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A Method for Presentation of Knowledge Sharing, Based on the Markov Chain Theory

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Abstract: In this paper,a method of modeling knowledge sharing success, has been proposed thru stochastic processes which is using an Analytic Hierarchy Process (AHP) model.The elements in each row of the transition matrix,is calculated.In Previous studies, thru AHP process, only forecasting of knowledge management (KM) project success or failure was possible. But the problem is, It is not desirable for senior managers to invest immensely for development, only with knowing about possibility of project success or failure.this paper, contribute senior management to make much more effective decision in order to increasing or decreasing investment in knowledge sharing thru implement of the Marcov chain transition matrix.

Key words: Knowledge Management (KM) • knowledge sharing • Analytical Hierarchy Process (AHP) • stochastic process, markov chains

INTRODUCTION

Knowledge has become one of the critical driving forces for business success [1]. Knowledge is often the basis for the effective utilization of many important resources. Organizations are becoming more knowledge-intensive [2].

Knowledge has grown fast recently, as in 20^{th} century, 80% of technology and knowledge and 90% of all of the knowledge and technical information have been produced in the world. The decision regarding whether to implement KM is difficult for many organizations. The sustainable survival or downfall of an organization could be based on this decision and consequently it is crucial to consider internal and external perspectives of an organization before consensus on the knowledge management implementation is achieved. Although successful KM cases have been widely reported, such as Microsoft, Samsung, etc., several examples of failure have also occurred around the world [3].

Many influential factors determine the success of KM implementation. The factors that require consideration include not only financial issues, but also organizational culture and harmony, problems in integrating the new operational process and old, human relationships, effectiveness of strategic management, CEO character and vision, definition of new roles in the organization and many others [4].

Human Resources (HR) and Knowledge management are tightly connected to each other. Owing to non-attentive approaches to human factors a vast number of KM programs confronted with failure [5]. Accordingly it is necessary for successful execution of KM programs; special attention is given to human position and its role.

KNOWLEDGE COMPANY

In recent years the most of Knowledge Company have implemented in knowledge management. The core of the organization is moving from being labor or capital-intensive to being technology-intensive and currently is moving towards becoming knowledge-intensive [4].

Choosing the best policy of knowledge management implementation especially knowledge sharing and keeping its success in the course the time are very important because companies investment is very valuable.

KNOWLEDGE SHARING

An organization that fails to learn, may be sub-optimal or even dysfunctional. In contrast, a learning organization is believed to be able to generate competitive capabilities to sustain its business performance in the market. Leaders who intend to develop their firms as learning organizations need to create supportive environments that are conducive to learn and exchange ideas and knowledge. In this regard, many academics and consultants consider the behaviors

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of learning and the sharing of knowledge among employees and internal organizational units to be the essential elements of knowledge management and Knowledge sharing among coordinated organizations.

Units should contribute to the generation of organizational capabilities, vital to a firm's business performance.

The necessary features for an effective KS in the enterprise would be defined as following: KS is a process through which for attaining the goal, the proper Knowledge, in the proper time, at the proper place, by the proper individual (conveyer), through the proper means and instruments should be at the disposal of proper individual (receiver), to be accepted and used for attaining the designated goal [6].

Human roles in knowledge sharing: One of the important issues that should be considered in the process of Knowledge Sharing is the role(s) which the human plays in this respect. These roles are as follows:

Knowledge presenter, Knowledge Receiver (Knowledge applicant), Knowledge User, Knowledge Broker, Knowledge Sharing Process Manager [7].

Effective factors in human activities and knowledge sharing: In a Knowledge-based enterprise and in an effective knowledge sharing process, everybody plays two roles of conveyer and receiver of Knowledge.In addition, three other critical factors are related to human resource performance in this process : Will, May, Can [8, 9].

- Interesting,transparent and effective on evaluation and compensation motivation and satisfaction of his /her services to give him/her motivation and satisfaction to do the role.(will)
- Defined as his/her possible duty and create proper organizational atmo sphere in order to improve effectiveness of the role(May)
- In his/her ability and authority (Can)

Main barriers and incentives in KS: Different factors, in different situations exist for KS, such as the incentives and barriers. These factors have mutual effect on each other and in case of compatibility/non-compatibility with KS play the role of incentive/barrier.In the next stage we have listed the factors which make the KS effective on the framework of the main factors of human productivity (Will, Can and May) [7]:

Will:

Compensation system: Reward and bonus

Focusing toward individual needs and their satisfaction for growth: Needs assessment, existence, security, esteemed, social, growing etc.

