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Analytical study: Workplace Environment in IT Companies and Ranking of Companies using AHP –Topsis Method

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Abstract: *Workplace Environment that attracts, keep and motivate its Employees is considered the best one. Today's workplace is persistently changing. Sound workplace environment lead to employees' satisfaction which in turn helps to increase the productivity of the any Organization. The purpose of the present work is to study analytically the workplace environment in IT companies and its impacts on employee's performance and then ranking of the Companies. To analyse the workplace environment in IT sector various factors are involved like Physical, Economic, Behavioural and Motivational. This paper aims to explore the relationship between workplace environment and ranking of the top-10 listed IT companies in terms of Physical, Economic, Behavioural and Motivational factors using combined AHP-TOPSIS approach. Primary data were collected through the standard questionnaire from the employees of IT Companies. The presented hybrid multiple criteria decision making helps the employees to select the company effectively and objectively when multiple criteria are evaluated simultaneously. The first part of the projected methodology, i.e. AHP is constructive for determining the importance of each criterion and calculating weight of each criterion, while the second part with TOPSIS is useful for evaluating alternatives more precisely and help in ranking of the companies. The model can be implemented as an effective decision aid for potential candidate, investor and customers. Selecting a good company is a big challenge that should be evaluated very carefully.*

Keywords: *Analytical Hierarchy process(AHP), Employees Productivity, IT Sector, Office Environment, Technique of Order Preference by Similarity to Ideal Solution(TOPSIS), Workplace Design*

I. Introduction

Work is most important part of everyone's life. Work and the place of work call attention to many issues related to organizational psychology including job satisfaction, value of work life, human factors, working conditions, performance evaluation, motivation and leadership, and the physical and mental health of workers.

The management has to institute an environment that gives motivation to its employees for higher productivity. This liability lies with the Mangers at various levels of the organization. They have to think over and investigate the innovative working ways through which people can get pleasure from, feel like and have self-importance about what they do. The work environment affects employee self-esteem, efficiency and commitment- both definitely and disapprovingly and it may affect together physical and mental well-being. The present working surroundings is unlike, sole and frequently changing from time to time and context. The conservative employer and employee relationship of past days has been curved upside down. In growing economic there are so many work opportunities in front of employees, this has created a situation where employer needs the employees rather than employee needs employer. Hence, it becomes imperative to understand that work environment which is thought to be very important influence on employees working in IT Sector

The excellence and extent of job done by employees are influenced by the workplace environment. Deprived environmental conditions can cause incompetent worker efficiency as well as reduce their job satisfaction. An unsatisfied worker is a liability for any organization. He can never contribute up to his maximum for the development of the Organization. It may not be out of way to mention that a dissatisfy worker may spread negativity in the Organization which may in turn eclipse its productivity. The various factors influencing the workplace environment are Physical, Economic Motivational and Behavioural. All these factors are interlinked in such a way that no one of them can be treated separately. If these factors are congenial for the workers, the output of the Organization will definitely be at a higher level. The importance of these factors is become more important in case of organization involving creative thinking like IT Industry. The factors have an impact on the psychology of the workers.

IT Companies in India have played a vital role in Indian Economy. In the last 20 years of economic liberalization their contribution has been significant for the Indian Economy. This sector has helped the economy to maintain its growth rate at a higher level and now the IT companies have carved a place for

themselves in the economy.

IT Sector still bears a great unexplored potential for the economy. The easy availability of Technologists is making this sector quite lucrative for domestic as well as for foreign investor. It contributes nearly 60% of our GDP. The productivity in this sector can be further improved if the workers feel comfortable at the work place. The work place environment in a majority of IT offices is unsafe and unhealthy because of poorly planned workstations, inappropriate furniture, lack of ventilation, unsuitable lighting, excessive noise, insufficient safety measures in case of fire emergencies and lack of personal protective equipments. People working in such environment are prone to occupational diseases and it influences their performances. The productivity decreases due to this bad workplace environment. So the purpose of our research is to study carefully all these factor so that performance of employees working in IT sector can be enhanced and simultaneously give an in hand data for all the stakeholders.

II. Literature Review

Yi. Li., 2011 [1] pointed out that both companies and employees are increasingly concerned about the physical environment with the social development and continuous improvement. Empirical studies of enterprises in 12 provinces of China on the basis of the theoretical analysis were conducted. Correlation analysis was used to analysis of data and it showed that physical work environment has a significant impact on employee satisfaction. The workers contentment and performance also have a direct link, thus proving there was a significant correlation between the physical environment and performance of employees. Physical surroundings are the vital guarantee to uphold physical and mental health of employees, improve performance, and constitute the core competitiveness of enterprises.

Saleem, Ambreen. et. al., 2012 [2] conducted the study on the impact of physical environment on employees' productivity in higher education establishment of Khyber Pakhtoonkhawa (KPK) region of Pakistan. A common observation was that an improved workplace environment produces better results**.** The majority of the workplaces are planned according to the nature of the work. In corporate level, productivity is affected by many factors such as workers, technology, and health, safety moral and cultural aspects. Better workplace provides a better output. This study was conducted at individual level i.e., who directly engage in the education at university level. Performance/productivity was taken as dependent variable while furniture, room temperature, noise, lighting and other arrangements were taken as independent variables. Dependent and independent factors were calculated by the feedback from the educationists' of different Universities of KPK province of Pakistan, through the questionnaire. The respondents' replies were obtained by adding across all the item scores of the individual variables. The hypothesize associations among the study variables represented in the model which were tested using multiple regressions & factor analysis. Results reveal that there was a positive relationship between spatial arrangements and productivity. However, there is a pessimistic and considerable impact of noise and temperature on academicians 'productivity of higher education institutes of KPK province of Pakistan. Furniture and lighting has an irrelevant impact on employees' productivity, which shows that sample was not quite enough to explain this relationship significantly.

David McGuire and Lauren McLaren (2008) **[3]** examined the effect of the physical environment on employee commitment. It explores how favorable working conditions can affect an employee's sense of well-being which in turn can generate higher levels of employee commitment. A questionnaire instrument based upon previously validated measures was completed by 65 front line call centre employees. The Baron and Kenny four-step procedure for testing mediation effects was adopted. The statistical analysis confirms that employee well-being mediates the relationship between physical environment and employee commitment.

