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Analytic network process (ANP) approach for selecting strategies influencing the productivity of knowledge women workers

Asadallah Najafi

Department of Engineering and Technology, Islamic Azad University, Zanjan Branch, Moallem Ave., Zanjan, Iran.

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It is commonly recognized that knowledge is the only source of core competence in the knowledge-based companies, but productivity rate of the knowledge women worker is always low. This study seeks to identify factors influencing productivity. In addition, it presents strategies that influence knowledge women workers' productivity. Strategies were selected using the ANP approach. It is hoped that this paper will help managers to implement different corresponding measures. A case study is presented where this model is measured by the Alupan, Mobarakeh Steel and Irancell companies.

Key words: Analytic Network Process (ANP), women, knowledge worker, productivity.

INTRODUCTION

The world economy has progressed from an industrial economy to a knowledge economy (Najafi, 2010). With knowledge being viewed as a major contributing factor to organisational success, the purveyors of this knowledge in organisations deserve to be focused on. Drucker (1974) first used the term "knowledge worker"; he described these individuals as employees who carry knowledge as a powerful resource which they, rather than the organisation, own. Drucker (1989: 175) states "knowledge workers know that their knowledge gives them freedom to move since everyone's knowledge has a multitude of applications in the information or knowledge age" (Najafi and Afrazeh, 2010; Ramírez and Nembhard, 2004).

Nowadays, improving the productivity of the women knowledge workers is one of the major challenges for the business world. Unlike the blue-collar employees who contribute through their muscle power, women knowledge workers contribute through thinking. The contribution of the women blue-collar employees can be monitored by monitoring their presence at the work spot and also by observing whether they are operating the machine or not; whereas the contribution of women knowledge worker cannot be monitored. It is impossible to observe whether the individual is thinking or not. For thinking, there is no boundary; the employee may think at work spot, residence, on the way to the office or during the morning walk or evening walk or any other time. So by monitoring the presence of the women knowledge worker his contribution cannot be ensured. It is only when the outcome of thinking comes out, the contribution of the women knowledge worker can be seen.

No doubt, productivity process of the women knowledge workers is an outcome of the interaction and combination of different factors (Leigt, 1984).

Productivity of the women knowledge workers is not just an abstract category, and it must necessarily be applicable. The management of the organization will play an important role in providing the suitable ground for institutionalizing and promoting it, and participation of the women knowledge workers is also of high importance from this viewpoint (Afrazeh and Zarinozv, 2010). The

E-mail: asad.najafi@gmail.com.

women knowledge workers are obviously non-manual workers and are usually employed by organizational managers to carry out innovative activities. A women knowledge worker is anyone who works for a living at the tasks of developing or using knowledge (Devenport et al., 2004). Managers that aim to continually improve in the organization should consider factors of the women knowledge workers as a part of the management process (Dainoff, 2009). Therefore, A scientific method is needed to classify factors of the women knowledge workers in organizations. We use the ANP approach, which measures strategic factors.

This study is divided into eight sections. Section 1 deals with women knowledge workers and its factors. Section 2 presents research methodology and the proposed algorithm. Section 3 presents the case study of Alupan, Mobarakeh Steel and irancell companies. The remaining sections analyse the research findings and present the research results and questions for future research.

WOMEN KNOWLEDGE WORKERS

Knowledge is a combination of experience, values, and new information (Lee and Ahmad, 2009). The women knowledge worker creates knowledge, knows how to tap and share it across an organisation (Najafi, 2010).

The women knowledge workers make a living by dealing purely with ideas and information. Anyone who makes a living out of creating, handling or spreading knowledge is a knowledge worker. This covers a wide range. Teachers, trainers, university professors and other academics are clearly included. Writers, authors, editors and public relations or communications people are all knowledge workers. Lawyers, scientists and management consultants can be described as the women knowledge workers. One key difference between the women knowledge workers and other white-collar workers is the level of education and training. As a rule, the women knowledge workers have at least a university undergraduate degree, but that is not always the case (Wiersba**,** 2006; Ramirez, 2006).

The women knowledge workers are well paid compared to other groups of workers. Some women knowledge workers join unions, but they are not usually organized in that sense. They can take their expertise elsewhere at the drop of a hat. We can distil a list of the women knowledge work characteristics (Massingham and Diment, 2009; Drucker, 1999).

1. Knowledge workers like autonomy; they do not like being told what to do.
2. Specifying detailed steps to follow is less valuable than in other types of work.
3. Knowledge workers find it difficult to describe what they do in detail.
4. Commitment matters and makes a huge difference in productivity.

Table 1. Knowledge management process.

Process	Factors
Knowledge identification	KWP_{id}
Knowledge creation	KWP_{cr}
Knowledge capturing	KWP_{ca}
Knowledge application	KWP_{ap}
Knowledge sharing	KWP_{sh}
Knowledge saving and storage	KWP_{ss}

Knowledge worker productivity factors are presented in Table 1 (Leight, 1984).

Factors of the women knowledge worker are defined in Figure 1 (Najafi and Afrazeh, 2010).