Heeding toward the position of reward for individual: Reward-cost>outcome.

Fairness toward: Individual, group and organization; equality theory, win-win policy, proportion to the abilities and possibilities of individual.

Promotion of positive activity and weakening of negative activity: Reinforcement theory.

Evaluation: Job compensation system, individual, consensus, etc.

Quality of work-life: Flexible working, transparency, Positive.

Job: Role perception, task identification, task signification, autonomy, interacting, feedback, innovation, heuristic, acknowledgement, etc. [8].

Can:

Psychological and physical abilities:

Competence: Expertise, method, social, intelligence

Creating the necessary ability: Empowering, coaching, mentoring.

Training: Leadership, team working, induction training, sabbatical, near the job, self confidence, job rotation etc.

Learning: Story telling, learned how to learn, learning to know, learning to do, etc.

Justification: Know what, know how, know where, know why, etc.

May:

Community of practice: Time and place, out side of the office, inside the office.

Methods, tools and instruments: Data, information bank, documentation, mind mapping, after action review, lessons learned, best practice, network relation, knowledge map, virtual room, visiting room, knowledge market place, face to face meet.

Structure: Network, flat, knowledge office virtual.

Culture: Sharing, open door, discussion groups, risk accepting, coordination. cooperation instead of competition, responsiveness, meeting culture, give and take, work ethic, feedback, confidence, share net shares, enquiry culture, etc.

Leadership: Partnering principal, human oriented, coaching, mentoring, management bye knowledge objectives.

Information and communication technology: Easy to use, just in time, ready to connect, user friendly, proper channel, proper soft,ware and hard ware infrastructure.

MARKOV CHAINS

The Russian mathematician Andreyevich Markov (1856-1922) developed the theory of Markov chains in his paper ‘Extension of the Limit Theorems of Probability Theory to a Sum of Variables Connected in a Chain [10]. A Markov chain is defined as a stochastic process fulfilling the Markov property (Eq. (6)) with a discrete state space and a discrete or continuous parameter space. In this paper, the parameter space represents time and is considered to be discrete. Accordingly, a Markov chain represents a system of elements making transitions from one state to another over time. The order of the chain gives the number of time steps in the past influencing the probability distribution of the present state and can be greater than one [10].

The conditional probabilities

$$p\{X_t = j \mid X_s = i\} = p_{ij}(s,t) \qquad (1)$$

are called transition probabilities of
order r=t-s from state i to state j for all indices

$$0 \le s \le t, \text{with } 1 \le i,j \le k$$

They are denoted as the transition matrix P. For k states P has the following form:

$$p = \begin{vmatrix} p_{11} & p_{12} & \cdots & p_{1k} \\ p_{21} & p_{22} & \cdots & p_{2k} \\ \cdots & \cdots & \cdots & \cdots \\ p_{k1} & p_{k2} & \cdots & p_{kk} \end{vmatrix} \qquad (3)$$

At time 0 the initial distribution of states is

$$P(X_0 = i) = p_i(0) \quad \forall i \in \{1,\ldots,k\} \qquad (4)$$

The state probabilities $p_i(t)$ at time t are estimated from the relative frequencies of the k states, resulting in the vector

$$p(t) = (p_1(t), p_2(t),\ldots,p_k(t)) \qquad (5)$$

Denoting the v-th observed state with in, a stochastic chain fulfilling Eq. (3) is a first-order Markov chain:

$$\begin{aligned} &P\{X_{t+1} = i_{v+1} \mid X_t = i_v, X_{t-1} = i_{v-1},\ldots,X_0 = i_0\} \\ &= P\{X_{t+1} = i_{v+1} \mid X_t = i_v\} \\ &\forall v \ge 2, \forall i_0, i_1,\ldots,i_{v+1} \in \{1\ldots k\} \end{aligned} \qquad (6)$$

Predictions of future state probabilities can be calculated by solving the matrix equation:

$$P(t) = P(t\text{-}1).P$$

With increasing time steps, a Markov chain may approach a constant state probability vector, which is called limiting distribution.

$$p(\infty) = \lim_{t\to\infty} p(t) = \lim_{t\to\infty} p(0).P^t \qquad (7)$$

A state i is called an ‘absorbing state’ if the state cannot be left again once it is entered, i.e. $p_{ii} = 1$. A Markov chain is time-homogeneous, if the transition probabilities are constant over time [11].