Jacqueline C. Vischer (2007) **[**4] Studied stress in the work environment and pay slight attention to factor of the physical environment in which work is done. Evidence accumulated that the physical environment of work affects both job performance and job contentment. This research reviewed theory and research bearing on stress in the workplace and explores how current theory might be applied to the relationship between worker behavior and physical features of the work environment. The research presented a hypothetical model of the worker–workspace relationship in which stress and comfort play a vital part, and propose a practical approach on which to base future empirical studies. Thus, by combining elements of work stress research with the environmental psychology of workspace, it was evident that a new area of study was opening up, namely the study of stress attributable to the design of workspace. As we find out more about how, when and why the buildings where people work affect their health and morale, so we would be able to help companies make more humane and cost-effective decisions about workspace.

Barry P. Haynes, (2008**)** [5] evaluated the impact that office comfort has on office occupiers' productivity. Author evaluates the literature that claims to make a linkage between the physical comfort of the office environment and the effect on the productivity of the office occupiers. Office comfort was initially discussed as a generic concept and subsequently broken down into sub-components. It was found that the evaluation of office comfort is a complex one. There appears to be no unanimously established explanation of

office comfort, and there is a clear need of conformity as to how office comfort should be measured. This research established that, there was sufficient data to support the claim that office comfort has an effect on productivity.

Workers in information technology (IT) - enabled services like business process outsourcing and call centers working with visual display units are facing health and psycho social disorders (C. Kesavachandran) 2006 [6], data from formerly published studies in journals and internet sources were examined to look at health problems and psycho-social problems among personnel working in IT-based services. In addition, author executed a questionnaire- based on pilot study. The accessible literature and the pilot study, together propose health disorders and psychosocial problems among workers of Business Process Outsourcing. It was found that Muscular-skeletal disorders, ocular disorders and psycho-social problems were the key health problems observed among IT professionals. The implementation of the course that include training of employees, concepts of ergonomics, health training and overcome the morbidity has become the need of today among workers in ITES

One way organizations increase their competitive advantage through innovative strategies that improve human performance Tim O. Peterson, Jon W. Beard, (2004) [7]. Human performance can be enhanced or constrained by situational factors that are introduced into the organization's work environment. Organization's workspace is one situational factor. The study examines the impact of a new workspace technology on individual privacy and on team interaction**.** It was found that the participants were generally satisfied with the visual privacy but not with the auditory privacy. The research originate that the participants were satisfied with the workspace's ability to facilitate team interaction.

Gretchen, M., Spreitzer. (1995) [8] developed and validated a multidimensional measure of psychological empowerment in the workplace. Second-order assenting factor analyses were conducted with two complementary samples to demonstrate the convergent and discriminated validity of four dimensions of empowerment and their contributions to an overall construct of psychological empowerment. Structural equations modelling were used to examine a homological network of psychological empowerment in the workplace. Tested hypothesis concerned key antecedents and consequences of the construct. Early support for the construct validity of psychological empowerment was found. Cronbah alphas and test-retest coefficient were used to assess the reliability of the empowerment measures. The research contributed to the literature by developing a conceptual definition of empowerment, measuring it, providing evidence of its construct validity and demonstrating its relationship to a number of antecedents and outcomes in the homological network.

Paul Roelofsen, 2002 [9] emphasized that one of the human need is to work in environment that allows people to perform their work optimally under comfortable conditions. Specified that structure and air conditioning systems are designed on the basis of a certain level of discomfort, this raises the key question 'What is the effect of the level of comfort on the productivity of people working in office environments?' He quantified this relationship as an aid to making choices regarding the working environment at strategic level within the facilities administration process, with meticulous emphasis on thermal conditions. It was found that the indoor environment has the biggest effect on productivity in relation to job stress and job dissatisfaction.

Alireza Bolhari et.al. (2012) [10] investigated occupational stress among information Technology (IT) professional and trying to measure the level of occupational stress and studying the relationship occupational stress level of IT professional and a) gender, b) age, c) work experience and d) stress management courses. The research was conducted among 236 IT professionals. The result suggested that stress reduction programs and strategies are inevitable due to high occupational stress levels. The association between strain level and gender, work experience, and stress management courses were approved through path analysis. Finally, implications of the study were discussed in terms of discussion and further research.

Nanjamari. K 2013 [11] emphasized on quality of the work environment because this is a place where workers spend mainly their time outside the home. Long hours are often spent in the working environment by IT employees. The organizations should help employees fight on-the-job-stress which can improve job satisfaction of its workers and thereby increases revenue for the company. There are other work circumstances that were used to determine job satisfaction, and these normally comprise how a company handle conflict, benefits, fair policies, level of interaction between management and employees, job safety, condition and accessibility of working tools and resources for performing work, growth and development opportunities in addition to flexibility, vacation, sick leave with pay, waged holidays, volunteer prospect, comp days, leave of absence, maternity leave, paternity leave, training and development. With all the factors mentioned, it is simple to observe why one's work situation seen as the most important factor of job satisfaction by many researchers. Consequently, study focused on investigating job satisfaction among information technology (IT) employees of Karnataka state. The primary objective of this study was to ascertain the levels of job satisfaction amongst information technology employees at an IT (information technology) and BPO (Business processing outsource) sector. The study undertaken to analyze the job satisfaction amongst information technology (IT) employees in Bangalore city in Karnataka state. The primary and secondary information was used to attain the objectives of

the study. The worldwide aspect of the study were based on the available articles and unpublished works on the theme etc. wholly in the study, books, journals and bulletins are considered to collect date. The primary date was collated through structured questionnaire and interview schedule in an unofficial environment to the IT professions.100 IT employees (1/2) of total employees were chosen randomly out of 200 IT employees in Bangalore city. The statistical tools like percentages and averages were used to analyze the data. The results of this study specify that general satisfaction is significantly associated with satisfaction levels about independence and fundamental factors.