RESEARCH METHODOLOGY

It was decided to adopt a case study approach for this paper as there is little existing research on measurement and identification factors of the women knowledge workers. It has been based on the descriptive research. This descriptive type research has been carried out using the questionnaire as the research tool for gathering the required data. Data gathering involved both reference material and a questionnaire survey. Sampling was simple random sampling and the data-gathering instrument was the questionnaire. The author had already undertaken research in this field, which had stimulated the measurement tools and the theoretical framework used to analyze this case study, based on the ANP Method. In November 2007, there was a request for interviews and questionnaires sent to a number of the female managers (240 persons, 65% over 15 years experience) and the female staff (210 persons, 65% over 20 years experience) in any company (Alupan, Mobarakeh Steel and Irancell). Prior to the interview and filling the questionnaire, the author explained the purpose of the research and made it clear that this information would be in the public domain, so any confidentiality concerns could be noted. The interview and questionnaire, from December 2007 to April 2009, lasted five hours per week. The interview and questionnaire were semi-structured in nature, starting off with general questions on the company background and the women knowledge workers to put the respondent at ease. Detailed questions based on factors influencing the women knowledge workers and related frameworks were then used to gather information, with other questions included so as not to limit the information collected. Care was taken not to produce expected answers and flexibility was allowed in the process which enabled an effective two-way dialogue to emerge. To ensure internal validity, the interview and questionnaire sent to the female staff in the Alupan, Mobarakeh Steel and Iran cell companies for

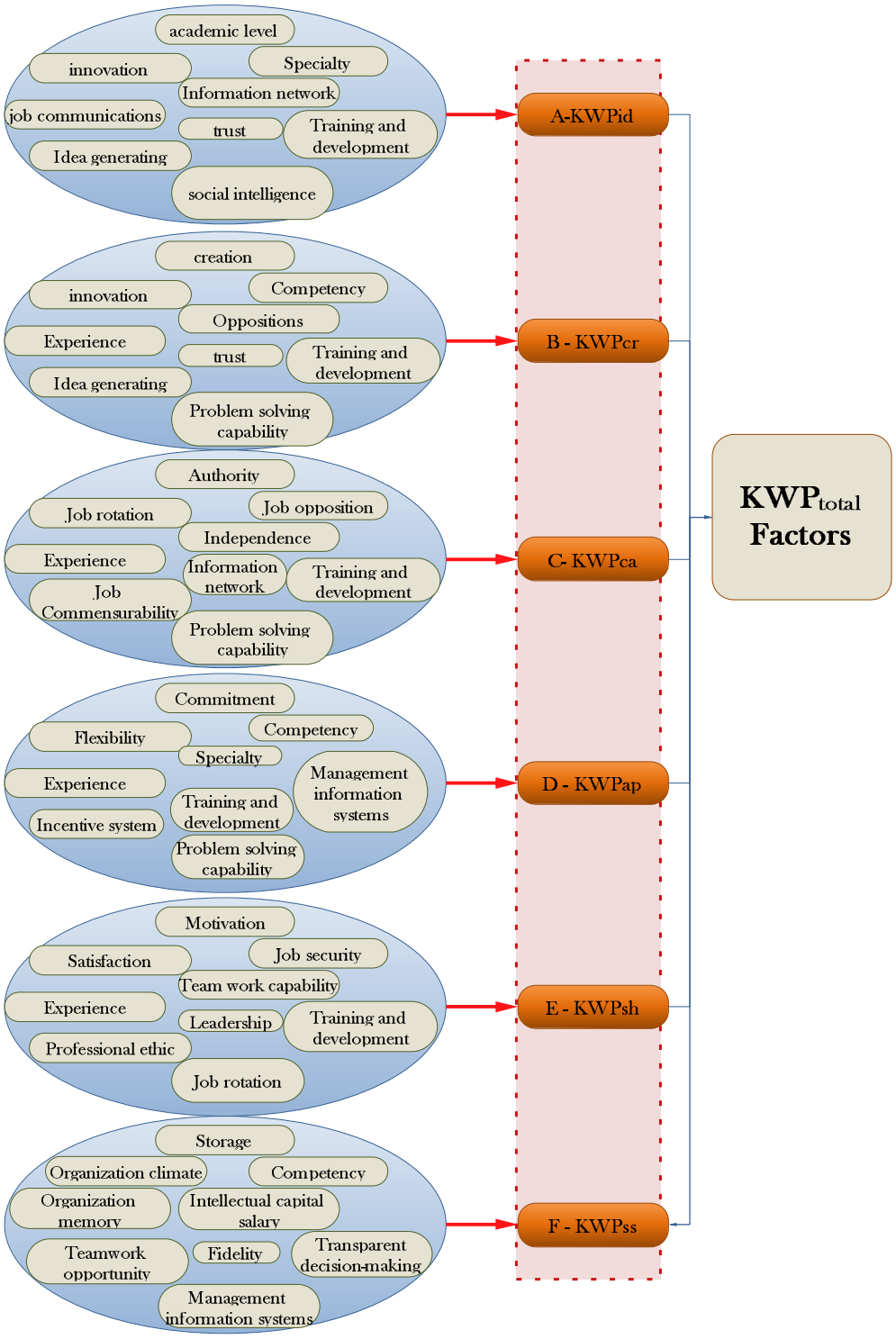

Figure 1. Knowledge worker factors.

confirmation of accuracy and to check that no commercially sensitive information had been included.

Generalizability of the research has been based on partial generalizations. It is possible to similar populations. The knowledge generated by qualitative research is significant in its own right. Problems related to sampling, and generalizations may have little relevance to the goals of the study and the reality of the situation. In this situation, a small sample size has been more useful in examining a situation in company from various

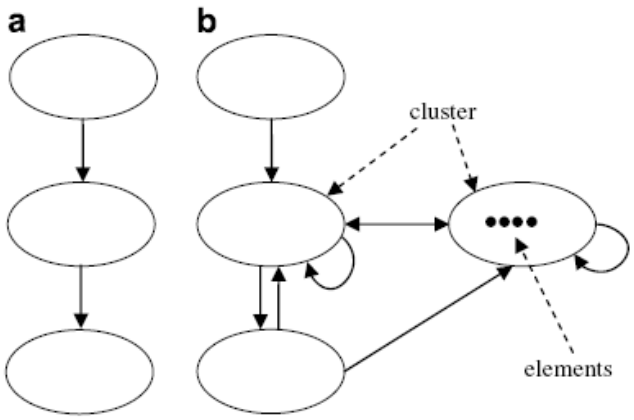

Figure 2. Structural difference between hierarchy (a) and network (b).

perspectives. The goal of a study has been to focus on a selected contemporary phenomenon such as factors influencing the women knowledge workers or measurement addiction where in-depth descriptions would be an essential component of the process. According to research methodology, it presents the ANP method for analyzing of factors.