CALCULATION OF MATRIX P FOR KNOWLEDGE SHARING

Choosing method: In the quantitative measurement of the knowledge management methods, two methods have more usages. One is AHP and another one is fuzzy measurement. It is possible to use these methods for quantitative measurement in knowledge sharing. We have to calculate probability distribution in each row of matrix P that has to satisfy theorem condition 1-2-3. the method which we used in this paper is AHP which we will get into more details [12].

AHP method: The AHP, developed by Saaty [13] is designed to solve complex multi-criteria decision problems. It is a flexible and powerful tool for handling both quantitative multi-criteria problems. The AHP is aimed at integrating different measures into a single overall score for ranking decision alternatives. Its main characteristic is that it is based on pair wise comparison judgments [14].

The primary advantage of the AHP is enabling to use pair wise comparisons to obtain a ratio scale of measurement which makes comparison among alternatives and measurement of both tangible and intangible factors, possible. For example, the criteria are pair wised compare in terms of their ability to achieve the goal and the alternatives are pair wised compare in terms of their ability to achieve each of the criteria. At each level, the pair wise comparisons are organized into a matrix and the weights of the items being compared are determined by computing the maximum eigen value of the matrix. A weighted averaging approach is used to combine the results across levels of the hierarchy to compute a final weight for each alternative (Fig. 1).

This approach requires a series of ratings or intensities be developed for each criterion (for example, excellent, very good, good, fair and poor). Another important advantage is that the AHP also measures and establishes a tolerance level of inconsistency. comparisons of the AHP and multi-attribute utility theory. They offer a critique of the AHP and argue that the pair wise comparisons are arbitrary, differences in factors such as costs and infection rates are subjectively interpreted and the modeling approach does not adequately represent the decision making problem and produces a unit less and therefore meaningless, score [15, 16] have argued convincingly against these claims [11]. four different states are considered for knowledge sharing. Set of S has four members {successful sharing, unsuccessful sharing, weak sharing and deficient sharing} so matrix P is a 4×4 matrix (Fig. 2).

	i th factor
j th factor	W_{ij}=comparing i th factor to j th factor(the ratio of importance of i th factor to j th factor)

Fig. 1: AHP table for weighting factors

Calculation of probability: In order to calculate matrix P elements AHP has been used. With each AHP implementation, elements of one row of matrix P will be calculated. In this way, implement AHP four times has been needed. According to theorem 1-2-3 and AHP properties one can see that the obtained solution in each implementation of AHP has a probability distribution properties. Process implementation algorithm is shown in Fig. 4.

METHOD IMPLEMENTATION

This method is implemented in one company which produced hygienic products in the country. The most important thing for this company is managers and employees awareness of sale status in different areas.

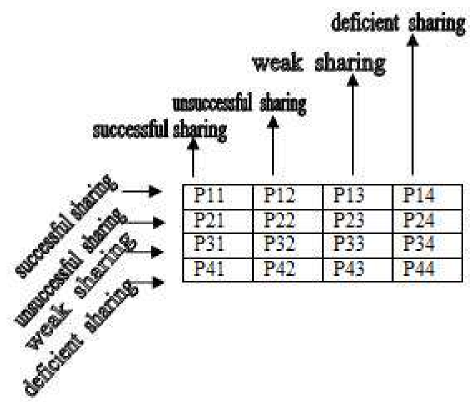

Fig. 2: Transition matrix

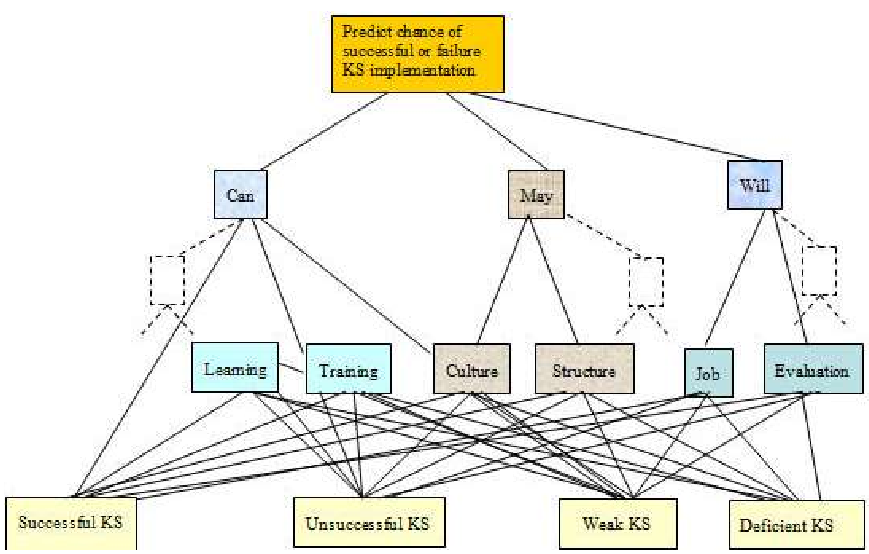

Fig. 3: The AHP model for workers selection

0.357	0.25	0.214	0.179
0.625	0.188	0.125	0.062
0.435	0.044	0.304	0.217
0.258	0.328	0.22	0.194