III. Methodology

In this study workplace environment is categorized into four types: Physical, Economic, Behavioural, and Motivational. Physical environments consist of connectivity between users and workplace environments. Subcategories of physical environments include; Flexibility of reorganizing furniture, Comfortable furniture, Noise effect, Room Temperature, Ventilation, Wall Colour, Creach Facility, Recreational facilities, Study Material, Green Surroundings, Pantry facility, Waiting Room, Cleanliness and Distance between gadgets. Economic factors of the work environment directly affected the economic condition of the individual it includes; Compensation paid, Compensation reviewed, Adequate paid leaves, Gratuity policy, financial grants, Interest free loan, Insurance Schemes and Fringe benefits. Behavioural and Motivational environments are concerned with connectivity amongst users, colleagues and their organization. Subcategories of these environments includes; Working conditions, Reorganization as an individual, Suggestions of workers, Identification of Strength and Weakness, Employees as an asset, Innovative things at work , Praise and rewards, Work and personal life, Comfortable and open work Environment, Birthday and Anniversary remembrance and Support in personal crises. Behavioural Factors includes; Clear reporting structure, Support and team work, Company's objectives, Clear cut goals, Defining job responsibilities, Communication for improvement, Individual care and High achievement. We conducted three surveys. The first survey was general survey to find out the relevant factors for second survey. In second survey, consist of 9 point scale given by Saaty in 1980 [12] for analytical hierarchy process (AHP) and the third survey was conducted which was analysed by TOPSIS method. The respondents were requested to mark each response carefully to obtain convincing judgments.

3.1 Analytical Hierarchy Process (AHP)

To achieve our goal we are using technique of Analytical Hierarchy Process (AHP) given by Saaty in 1980 [12]. AHP present an absolute structure for structuring a decision problem to signify and quantify its elements. The result of AHP is a prioritized weighing of each decision alternative. The AHP convert this estimation to numerical values which can be processed and compared over the entire range of the problem. A numerical weight or priority is calculated for each element of the hierarchy which allow varied and repeatedly incommensurable elements to be compared with one another in a realistic and consistent way. The initial step in AHP is to formulate the problem as a hierarchy. The hierarchy comprises of an overall goal at the top level, alternatives for attaining the goal and criteria that relate the alternatives to the goal.

Once the hierarchy is formed, the participants make use of the AHP to establish priorities for all its nodes. For this, the elements of a problem are compared in pairs with respect o their relative impact on a property they share in common. The pair wise comparison is quantified in matrix form by using the scale of Relative Importance developed by Saaty [12] as shown in Table 1.

Table 1 Analytic Hierarchy Measurement Scale

Reciprocal measure of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Weak importance of one over another	Experience and judgment slightly favour one activity over another
5	Moderate importance	Experience and judgments moderately favour one activity over another.
7	Strong Importance	An activity is strongly favoured and its dominance is demonstrated in practice
9	Absolute Importance	The evidence favouring one activity over another is of the highest possible order of affirmation
2,4,6,8	Intermediate values between two adjacent judgments.	When compromise is needed

During the elicitation process, a positive reciprocal matrix is formed in which the $(i,j)^{th}$ element a_{ij} is filled by the corresponding number from the Table 1 and the number is chosen according to the following criterion.

$$\begin{cases} a_{ij},\ if\ x_i\ dominates\ \ x_j \\ \frac{1}{a_{ij}},\ if\ x_j\ dominates\ \ x_i \\ 1,\ if\ x_i\ does\ not\ dominate\ \ x_j\ and\ x_j\ does\ not\ dominate\ \ x_i. \end{cases}$$

The matrix so formed is called the reciprocal matrix. It is used to compute the local priority weight of each criterion. The local priority weight (w) is the normalized eigen vector of the priority matrix corresponding to the maximum eigen value of the matrix. For detail reasoning of this account we refer to Ball and Noel [13], Bryson and Mobolurin [14], Lunging [15] and Saaty [12].

An attractive property of the priority matrix is that if in addition its elements are such that

$$a_{ij}\, a_{jk} = a_{ik}, \quad \forall\ i \le j \le k \qquad (1)$$

Then the derived priority vector w satisfies

$$w_i / w_j = a_{ij}, \quad \forall\ i < j \qquad (2)$$

Any reciprocal matrix satisfying "equation 1" is called consistent. However in practice, the priority matrix seldom satisfies "equation 1", thereby making it more important to define some relaxed measuring of consistency check. Saaty introduced the concept of consistency index CI of a reciprocal matrix as the ratio $\frac{\lambda_{max} - n}{n-1}$, Where λ_{max} and 'n' respectively stand for the maximum eigen value and order of the reciprocal matrix.

Table 2 Random Consistency Index (RI)

N	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

3.1.1 Development of Hierarchical Structure

Planning a hierarchy means of modeling the result graphically at hand. It consists of an overall goal, alternatives to achieve the goal, and a collection of factors or criteria that relate the alternatives to the goal.

The above identified factors are now considered as the relevant criteria and sub criteria and are used to formulate an appropriate AHP model for selecting the factors of workplace environment of IT Companies. Theoretically, all the factors can be included in the AHP-based model, as the AHP methodology will enable us to compare and prioritize them. However, it is not practical to include all factors as they increase the number of pair wise comparisons and the related computational effort. It is also possible that assessment biases may occur in obtaining the pair wise comparison judgments from evaluators. Through AHP application we will come to the weights/importance of each factor in the set of hierarchy. The study includes Employees of IT sectors of all levels. The ranking shows the selection of the most preferred Work Environment where the candidate will prefer to work in.