ANALYTIC NETWORK PROCESS

The ANP approach is a generalization of the analytical hierarchy approach (AHP). The AHP approach represents a framework with a unidirectional hierarchical AHP relationship. The ANP approach allows for complex interrelationships among decision levels and attributes. The ANP feedback approach replaces hierarchies with networks in which the relationships between levels are not easily represented as higher or lower, dominant or subordinate, direct or indirect (Yüksel and Dagdeviren, 2007). Figure 2 presents Structural difference between hierarchy (a) and network (b).

The ANP approach is considered comprehensive and explanatory for multipurpose decision-making discussions and also for solving complex decision-making issues. Studies by Yüksel and Dagdeviren (2007) used the ANP approach to select information system projects that are internally dependent. These studies saw no requirement for doing an ideal zero and one programming (Mikhailov and Singh, 2003). A system with reflective state can be explained by a network. The structural difference between the hierarchy and the network is depicted in Figure 3. The existent element in each cluster can affect all or some of the other cluster elements. A network may contain main clusters, middle clusters, and final clusters. Arrows show the relationships in the network, and their direction shows the dependence. The dependence among clusters can be named external dependence and the internal

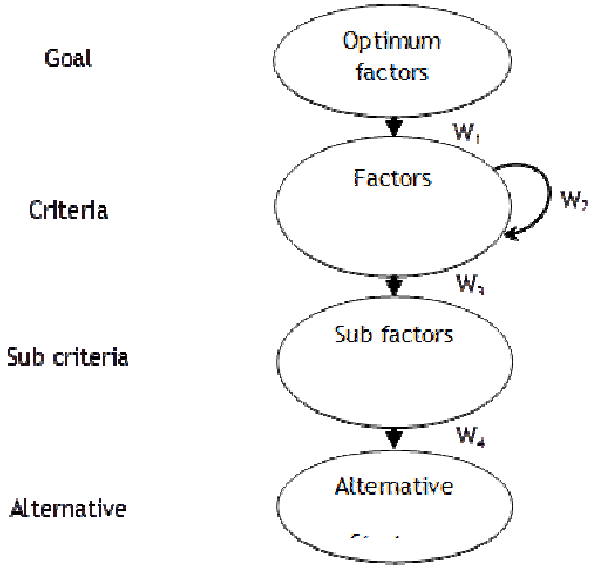

Figure 3. The ANP approach structure.

dependence among elements of a cluster can be called circle dependence (Chung et al., 2005).

THE ANP APPROACH

The ANP approach used in this research is presented in Figure 3.

The main steps of the method are as follows. The first step is locating the element factors, sub-factors and options. Then, according to the internal dependence relationship among the element factors, one determines the internal dependence, element factors weights and strategic options priority vectors, respectively, based on the sub-factors. In Figure 3, the letters inside the parenthesis show the relationship between sub-matrix and super matrix evaluations and are in line with their importance. The following matrix depicts a general sub-matrix for the element model.

$$W = \begin{matrix} \text{Goal} \\ \text{Factors} \\ \text{Sub} \\ \text{Factors} \\ \text{Alternative} \end{matrix} \begin{bmatrix} 0 & 0 & 0 & 0 \\ w_1 & W_2 & 0 & 0 \\ 0 & W_3 & 0 & 0 \\ 0 & 0 & W_4 & I \end{bmatrix},$$

Step 1: Determine the element sub-factors and strategic options according to sub-factors

Step 2: Assume that no dependencies among element factors exist, and then the importance degree of element factors is shown by the numerical scale of 1 to 9

Step 3: Determine the element factors of the internally dependent matrix by the numerical scale of 1 to 9, and

consider other factors by schematic view and internal dependencies among them. (W2 calculation)
Step 4: Specify the internal dependencies' priorities, that is, calculate $w_{factors} = W_2 \times w_1$
Step 5: Specify the importance degree of element sub-factors using the numerical scale of 1 to 9.
Step 6: Specify the importance degree of sub-factors
Step 7: Specify the importance degree of strategic options, considering each sub-factor, on the scale of 1 to 9
Step 8: Calculate the final priority of strategic options derived from the internal relationships among element factors.

$$w_{alternatives} = W_4 \times w_{sub-factors(global)}$$

Case studies: The Alupan, Mobarakeh Steel and Irancell Companies

This section presents an illustration of the proposed approach summarized in the previous section.

The Alupan Company has been established in 1974. Its original capacity was 11 000 tonnes, and it was situated on a plot of land covering 50,000 square metres, 25,000 metres of which were devoted to production. This company is one of the largest producers in the Middle East of industrial profile sections, aluminium doors and windows and exports much of its production to Europe.

The Irancell Company is a private company governed by the Islamic Republic of Iran's commercial code of practice as amended in the year 1347 of the Iranian calendar, which is 1969 in the Gregorian calendar, and the provisions of its Articles of Association. The Company was established on the 14 August, 2005, and the registration number is 252949. The Company has been established for an indefinite period. Irancell comprises two shareholders, which are the Iran Electronic Development Company (IEDC) and MTN International (Mauritius) Limited. A shareholder's agreement was signed between IEDC and MTN in November 2005, and the second mobile operator license was awarded to MTN Irancell on 27 November, 2005 by *MCIT/CRA.