Fig. 4: AHP numerical result

This problem of predicting the success of KMS implementation. Pair wise comparisons for these three factors are obtained via a series of interviews with the assessment representatives. We ask a group comprising two senior managers, three IT representatives, two KM project representatives and four random sampling staff to analyze the chance of successful KMS implementation.

These managements believed that some of introduced parameters are not compatible with organizational culture or domestic abilities or sale system which is impressed by environmental conditions in north of the country as well as summer trips is not compatible with some parameters. Ultimately, for coordination, some of parameters which were usable in less than 20% of system were omitted. Results are shown in Fig. 4.

CONCLUSION

Nowadays, many organizations are trying to improve their productivity thru KM.Also human resource productivity has a vital role in KS.Therefore, this paper purpose was proposing a method regarding to both effective factors in human resource productivity and in (will,can, may) frame, in order to compute weight and modeling thru AHP. And also show possibility of KS success in transition matrix. It is able to present AHP numerical results as well. This method helps managers to make effective decisions for organizational appropriate KS system according to human resource productivity factors.

REFERENCES

1. Bloodgood, J.M. and David Salisbury, 2005. Understanding the influence of organizational change strategies on information technology and knowledge management strategies, Management Accounting Research, 16: 371-394.
2. Yew Wong, K., 2005. Critical success factors for implementing knowledge management in small and medium enterprises. Industrial Management & Data Systems, 105 (3): 261-279.
3. Liebowitz, J., 1999. Knowledge management, CRC Press.
4. Tien-Chin, W., 2007. Forecasting the probability of successful knowledge management by consistent fuzzy preference relations. Expert Systems with Applications Journal 32:801-813. of Rabbits. Pak. J. Nutr., 1: 279-281.
5. Gibbert, M., M. Leibold and G. Probst, 2002. Five Styles of Customer Knowledge Management and How Smart Companies Use Them To Create Value. European Management Journal, 20 (5): 459-469.
6. Chuck, C.H. Law and Eric W.T. Ngai, 2008. An empirical study of the effects of knowledge sharing and learning behaviors on firm performance. Expert Systems with Applications Journal Volume, 34 (4): 2342-2349.
7. Afrazeh, A., H. Bartsch and H. Hinterhuber, 2003, Effective Factors in Human Activities and Knowledge Sharing', Zuelch, A. (Eds.). European Series in Industrial Management, Vol: 6-2003, Esim, Company Aachen, Germany.
8. Afrazeh, A. and H.H. Bartsch, Hinterhuber, 2004. Human Resources Productivity measurement an Problem Solving Algorithm. Amirkabir Journal of Science & Technology, 15: 157-158.
9. Afraz Afrazeheh, A., 2008. Knowledge Management (Introduction, Models, Measurement and Implementation), 2th Ed., Amirkabir University of Technology Pub. (In Farsi).
10. Markov, A., 1907. Extension of the limit theorems of probability theory to a sum of variables connected in a chain. The Notes of the Imperial Academy of Sciences of St.Petersburg, VIII Series, Physio-Mathematical College XXII, No. 9.
11. Matthew, J. Liberatore and Robert L. Nydick, 2008. The analytic hierarchy process in medical and health care decision making: A Literature Review, European Journal of Operational Research, 189: 194-207.
12. Dyer, J.S., 1990. Remarks on the analytic hierarchy process Management Science, 36 (3): 249-258.
13. Saaty, T.L., 1977. A scaling method for priorities in hierarchical structures. Journal of Mathematical Psychology, 15: 234-281.
14. Ngai, E.W.T. and E.W.C. Chan, 2005. Evaluation of knowledge management tools using AHP. Expert Systems with Applications, 29 (4): 889-899.
15. Dolan, J.G. and D.R. Bordley, 1992. Using the Analytic Hierarchy Process (AHP) to develop and disseminate guidelines. Quality Review Bulletin, 18 (12): 440-447.
16. Dolan, J.G., 1990. Can decision analysis adequately represent clinical problems? Joumal of Clinical Epidemiology, 43 (3): 277-284.