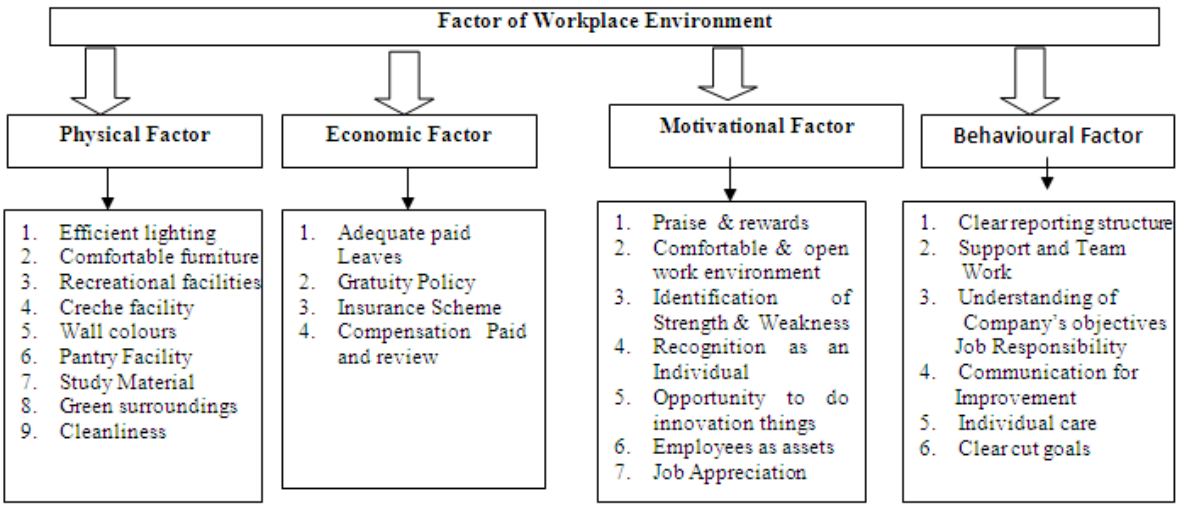

Figure 1 Hierarchy for Workplace Environments and Employees Satisfaction in I.T. Sector

To evaluate the hierarchy (Fig. 1), surveys were conducted to rate each attribute to others in a series of pair wise comparison using a Scale from 1 to 9 (Table 1).An approach of Analytic Hierarch process is applied to find out the weights of each criterion a different levels of hierarchy. Survey results were analyzed for each level of the hierarchy and reciprocal matrices were generated. An aggregated reciprocal matrix was developed for each set of matrices having (C.R<0.2) by taking geometric mean of corresponding values for further calculations. The local priority weights were derived from a series of pair wise comparisons involving all the nodes.

Table 3 Relative Importance of Criteria at Main Level

Attributes	Physical	Economic	Motivational	Behavioural	Priority
Physical	1	1.2268	1.993	0.8247	0.280096
Economic	0.81512	1	2.6502	0.7363	0.265692
Motivational	0.50175	0.37733	1	0.432	0.126308
Behavioural	1.21256	1.35814	2.31481	1	0.327904

λmax = 4.02791 C.I.=0.00930169 C.R. = 0.010341

Table 4, 5, 6 and 7 gives the corresponding matrix at level 2 and weights are also calculated at Physical, Economic, Motivational and Behavioural level. Further, the Global weights of the criteria are calculated as given in table 8 and the graphic presentation of all the weights are shown in "Fig. 2".

Table 4 Relative Importance of Criteria at Physical Factor

Attributes	Efficient lighting	Comfortable furniture	Recreational facilities	Creche facility	Wall colours	Pantry Facility	Study Material	Green surroundings	Cleanliness	Priority
EL	1	2.7737	2.6982	3.06921	2.674	2.4777	2.577	1.7814	2.2747	0.232777
CF	0.360529	1	1.9732	1.4529	0.899	1.1268	1.569	0.57988	0.7562	0.0999892
RF	0.370617	0.50678	1	0.82795	0.715	0.7015	0.672	1.06943	0.4558	0.0692839
CF	0.325817	0.68827	1.2078	1	0.696	1.2648	1.355	0.634639	0.4904	0.0797482
WC	0.373972	1.11175	1.3982	1.4366	1	0.6635	1.193	0.81686	0.4594	0.0883255
PF	0.4036	0.88740	1.4253	0.790591	1.507	1	0.783	0.666111	0.5609	0.0853747
SM	0.387919	0.637137	1.4869	0.737647	0.837	1.2770	1	0.90815	0.5622	0.0832981
GS	0.561355	1.72449	0.9350	1.5757	1.2242	1.5012	1.101	1	0.5614	0.110378
C	0.439618	1.3224	2.1937	2.03882	2.1765	1.7826	1.778	1.78113	1	0.150825

λmax =9.21042 C.I.=0.0263028 CR= 0.018139

Table 5 Relative Importance of Criteria at Economic Factors

Attributes	Adequate paid leaves	Gratuity Policy	Insurance Scheme	Compensation Paid & review	Priority
Adequate paid leaves	1	1.6921	1.42208	1.21252	0.31749
Gratuity Policy	0.590982	1	1.60058	0.668706	0.215905
Insurance Scheme	0.703195	0.624775	1	0.527314	0.169164
Compensation Paid & review	0.824731	1.49543	1.8964	1	0.297441

λmax =4.04435 C.I.=0.014784 C. R. = 0.01642

Table 6 Relative Importance of Criteria at Motivational Factors

Attributes	Praise & rewards	Comfortable & open work envi.	Identification of Strength & Weaknesses	Recognition as an Individual	Opportunity to do innovation things	Employees as an assets	Job Appreciation	Priority
P&R	1	1.9705	2.1118	2.3812	1.584	2.1369	1.578	0.240385
C&OWE	0.5074	1	2.21972	2.2755	1.032	1.2528	1.539	0.172863
ISW	0.4735	0.4505	1	1.9198	0.690	0.793371	1	0.110631
RI	0.4199	0.4394	0.520888	1	0.693	0.71797	0.663	0.083106
OIT	0.6310	0.9683	1.44728	1.4422	1	0.894403	1.164	0.140798
EA	0.4679	0.7982	1.26044	1.3928	1.118	1	0.958	0.128292
JA	0.6335	0.6497	1	1.5071	0.858	1.0432	1	0.123924