The Mobarakeh Steel Company is the largest industrial complex in the Islamic Republic of Iran and has been established, commissioned after the victory of the Islamic revolution, and entered into operational stage in early 1993. This company is located at 65 kms from south west of Esfahan, which covers a land of 35 kms and has an annual capacity of 4 mt/years of flat steel products ranging in thickness from 0.18 mm to 16 mm in the cold-rolled coils and sheets, tinplate sheets and coils, galvanized and repainted coils. The proposed algorithm is done in the three companies as follows:

Step 1: First, the issue is depicted as a hierarchical structure, which contains the strategic options and sub-factors for the next calculations using ANP approach (Figure 4). The goal is chosen at the first level of the ANP approach and the element factors (identification, creation, acquisition, application, sharing and maintenance) are determined at the second level. The third level contains the three element sub-factors. Furthermore, 13 strategic options are given in the fourth level. The strategic options are as follows: A-C Spiritual and financial motivation based on the output work level, A-D Authority designation to the women Knowledge Workers and awkward rule omission, A-E Communicative and creative environment based on trust, A-F Considering the women Knowledge Workers as piece workers, not day workers, B-D Staff training and development, B-E work cycling in the organization, B-F Bonus and evaluation framework for organizational staff, C-D Creating flexible structures, C-E activity transparency and intellectual property right ownership, C-F Creating suitable informative and communicative structures, D-E creating collaboration opportunities, D-F Improving the organizational atmosphere, E-F Creating job security. The women knowledge workers' strategies at Alupan are defined in Figure 4 [Najafi, Afrazeh 2010].

Step 2: Assume that there is no dependency among the element factors. Determine the factors' pair comparison matrix using the numerical scale of 1 to 9.

$$W_1 = \begin{bmatrix} A \\ B \\ C \\ D \\ E \\ F \end{bmatrix} = \begin{bmatrix} .366 \\ .231 \\ .170 \\ .114 \\ .078 \\ .041 \end{bmatrix}$$

Step 3: The internal dependency among element factors is determined by comparing the effect of each factor on other factors. As mentioned in the preface, considering independence among the element factors is not always possible. Suitable and realistic results are obtained from the ANP technique and element analysis. An analysis of internal and external environment elements reveals the element factors' dependencies as shown in Figure 5. The internal dependency of the element matrix, based on the calculated relative importance weights, is shown by W2. While opportunities are only influenced by strengths, a pair comparison matrix cannot be formulated for the opportunities. Internal dependency of factors is defined in Figure 5.

$$W_2 = \begin{bmatrix} 1 & 0 & .565 & .44 & .422 & .490 \\ 0 & 1 & 0 & .307 & .329 & .249 \\ .53 & 0 & 1 & .029 & .039 & .042 \\ .31 & .055 & .056 & 1 & .078 & .081 \\ .117 & .173 & .089 & .067 & 1 & .138 \\ .042 & .772 & .290 & .157 & .131 & 1 \end{bmatrix}$$

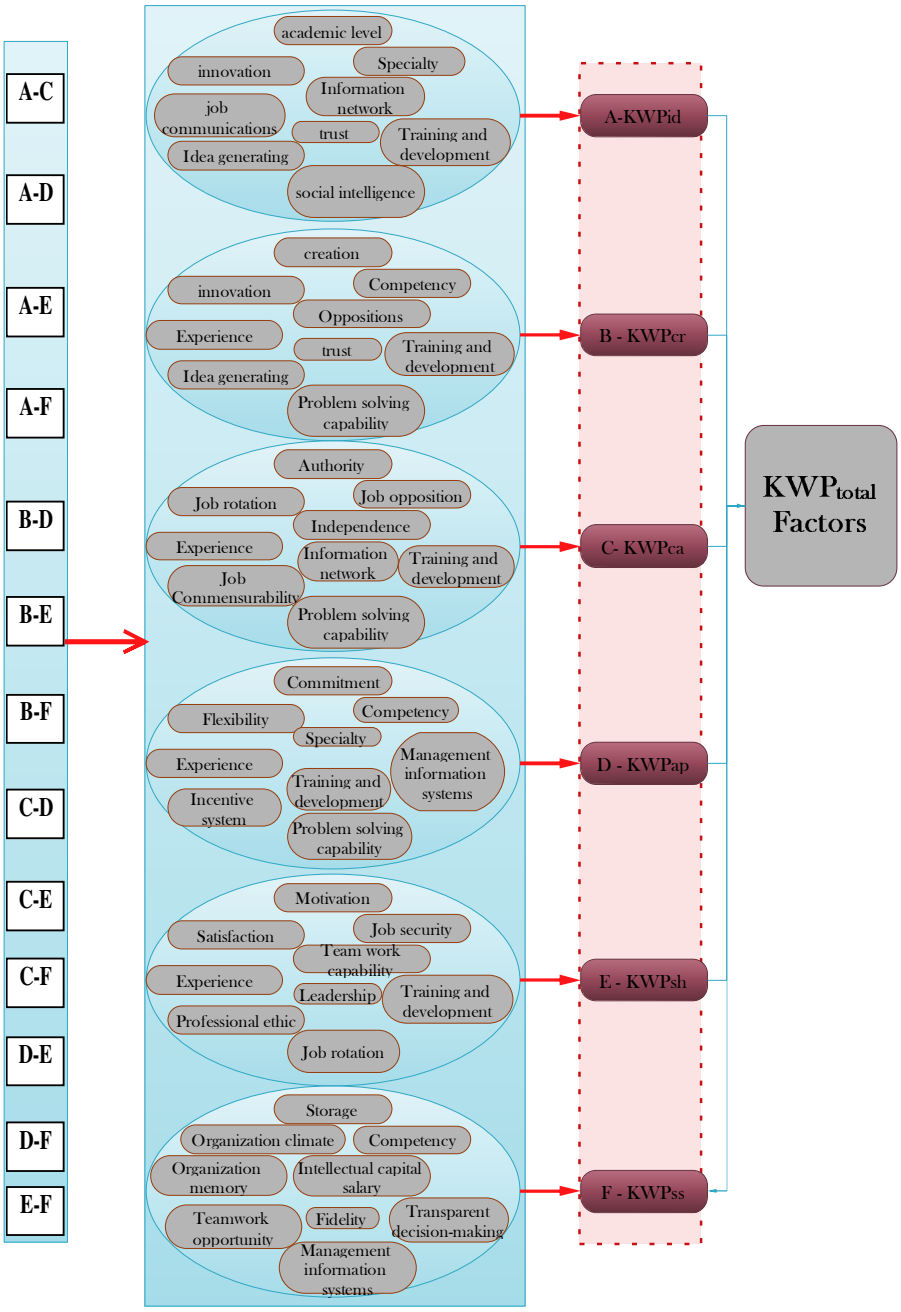

Figure 4. The women knowledge worker strategies.

