
- Using the opportunity to provide a strategic planning;
- Improving activities continuously by providing a suitable feedback from working results;
- Increasing employees and managers independency to do their tasks;
- Decreasing expenses to pursuit affairs;
- Standardizing the way of performing each activity;
- Decreasing employees overtime;

According to the estimate of Science Ministry, it has led to improving the academic, educational, research, welfare and management levels of the given university among Iran universities.

5. Conclusions and Recommendations

This research provides an efficient and effective model for designing portfolio motivations factors to increase the

Table 7
Comparison of research results with those in literature review

Code	Factors	%	Compared references
A3	A serious and practical action in performance assessment	0.85	[22], [26]
A1	Fair salary criteria	0.8	[11,] [19], [16], [27]
S5	Adequate salary	0.7	[22]
M6	Applying the assessment results to improve the performance	0.8	[9], [11], [17], [19]
A2	Work standard	0.75	[19], [26]
S4	Receive appropriate feedback during the work	0.75	[11], [35]
S2	Special skills for specific works	0.35	[11], [35]
S3	Existing freedom and independence on duty	0.55	[11]
S1	Variety of jobs	0.25	[11]
B4	Existing enhanced opportunities	0.8	[9], [11]
M3	Encouragement of employees by manager	0.2	[17]
M4	Get opinion of employees for decision making	0.25	[18]
M2	Setting goal for the staff by manager	0.15	[35], [36]
M1	Manager's Competency and qualification	0.3	-
D2	Effect of gender on motivation (more effect for females)	0.15	[22], [35]
D3	Effect of education on motivation (more effect for educated)	0.3	[22]
D4	Effect of marriage on motivation (more effect for married)	0.15	[18]
D5	Job background and experience	0.5	[19], [26]
S5	Having adequate salary	0.7	[19], [36]
P5	Work ethic	0.5	[18], [22]

productivity by integrating ANP and linear planning in fuzzy conditions. Motivation factors were studied and identified by some interviews and questionnaires. Figure 1 illustrates interaction of factors and effective options on productivity of the organization.They were classified and prioritized; then, the final weight of each motivation factor and reward system being effective in the productivity was defined. Weight of factors and measures are shown in Table 3 for Fuzzy purpose.Finally, considering the limitations of organizational resources, the fulfillment of each motivation factor and reward system for improving productivity were provided. Briefly, the major factors of increasing employees' motivation include: evaluating performance seriously and scientifically, receiving feedback about working results by different ways, providing an opportunity for all employees to progress, the merit and competency of a manager, feeling equality while evaluating employees continuously, a proper and fair measure for salary, premium and reward payment, a standard procedure for doing tasks and consulting with employees for making decisions.Response of each methodof motivation factors for productivity is shown in Table 6, and expense for implementing each option of reward system and motivation factor is illustrated in Table 5. It is also necessary to measure factors affecting employees' motivation by studying and evaluating employees continuously and considering these factors in a specific manner in order to retain and improve employees' motivation for the achievement of organizational plans.Thus, organizations must take serious actions to provide an opportunity for significant improvement and scientific performance evaluation,reflect continuous feedback about the state of job to employees and appoint a competent manager in order that they can increase the productivity of their own organization desirably as they provide a context for employees' professional and social development and evolution.

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