λmax =7.09454 C.I.=0.0157559 C. R. = 0.01193

Table 7 Relative Importance of Criteria at Behavioural Factors

Attributes	Clear reporting structure	Support and team work	Understanding of Company's Objective	Job Responsibility	Communication for improvement	Individual care	Clear cut goals	Local Weights
CRS	1	2.22358	2.29879	1.83491	1.83713	2.15125	1.894	0.24965
STW	0.449725	1	2.23325	2.11573	0.96783	1.63783	1.56337	0.17313
UCO	0.435011	0.447778	1	2.16387	0.730607	0.84733	0.96404	0.11274
JR	0.544986	0.472651	0.462136	1	0.872064	0.698827	0.63964	0.08880
CI	0.544328	1.03324	1.36872	1.1467	1	0.918529	1.14221	0.13318
IC	0.464846	0.610564	1.18018	1.43097	1.0887	1	0.693648	0.11580
CCG	0.527983	0.639644	1.0373	1.56338	0.875495	1.44165	1	0.12668

λmax= 7.17197 C.I. = 0.0286614 C.R. =0.02171

Similar matrices are worked out for all the criteria at level 3. Also global priority weights for each criterion are calculated by multiplying its local weight by its upper level criterion's global priority weight.
The evaluation process finally generates the global weights for each requisite criterion of interest as shown in Table 8 and the graphic presentation of all the weights are shown in "Fig. 2".

Table 8: Global weights of the Criteria

Ranking	Attributes	Local Weights	Global Weights
1	Adequate paid Leaves	0.31749	0.084355
2	Clear reporting structure	0.24965	0.08186
3	Compensation Paid and review	0.29744	0.079027
4	Efficient lighting	0.23277	0.065201
5	Gratuity Policy	0.21590	0.057364
6	Support and team work	0.17313	0.05677
7	Insurance Scheme	0.16916	0.044945
8	Communication for Improvement	0.13318	0.04367
9	Cleanliness	0.15082	0.042246
10	Clear cut goals	0.12668	0.04154
11	Individual care	0.11580	0.037973
12	Understanding of Company's Objective	0.11274	0.036968
13	Green surroundings	0.11037	0.030917
14	Praise and rewards	0.24038	0.030363
15	Job Responsibility	0.08880	0.029119
16	Comfortable furniture	0.09998	0.028007
17	Wall colours	0.08832	0.02474
18	Pantry Facility	0.08537	0.023913
19	Study Material	0.08329	0.023332
20	Creche facility	0.07974	0.022337
21	Comfortable and open work environment	0.17286	0.021834
22	Recreational facilities	0.06928	0.019406
23	Opportunity to do innovation things	0.14079	0.017784
24	Employees as assets	0.12829	0.016205
25	Job Appreciation	0.12392	0.015653
26	Identification of Strength and Weaknesses	0.11063	0.013974
27	Recognition as an Individual	0.08310	0.010497

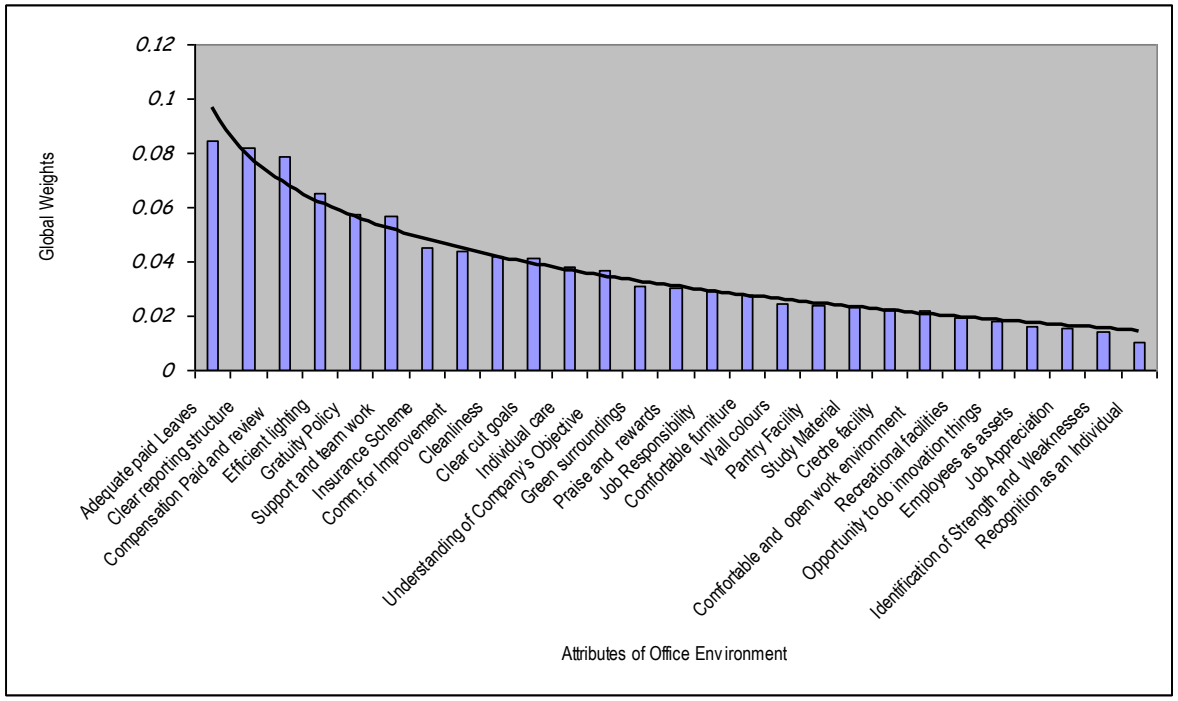

Figure 2

On the basis of above calculations it can be held that factors like adequate paid leave, clear reporting structure, compensation paid and reviewed have a dominant role to play for the employees satisfaction and thereby have a clear cut impact on their productivity compared to the factors like recognition as an Individual, identification of strength and weakness and job appreciation have least impact on the employees satisfaction and thereby on their productivity. It seems that the employees in the IT sector are giving more preference to economic consideration than Motivational Behavioural and Physical Factors.

In the next section, on the basis of factors deprived from AHP , we will rank the companies by using TOPSIS Method that will result in ranking of the companies will give in hand data to the employees, customer and investors.