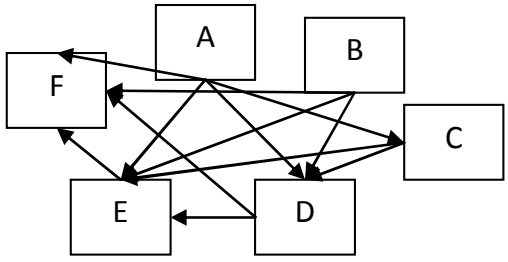

Figure 5. Internal dependency of factors.

Step 4: Priorities for internal dependencies among the factors are calculated as follows:

$$w_{factorsw} = W_2 * W_1 = \begin{bmatrix} 1 & 0 & .565 & .44 & .422 & .490 \\ 0 & 1 & 0 & .307 & .329 & .249 \\ .53 & 0 & 1 & .029 & .039 & .042 \\ .31 & .055 & .056 & 1 & .078 & .081 \\ .117 & .173 & .089 & .067 & 1 & .138 \\ .042 & .772 & .290 & .157 & .131 & 1 \end{bmatrix} * \begin{bmatrix} .366 \\ .231 \\ .170 \\ .114 \\ .078 \\ .041 \end{bmatrix} = \begin{bmatrix} .565 \\ .302 \\ .372 \\ .260 \\ .189 \\ .312 \end{bmatrix}$$

Factor priority results, including A, B, C, D, E, F have changed from 0.366 to 0.565, from 0.231 to 0.302, from 0.17 to 0.372, from 0.114 to 0.260, from 0.078 to 0.189 and from 0.041 to 0.312.

Step 5: Local priorities of sub-factors were calculated using the pair comparisons matrix. The priority vector is defined in Appendices 1, 2, 3. According to the priorities, it defines the vector of sub factors.

$$W_{sub-fdactors-A} = \begin{bmatrix} 0.308 \\ 0.192 \\ 0.151 \\ 0.133 \\ 0.108 \\ 0.108 \end{bmatrix}, W_{sub-fdactors-B} = \begin{bmatrix} 0.352 \\ 0.181 \\ 0.150 \\ 0.110 \\ 0.150 \\ 0.062 \\ 0.031 \\ 0.028 \\ 0.022 \\ 0.015 \\ 0.009 \end{bmatrix},$$

$$W_{sub-fdactors-C} = \begin{bmatrix} 0.35 \\ 0.29 \\ 0.15 \\ 0.13 \\ 0.08 \end{bmatrix}, W_{sub-fdactors-D} = \begin{bmatrix} 0.255 \\ 0.202 \\ 0.132 \\ 0.123 \\ 0.102 \\ 0.095 \\ 0.085 \\ 0.072 \\ 0.033 \\ 0.028 \\ 0.018 \\ 0.012 \\ 0.008 \end{bmatrix},$$

$$W_{sub-fdactors-E} = \begin{bmatrix} 0.208 \\ 0.119 \\ 0.113 \\ 0.122 \\ 0.106 \\ 0.095 \\ 0.084 \\ 0.052 \\ 0.034 \\ 0.025 \\ 0.018 \\ 0.012 \\ 0.008 \\ 0.003 \\ 0.001 \end{bmatrix}, W_{sub-fdactors-F} = \begin{bmatrix} 0.342 \\ 0.211 \\ 0.178 \\ 0.105 \\ 0.077 \\ 0.055 \\ 0.032 \end{bmatrix}$$

Step 6: General priorities of the element sub-factors are calculated by multiplying the internal dependency priorities, obtained in Step 4, by the local priorities of element sub-factors, obtained in Step 5. The results are depicted in appendices 1, 2, 3. Vector $W_{sub-factors(global)}$ which is obtained from the general priority amounts in the last column of appendix 1, 2, 3 is at appendix 4.

Step 7: The degree of strategic options' importance is calculated from each element's sub-factor viewpoints. Special vectors are calculated from the analysis of this matrix and matrix W4 in Appendix 5.

Step 8: Finally, the general priorities of strategic options are calculated considering the internal dependencies of element factors, as follows:

$$w_{alternatives} = \begin{bmatrix} \text{A - C} \\ \text{A} - D \\ \text{A} - \text{E} \\ \text{A} - F \\ \text{B} - D \\ \text{B} - \text{E} \\ \text{B} - F \\ C - D \\ C - E \\ C - F \\ D - E \\ D - F \\ E - F \end{bmatrix} = W_4 * w_{sub-factors(global)} = \begin{bmatrix} 0.076 \\ 0.080 \\ 0.085 \\ 0.081 \\ 0.063 \\ 0.071 \\ 0.078 \\ 0.086 \\ 0.097 \\ 0.089 \\ 0.095 \\ 0.066 \\ 0.078 \end{bmatrix}$$

The general results can be organized from the highest score to the lowest. The results of the ANP approach show that the most important strategy for the women knowledge worker's productivity is the C-E strategy or activity transparency and intellectual property right ownership whose score is 0.097. Another important strategy in step 2 is D-E or creating collaboration opportunities in organizations. The significant strategies in step 3 are C-F or creating suitable informative and communicative structures, C-D or creating flexible structures, A-E or Communicative and creative environment based on trust, A-F or considering the women Knowledge Workers as piece workers, not day workers, A-D or authority designation to the women Knowledge Workers and awkward rule omission. The important strategies in the fourth step are as follows: B-F Bonus and evaluation framework for organizational staff, E-F Creating job security, -C or Spiritual and financial motivation based on the output level, B-E or work cycling in the organization. The important strategies in the last step are as follows: D-F or Improving the organizational atmosphere, B-D or Staff training and development. It should be mentioned that to improve organization success, all the above-mentioned strategies must be employed. However, in keeping with the company's financial and time constraints, they have been divided into five categories. The project of

the company has based its current year's programme on the first step or optimum strategy and is affecting reforms based on that. Next year's programme will include all the above strategies. This method was tested using Cronbach's alpha (its value was more than 98.03); it has been validated and confirmed by 97% of the experts, 98% of the managers, and by company directors. The results showed a questionnaire validity of 97.0784%. Its validity was measured using the Cronbach Alpha Coefficient, which equalled 98.3. These results indicate the reliability and validity of the research.

DISCUSSION

This study faced many challenges in its model validation test. The first is that the ANP approach factors are not naturally quantitative. The ANP approach is a technique for solving multi-criteria decision-making by using the dependence among quantitative and qualitative factors. However, it is not always possible to apply numerical and quantitative amounts to elements in decision-making. It is also that for each calculation, different amounts resulted. This may be due to the different viewpoints among the experts who evaluated the matrix. Thus, it seems impossible to obtain similar amounts based on the data obtained from different studies. These limitations are exacerbated by the nature of decision-making. It is natural that in different circumstances, there are different priorities. It should be noted that the existent differences among the pair comparison amounts, which are due to the differences in expert viewpoints, are not sufficient reasons for rejecting the proposed model's validity in the ANP approach discussions (Chung et al., 2005; Ngai, 2003). Another problem is that the validity of this model has not been tested using the latest data, and that is because those data are available only to special managers. The comparison matrix, which is the input for the proposed model, was composed under definite conditions; hence, results may differ due to the pair comparison matrix's composition in different periods (Saaty, 1980). This model may be improved as the factors and sub-factors keep changing. Each management team should apply these strategies to the model according to the strategic factors in play. Second, the amount of dependence among factors and sub-factors may vary based on the management type. For example, in The Alupan, Mobarakeh Steel and Irancell companies, only the dependence among important element factors is evaluated. The inconsistent ratio resulting from the pair comparison matrix also confirms this model. The inconsistent ratio or CR is based on the inconsistency index and Random index. Inconsistency index or CI can be obtained through the following formula:

$$CI = (\lambda_{\max} - n)/(n-1)$$

Where $\lambda_{\max}$ is the highest special amount and n is the matrix dimension. Inconsistency ratio (CR) is composed of two parameters: inconsistency index (CI) and Random index (RI). The relationship between RI and n is as follows: RI = 1.98 * [(n – 2) / n].

Where 1.75 is the ratio of the average amount of all numbers for n=3 until n=15, each having been multiplied by (n-2)/n. The calculated amount for the inconsistency ratio in ANP should not be less than 0.1. The inconsistency ratio of the pair comparison matrix is calculated using Expert Choice (Expert Choice, 2000). All inconsistency ratio amounts are less than 0.1. The most important elements in the women knowledge workers are activity transparency and intellectual property right ownership. This analysis of factors for the women knowledge workers' productivity using the proposed approach is the first to its kind and is hence considered unique.

Conclusion

This study has identified and analyzed factors influence productivity of the women knowledge workers. In addition, it has presented strategies that influence the women knowledge workers' productivity. Strategies were selected using the ANP approach. This approach has been verified and validated in the case studies (The Alupan, Mobarakeh Steel and Irancell companies).

The results of this research show that the most important strategy is the C-E strategy or activity transparency and intellectual property rights whose score is 0.097.

Activity transparency and intellectual property rights are very important for these companies, because the current global economic crisis is focusing renewed attention on the urgent need to incentivize and protect innovation to both solve the world's most challenging problems and to generate jobs and economic growth. Intellectual Property (IP), which refers to everything from inventions to the creative arts, drives innovation and improves our lives—generating life-saving devices and medicines, discovering new energy and climate-saving technologies, finding novel ways to create and deliver information, and generating consumer goods of all types. Indeed, the nation's future economy will be in the companies that rely on innovation and strong IP rights. Below are some specific arguments and facts about the importance of fostering effective protection of IP, in particular patent, trademark, and copyright protection and enforcement.

All inconsistency ratio amounts are less than 0.1, and this method tested using Cronbach's alpha (its value was more than 98.03); it is validated and confirmed by 97% of the experts, 98% of the managers, and by company directors.

The results showed a questionnaire validity of 97.0784%. Its validity is measured using the Cronbach Alpha Coefficient, which is equal to 98.3. These results indicate the reliability and validity of the research.

LIMITATIONS

Before addressing the future research and references of the review, the study first needs to address three important limitations of our study. First, only few empirical and relevant conceptual studies were found, and the study is therefore, not able to draw strong conclusions on the impact of the various conceptualizations of factors influencing women knowledge workers. Furthermore, from the literature review, it appears that several factors may intervene in the women knowledge workers. Finally, the operationalizations of the women knowledge worker factors differ across the studies reviewed, reducing the ability to compare the results found in these studies. One possible follow-up is the comparison of the proposed method with other models, such as Fuzzy MCDM methods.

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Appendix 1. Sub-factor priorities of A and B.