3.2 TOPSIS (Technique for Order Preference by Similarity to the Ideal Solution)

TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) is a popular approach to AHP and has been widely used in the literature. According to Shih et al. [11], some advantages of TOPSIS are as follows:

- A sound logic that embodies the rational of human choice
- A simple computation process that can be easily programmed into a spreadsheet
- A scalar value that accounts for both the best and worst alternative at the same time.

Let A_i, i = (1,..., m) be a set of m alternatives, C_j, j = (1, ..., n) be n evaluation criteria and W_j, j = (1, ..., n) be the associated criteria weights as shown in "Table 9". It is also assumed that the weights W_j of the criteria have been determined by AHP. Furthermore x_{ij} is the performance measure of alternative A_i with respect to criterion C_j

Table 9 : Decision Matrix

(A_i) ↓	C_1	C_j	C_n
	W_1	W_j	W_n
A_1	x_{11}		x_{1n}
A_i		x_{ij}	
A_m	x_{m1}		x_{mn}

The procedural steps of TOPSIS are summarized as follows:

Step 1: Obtain an evaluation x_{ij} as crisp score for each alternative corresponding to the respective criterion. Here x_{ij} is the performance measure of i^{th} alternative with respect to j^{th} criterion.

Step 2: Normalize the decision matrix using the following equation:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_i x^2_{ij}}} \quad (i=1,..., m), \quad (j=1,..., n) \qquad (1)$$

Normalization of the decision matrix transforms the various attribute dimensions into non dimensional attributes, which allows comparison across the attributes.

Step 3: Form the weighted normalized decision matrix using the formula

$$v_{ij} = w_j r_{ij} \quad (i=1,..., m), \quad (j=1,..., n) \qquad (2)$$

Step 4: Determine the positive ideal and negative-ideal solutions.

$$A^+ = [(\max_i (v_{ij}): j \in J), (\min_i (v_{ij}): j \in J'), (i=1,..., m)]$$

$$= [v_1^+, v_2^+, ..., v_j^+, ...v_n^+] \qquad (3)$$

$$A^- = [(\min_i (v_{ij}): j \in J), (\max_i (v_{ij}): j \in J'), (i=1,..., m)]$$

$$= [v_1^-, v_2^-, ..., v_j^-, ...v_n^-] \qquad (4)$$

- J be the set of benefit attributes or criteria (more is better).
- J´ be the set of negative attributes or criteria (less is better)

Step 5: Calculate the separation measures for each alternative.
Ideal Separation

$$S_i^+ = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^+)^2}, \quad (i=1,..., m) \qquad (5)$$

Negative Ideal Separation

$$S_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^-)^2}, \quad (i=1,..., m) \qquad (6)$$

Step 6: Calculate the relative closeness to the ideal solution.

$$C_i^* = \frac{S_i^-}{S_i^+ + S_i^-}, \quad (i=1,..., m) \qquad (7)$$

Step 7: A set of alternatives can now be preference ranked according to the descending order of C_i^*.

Application of TOPSIS method

We asked 10 experts to give their opinion on 5 point scale for 10 companies based on the given 27 criteria discussed in the previous section. Now we have 10 matrix of each expert which is aggregated by Arithmetic Mean. The resultant aggregated matrix is given in "Table 10" and corresponding normalized matrix (by using equitation 1) given in "Table 11". Weighted normalized Decision Matrix is calculated by using "equation 2" is given in "Table 12". It is to note here that the global weights calculated through AHP in section

3.1 have been used to calculate the weighted normalized decision matrix. Determine the positive ideal and negative-ideal solutions by using "equations 3 & 4" given in "Table 13 and 14" respectively. Finally the ranking of the alternatives is given in the last "Table-15" and also "Fig. 3" depicts the final result via graphic representation.

Table 10 Average Mean of the Data

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27
A1	4	3.2	4	4	4	4	3	2	4	4	4	4	3	5	3	3	2	3	3	3	3	4	3	4	4	3	3
A2	4	3	3	4	1	3	2	3	4	2	3	4	3	3	4	3	3	3	4	2	3	3	3	2	3	3	3
A3	1	2	3	4	1	3	2	2	4	2	4	4	3	2	2	2	3	3	3	3	2	2	3	3	2	2	2
A4	3.9	3.9	4.1	3.6	4.6	3.8	4.5	3.5	4.8	3.6	3.9	3.7	2.9	3.9	3.8	3.8	3.7	4.1	4.7	3.9	4.4	4.2	3.8	3.9	4.1	3.8	4.1
A5	1	2	2	3	1	2.2	1	2.2	3.4	3.4	2.5	1.9	2.1	3.4	2.5	1.1	1.8	2.2	3.1	1.3	2.2	1	2.2	3.4	3.4	2.5	1.9
A6	4.3	2.1	3.8	2.9	3.4	3.1	3.4	3.3	3.9	3.1	4.3	2.1	3.8	2.9	3.4	3.1	3.4	3.3	3.9	3.1	3.1	3.8	2.9	3.4	3.1	3.4	4
A7	4.3	2.1	3.8	2.9	3.4	3.1	3.4	3.3	3.9	3.1	4.3	2.1	3.8	2.9	3.4	3.1	3.4	3.3	3.9	3.1	3.1	3.8	2.9	3.4	3.1	3.4	4
A8	4.3	4	4.1	3.6	5	4.3	4	4.1	4.4	5	4.3	4	4.1	3.6	5	5.3	2.3	3.2	3.3	2.8	4.5	4	4	3.8	3.9	3.8	3.9
A9	4	3.8	4	3.5	5	4.5	4.3	3.1	3.4	3.3	3.9	3.1	4.3	2.1	3.8	2.9	3.4	3.1	3.4	3.3	3.9	3.1	3.8	3.9	3.8	3.9	5.3
A10	1.7	2.7	2.5	4.3	1.2	3.7	4	3.4	4	3.9	3.4	4	4	3.4	4	3.9	3.4	4	2.1	2.8	2.5	2.6	1.7	2.1	2.8	2.5	2.6

Table-11 Normalized decision Matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27
A1	0.36	0.34	0.36	0.35	0.37	0.36	0.29	0.21	0.32	0.37	0.33	0.37	0.27	0.48	0.27	0.29	0.21	0.29	0.27	0.33	0.29	0.38	0.31	0.38	0.37	0.30	0.27
A2	0.36	0.32	0.27	0.35	0.09	0.27	0.19	0.31	0.32	0.18	0.25	0.37	0.27	0.29	0.35	0.29	0.32	0.29	0.36	0.22	0.29	0.29	0.31	0.19	0.28	0.30	0.27
A3	0.09	0.21	0.27	0.35	0.09	0.27	0.19	0.21	0.32	0.18	0.33	0.37	0.27	0.19	0.18	0.19	0.32	0.29	0.27	0.33	0.19	0.19	0.31	0.28	0.19	0.20	0.18
A4	0.35	0.41	0.37	0.32	0.43	0.34	0.43	0.36	0.38	0.33	0.32	0.34	0.26	0.37	0.34	0.36	0.39	0.40	0.42	0.42	0.43	0.40	0.39	0.37	0.38	0.38	0.37
A5	0.09	0.21	0.18	0.26	0.09	0.20	0.10	0.23	0.27	0.31	0.21	0.18	0.19	0.32	0.22	0.11	0.19	0.21	0.28	0.14	0.21	0.10	0.22	0.32	0.32	0.25	0.17
A6	0.39	0.22	0.35	0.25	0.32	0.28	0.32	0.34	0.31	0.28	0.36	0.20	0.35	0.28	0.30	0.30	0.36	0.32	0.35	0.34	0.30	0.36	0.30	0.32	0.29	0.34	0.36
A7	0.39	0.22	0.35	0.25	0.32	0.28	0.32	0.34	0.31	0.28	0.36	0.20	0.35	0.28	0.30	0.30	0.36	0.32	0.35	0.34	0.30	0.36	0.30	0.32	0.29	0.34	0.36
A8	0.39	0.43	0.37	0.32	0.47	0.39	0.38	0.42	0.35	0.46	0.36	0.37	0.37	0.34	0.44	0.51	0.24	0.31	0.30	0.30	0.43	0.38	0.41	0.36	0.37	0.38	0.35
A9	0.36	0.40	0.36	0.31	0.47	0.41	0.41	0.32	0.27	0.30	0.32	0.29	0.39	0.20	0.34	0.28	0.36	0.30	0.31	0.36	0.38	0.30	0.39	0.37	0.36	0.39	0.48
A10	0.15	0.29	0.23	0.38	0.11	0.33	0.38	0.35	0.32	0.36	0.28	0.37	0.37	0.32	0.35	0.37	0.36	0.39	0.19	0.30	0.24	0.25	0.17	0.20	0.26	0.25	0.23

Table-12 Weighted Normalized Decision Matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27
Weights taken from AHP	*0.31*	*0.24*	*0.29*	*0.23*	*0.21*	*0.17*	*0.16*	*0.13*	*0.15*	*0.12*	*0.11*	*0.11*	*0.11*	*0.24*	*0.08*	*0.09*	*0.08*	*0.08*	*0.08*	*0.07*	*0.17*	*0.06*	*0.14*	*0.12*	*0.12*	*0.11*	*0.08*
A1	0.11	0.08	0.11	0.08	0.08	0.06	0.05	0.03	0.05	0.04	0.04	0.04	0.03	0.11	0.02	0.03	0.02	0.02	0.02	0.02	0.05	0.02	0.04	0.05	0.00	0.03	0.02
A2	0.11	0.08	0.08	0.08	0.02	0.05	0.03	0.04	0.05	0.02	0.03	0.04	0.03	0.07	0.03	0.03	0.03	0.02	0.03	0.02	0.05	0.02	0.04	0.02	0.00	0.03	0.02
A3	0.03	0.05	0.08	0.08	0.02	0.05	0.03	0.03	0.05	0.02	0.04	0.04	0.03	0.05	0.01	0.02	0.03	0.02	0.02	0.02	0.03	0.01	0.04	0.03	0.00	0.02	0.01
A4	0.11	0.10	0.11	0.07	0.09	0.06	0.07	0.05	0.06	0.04	0.04	0.04	0.03	0.09	0.03	0.03	0.03	0.03	0.03	0.03	0.07	0.02	0.05	0.04	0.00	0.04	0.03
A5	0.03	0.05	0.05	0.06	0.02	0.03	0.02	0.03	0.04	0.04	0.02	0.02	0.02	0.08	0.02	0.01	0.02	0.02	0.02	0.01	0.04	0.01	0.03	0.04	0.00	0.03	0.01
A6	0.12	0.05	0.10	0.06	0.07	0.05	0.05	0.04	0.05	0.03	0.04	0.02	0.04	0.07	0.02	0.03	0.03	0.03	0.03	0.02	0.05	0.02	0.04	0.04	0.00	0.04	0.03
A7	0.12	0.05	0.10	0.06	0.07	0.05	0.05	0.04	0.05	0.03	0.04	0.02	0.04	0.07	0.02	0.03	0.03	0.03	0.03	0.02	0.05	0.02	0.04	0.04	0.00	0.04	0.03
A8	0.12	0.10	0.11	0.07	0.10	0.07	0.06	0.06	0.05	0.06	0.04	0.04	0.04	0.08	0.04	0.05	0.02	0.02	0.02	0.02	0.07	0.02	0.06	0.04	0.00	0.04	0.03
A9	0.11	0.10	0.11	0.07	0.10	0.07	0.07	0.04	0.04	0.04	0.04	0.03	0.04	0.05	0.03	0.03	0.03	0.02	0.02	0.03	0.06	0.02	0.05	0.04	0.00	0.04	0.04
A10	0.05	0.07	0.07	0.09	0.02	0.06	0.06	0.05	0.05	0.04	0.03	0.04	0.04	0.08	0.03	0.03	0.03	0.03	0.02	0.02	0.04	0.01	0.02	0.02	0.00	0.03	0.02