Total Priority of Sub-factors	Priority of Sub-factors	Sub-factors	Priority of factors	Factors
0.1127	0.308	Social intelligence		
0.0703	0.192	Academic level		
0.0553	0.151	Job communications		
0.0487	0.133	Specialty		
0.0395	0.108	Training and development		
0.0395	0.108	Information network	0.366	**A**
0.0813	0.352	Creation		
0.0418	0.181	Innovation		
0.0347	0.15	Experience		
0.0254	0.11	Idea generating		
0.0347	0.15	Oppositions		
0.0143	0.062	Problem solving capability		
0.0072	0.031	Trust		
0.0065	0.028	Competency		
0.0051	0.022	Job opposition		
0.0035	0.015	Independence		
0.0021	0.009	Information network	0.231	**B**

Appendix 2. Sub-factor priorities of C and D.

Total Priority of Sub-factors	Priority of Sub-factors	Sub-factors	Priority of factors	Factors
0.0595	0.35	Authority		
0.0493	0.29	Job Commensurability		
0.0255	0.15	Team work capability	0.17	**C**
0.0221	0.13	Information network		
0.0136	0.08	Teamwork opportunity		
0.0291	0.255	Experience		
0.023	0.202	Commitment		
0.015	0.132	Fidelity		
0.014	0.123	Job communications		
0.0116	0.102	Flexibility		
0.0108	0.095	Organizational culture		
0.0097	0.085	Leadership	0.114	**D**
0.0082	0.072	Job Commensurability		
0.0038	0.033	Team work capability		
0.0032	0.028	Incentive system		
0.0021	0.018	Transparent decision-making		
0.0014	0.012	Job rotation		
0.0009	0.008	Intellectual capital salary		

Appendix 3. Sub-factor priorities of E and F.

Total Priority of Sub-factors	Priority of Sub-factors	Sub-factors	Priority of factors	Factors
0.0162	0.208	Professional ethic		
0.0093	0.119	Commitment		
0.0088	0.113	Fidelity		
0.0095	0.122	Social intelligence		
0.0083	0.106	Motivation		
0.0074	0.095	Satisfaction		
0.0066	0.084	Organizational culture		
0.0041	0.052	Trust	0.078	**E**
0.0027	0.034	Job security		
0.002	0.025	Competency		
0.0014	0.018	Team work capability		
0.0009	0.012	Organizational climate		
0.0006	0.008	Incentive system		
0.0002	0.003	Job rotation		
0.0001	0.001	Teamwork opportunity		
0.014	0.342	Fidelity		
0.0087	0.211	Transparent decision-making		
0.0073	0.178	Storage		
0.0043	0.105	Management information systems	0.041	**F**
0.0032	0.077	Communication Infrastructures		
0.0023	0.055	Organizational memory		
0.0013	0.032	Intellectual capital salary		

$$W_{sub-factors} = \begin{bmatrix} 0.112\,7 \\ 0.070\,3 \\ 0.055\,3 \\ 0.048\,7 \\ 0.039\,5 \\ 0.039\,5 \\ 0.081\,3 \\ 0.041\,8 \\ 0.034\,7 \\ 0.025\,4 \\ 0.034\,7 \\ 0.014\,3 \\ 0.007\,2 \\ 0.006\,5 \\ 0.005\,1 \\ 0.003\,5 \\ 0.002\,1 \\ 0.059\,5 \\ 0.049\,3 \\ 0.025\,5 \\ 0.022\,1 \\ 0.013\,6 \\ 0.029\,1 \\ 0.023\,0 \\ 0.015\,0 \\ 0.014\,0 \\ 0.011\,6 \\ 0.010\,8 \\ 0.009\,7 \\ 0.008\,2 \\ 0.003\,8 \\ 0.003\,2 \\ 0.002\,1 \\ 0.001\,4 \\ 0.000\,9 \\ 0.016\,2 \\ 0.009\,3 \\ 0.008\,8 \\ 0.009\,5 \\ 0.008\,3 \\ 0.007\,4 \\ 0.006\,6 \\ 0.004\,1 \\ 0.002\,7 \\ 0.002\,0 \\ 0.001\,4 \\ 0.000\,9 \\ 0.000\,6 \\ 0.000\,2 \\ 0.000\,1 \\ 0.014\,0 \\ 0.008\,7 \\ 0.007\,3 \\ 0.004\,3 \\ 0.003\,2 \\ 0.002\,3 \\ 0.001\,3 \end{bmatrix}$$

Appendix 4. Vector $W_{sub-factors(global)}$.