Table-13 The positive ideal solution

A1	0.01
A2	0.01
A3	0.02
A4	0.01
A5	0.03
A6	0.01
A7	0.01
A8	0.01
A9	0.01
A10	0.01

Table-14 The negative-ideal solution

A1	0.02
A2	0.01
A3	0.00
A4	0.03
A5	0.00
A6	0.02

A7	0.02
A8	0.03
A9	0.03
A10	0.01

Table -15- Ranking of Companies

Ranking	Alternative	Relative Closeness to the ideal solution of 10 alternative is computed using equation 5 & 6
1	A7	0.93641827
2	A4	0.85759309
3	A5	0.73196203
4	A8	0.66539337
5	A1	0.63673304
6	A6	0.59559667
7	A9	0.58803685
8	A2	0.54935141
9	A10	0.44149284
10	A3	0.24358419

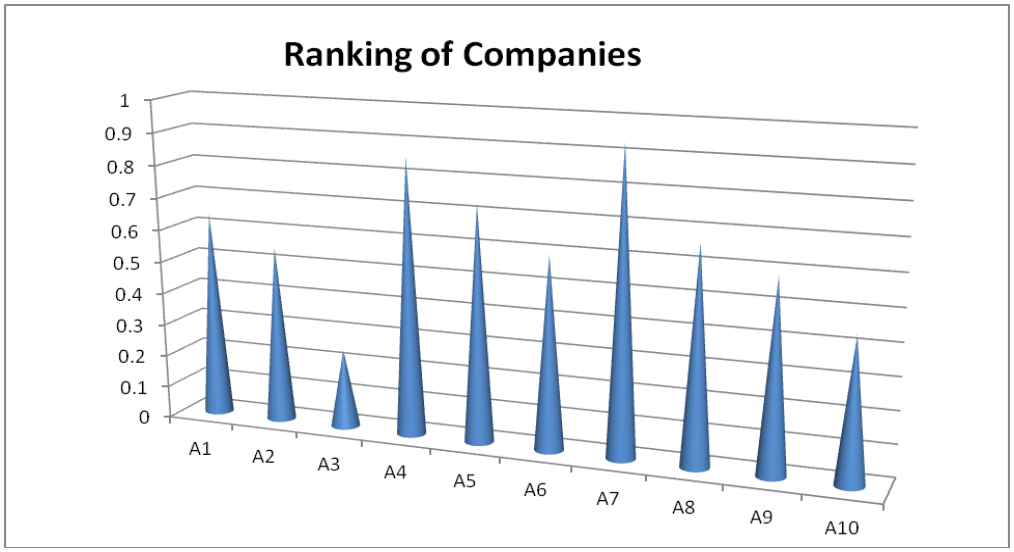

Figure 3

IV. Conclusion

In this paper we have suggested the way of weighing and ranking of companies. The aim of the current research is to develop the decision model for prospective candidate, investor and customers. In the current paper Analytic Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution method is used for ranking 10 IT companies. By applying the AHP the decision maker can examine the strengths and weakness of company by comparing them with respect to appropriate criteria and sub criteria. The model enables us to visualize the impact of various criteria on the final ranking and determines the level of importance of each criterion based on survey analysis. Ranking of companies make a distinction the distress from the healthy ones. Ranking of the Companies promotes Competition and market effectiveness. By ranking of companies Candidates will have enough indication which company to join and making his/her career there. Investors and market-operator will get guild as to where to put money for better return. Customer will also get good information as to with whom they should enter in the contact and develop their software. To support the calculation at advance level we have used TOPSIS method.

Reference

[1]. Yi. Li., Empirical study of the impact of physical environment on the employees performance, in proceeding of Emergency Management and Management Sciences (ICEMMS), 2011 2nd IEEE International Conference, August, 8-11, 2011, Beijing, China Available : IEEE Xplore, http://www.ieee.org.

[2]. Ambreen Saleem et al., Impact of Internal Physical Environment on Academicians Productivity in Pakistan, European Journal of Business and Management, 4(2), 2012, 43-62.
[3]. McGuire David and McLaren Lauren, The impact of physical environment on employee commitment in call centres: The mediating role of employee well-being, Team Performance Management: An International Journal, 15, (1/2), 2009, 35 – 48.
[4]. Jacqueline C. Vischer, The effects of the physical environment on job performance: towards theoretical model of workspace stress, Stress and Health, 23 (3), 2007, 175-184.
[5]. Barry P. Haynes, An Evaluation of the Impact of the Office Environment on Productivity, Facilities, 26 (5/6), 2008, 178 – 195
[6]. C. Kesavachandran et al., Working Conditions and Health among Employees at Information technology--enabled services: a review of current evidence, Indian Journal of Medical Sciences, 60 (7), 2006, 300-30.
[7]. Tim O. Peterson and Jon W. Beard, Workspace Technology's impact on individual privacy and team interaction, Team Performance Management: An International Journal, 10(7/8), 2004, 163 – 172.
[8]. Gretchen, M., Spreitzer, Psychological empowerment in the workplace: Dimensions, measurements and validation, Academy of Management Journal, 38(5), 1995, 1442 – 1465.
[9]. Paul Roelofsen, Performance Loss in Open-Plan Offices due to Noise by Speech, Journal of Facilities Management, 6(3),2008,202 – 211.
[10]. Alireza Bolhari et al., Occupational stress Level among Information Technology Professionals in Iran, International Journals of Information and Electronics Engineering, l 2(5), 2012.
[11]. H.S. Shih., H. J. Syur and E.S. Lee, An Extension of TOPSIS for group decision making, Mathematical and Computer Modeling, 2007, 45(7-8).
[12]. T. L. Saaty, the Analytic Hierarchy Process (McGraw Hill, 1980).
[13]. V.C. Ball, J. Noel and Srinivasan, Using the analytic hierarchy process in house selection, Journal of Real Estate Finance and Economics, 9, 1994, 69-85.
[14]. N. Bryson and A. Mobolurin A, An approach to using the analytic hierarchy process for solving multiple criteria decision making problems, European Journal of Operational Research, 76, 1994, 440-454.
[15]. F. Lunging, Analytical hierarchy in transportation problems, an application for Istanbul, Urban Trans- portation Congress of Istanbul, 2,1992,16-18.