Appendix 5. W_4 matrix $W_{4=}$.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.05	0.03	0.10	0.01	0.06	0.10	0.11	0.04	0.08	0.10	0.09	0.03	0.05	0.06	0.08
0.11	0.10	0.07	0.05	0.09	0.09	0.01	0.12	0.14	0.06	0.07	0.03	0.06	0.14	0.12
0.09	0.06	0.10	0.08	0.13	0.12	0.01	0.12	0.08	0.11	0.11	0.01	0.04	0.12	0.06
0.08	0.05	0.10	0.11	0.06	0.12	0.03	0.05	0.13	0.05	0.07	0.13	0.15	0.13	0.05
0.04	0.05	0.07	0.01	0.13	0.04	0.04	0.06	0.01	0.04	0.08	0.16	0.01	0.03	0.07
0.08	0.05	0.06	0.11	0.07	0.07	0.09	0.01	0.07	0.09	0.07	0.01	0.08	0.01	0.00
0.11	0.01	0.10	0.03	0.04	0.11	0.08	0.06	0.08	0.16	0.03	0.05	0.05	0.05	0.16
0.06	0.13	0.04	0.15	0.02	0.04	0.14	0.06	0.02	0.04	0.06	0.09	0.12	0.08	0.01
0.09	0.16	0.08	0.10	0.11	0.12	0.12	0.08	0.06	0.01	0.10	0.18	0.12	0.00	0.02
0.06	0.14	0.08	0.10	0.04	0.00	0.12	0.08	0.05	0.14	0.09	0.16	0.15	0.14	0.15
0.12	0.11	0.10	0.11	0.10	0.09	0.16	0.16	0.05	0.04	0.08	0.04	0.09	0.10	0.10
0.01	0.11	0.04	0.05	0.02	0.01	0.08	0.13	0.15	0.04	0.04	0.01	0.08	0.10	0.06
0.12	0.01	0.08	0.09	0.13	0.11	0.01	0.03	0.09	0.14	0.10	0.10	0.00	0.05	0.12
...														
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0.06	0.07	0.05	0.02	0.16	0.04	0.09	0.10	0.08	0.06	0.12	0.17	0.19	0.01	0.05
0.16	0.15	0.01	0.14	0.04	0.00	0.07	0.12	0.07	0.01	0.14	0.10	0.18	0.10	0.06
0.04	0.04	0.10	0.14	0.03	0.05	0.11	0.10	0.00	0.12	0.09	0.09	0.03	0.08	0.10
0.12	0.07	0.10	0.13	0.10	0.09	0.06	0.10	0.08	0.08	0.00	0.07	0.04	0.13	0.10
0.00	0.05	0.01	0.05	0.14	0.10	0.16	0.13	0.04	0.13	0.08	0.08	0.15	0.13	0.08
0.05	0.13	0.08	0.06	0.05	0.10	0.12	0.03	0.13	0.08	0.02	0.02	0.03	0.07	0.05
0.16	0.15	0.05	0.09	0.03	0.07	0.01	0.13	0.16	0.11	0.07	0.07	0.07	0.06	0.10
0.04	0.04	0.17	0.09	0.03	0.13	0.02	0.09	0.04	0.11	0.16	0.07	0.02	0.02	0.07
0.14	0.06	0.13	0.03	0.11	0.13	0.14	0.02	0.07	0.10	0.16	0.05	0.09	0.12	0.05
0.05	0.12	0.02	0.12	0.10	0.15	0.11	0.10	0.11	0.04	0.08	0.12	0.09	0.11	0.10
0.15	0.08	0.02	0.09	0.09	0.07	0.07	0.05	0.14	0.09	0.03	0.01	0.05	0.05	0.10
0.02	0.01	0.16	0.02	0.10	0.00	0.05	0.00	0.03	0.04	0.01	0.15	0.00	0.07	0.11
0.03	0.05	0.12	0.03	0.03	0.06	0.01	0.03	0.07	0.05	0.05	0.01	0.06	0.05	0.03
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
0.17	0.10	0.13	0.10	0.08	0.15	0.05	0.12	0.09	0.11	0.07	0.06	0.12	0.03	0.12
0.07	0.04	0.00	0.03	0.12	0.13	0.07	0.03	0.08	0.09	0.12	0.10	0.04	0.03	0.09
0.11	0.04	0.02	0.06	0.14	0.04	0.14	0.05	0.03	0.11	0.04	0.13	0.09	0.09	0.11
0.06	0.07	0.11	0.11	0.02	0.06	0.03	0.01	0.08	0.02	0.11	0.04	0.03	0.10	0.05
0.01	0.10	0.11	0.12	0.11	0.02	0.05	0.18	0.08	0.09	0.04	0.05	0.05	0.10	0.09
0.20	0.07	0.09	0.06	0.01	0.02	0.15	0.12	0.13	0.08	0.01	0.09	0.08	0.01	0.08
0.05	0.02	0.08	0.13	0.05	0.17	0.10	0.08	0.00	0.08	0.10	0.11	0.08	0.13	0.03
0.01	0.09	0.04	0.00	0.00	0.11	0.05	0.11	0.04	0.09	0.12	0.02	0.08	0.01	0.08
0.17	0.06	0.06	0.09	0.14	0.02	0.01	0.06	0.13	0.10	0.03	0.01	0.08	0.13	0.11
0.02	0.15	0.14	0.08	0.04	0.06	0.03	0.11	0.08	0.04	0.02	0.07	0.09	0.11	0.02
0.02	0.02	0.08	0.03	0.11	0.05	0.15	0.02	0.07	0.09	0.11	0.09	0.12	0.04	0.08
0.05	0.15	0.06	0.08	0.06	0.15	0.03	0.02	0.13	0.03	0.05	0.09	0.01	0.12	0.07
0.06	0.11	0.09	0.12	0.10	0.03	0.15	0.09	0.06	0.10	0.19	0.15	0.11	0.11	0.08
46	47	48	49	50	51	52	53	54	55	56	57			
0.14	0.10	0.03	0.11	0.03	0.14	0.10	0.03	0.11	0.03	0.12	0.07			
0.01	0.02	0.08	0.10	0.12	0.01	0.02	0.08	0.10	0.12	0.04	0.05			
0.07	0.09	0.15	0.06	0.03	0.07	0.09	0.15	0.06	0.03	0.02	0.07			
0.08	0.00	0.02	0.07	0.05	0.08	0.00	0.02	0.07	0.05	0.19	0.01			
0.15	0.01	0.04	0.02	0.10	0.15	0.01	0.04	0.02	0.10	0.03	0.05			
0.05	0.03	0.11	0.06	0.11	0.05	0.03	0.11	0.06	0.11	0.06	0.10			
0.02	0.06	0.02	0.04	0.12	0.02	0.06	0.02	0.04	0.12	0.03	0.09			
0.12	0.06	0.13	0.07	0.04	0.12	0.06	0.13	0.07	0.04	0.14	0.07			
0.05	0.15	0.04	0.09	0.11	0.05	0.15	0.04	0.09	0.11	0.03	0.10			
0.04	0.15	0.03	0.10	0.08	0.04	0.15	0.03	0.10	0.08	0.21	0.14			
0.02	0.01	0.15	0.10	0.12	0.02	0.01	0.15	0.10	0.12	0.06	0.04			
0.11	0.19	0.07	0.07	0.03	0.11	0.19	0.07	0.07	0.03	0.03	0.04			
0.15	0.14	0.13	0.10	0.07	0.15	0.14	0.13	0.10	0.07	0.05	0.17			