Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X
IMPACT FACTOR: 6.017

IJCSMC, Vol. 6, Issue. 2, February 2017, pg.51 – 59

Analysis of Challenges to Improve Jordanian National Database for Researches

Dr. Hussein M.Elsayyed, Dr. Ziad A.AlQadi

Albalqa Applied University

Abstract: ***The Jordanian national database for researchers (JNDBR) aims at documenting all academic staff research studies concerned with issues related to Jordanian community. This data base includes information about Jordanian research studies published by Jordanian researchers inside and outside Jordan. This data base will facilitate the process of research utilization and production, access and dissemination of information knowledge. Further, the JNDBR will assist researcher in general researchers in particular in identifying priority areas that need further investigation which will consequently improve education and practice in Jordan.***
The consistency issue is one of the hot research topics in the analytic hierarchy process (AHP) and analytic network process (ANP). To identify the most inconsistent elements for improving the consistency ratio of a reciprocal pair wise comparison matrix (PCM), a bias matrix can be induced to efficiently identify the most inconsistent elements, which is only based on the original PCM. The goal of this paper is to conduct a questionnaire which include pair wise comparison between the challenges that face the JNDBR improving,
A decision matrix will be obtained and a consistency analysis will be provided in order to fined the consistent rank of each challenge.

Keywords: Decision matrix, normalized decision matrix, priority vector, priority Eigen value, consistency index, consistency ratio.

1. Introduction

The existing studies suggested the *Use Case based Goal oriented Requirements Engineering (GoRE)*[1,2]. This method has the goal to reflect the exact customers' requests in developing software. However, in this method, customers subjectively judged and decided ERRC of Use Case according to the judgment standard of Hybrid Approach [1,2]. Moreover, it is very difficult for customers to judge the extracted Use Case whether it is correct or not. In order to solve such a problem, this paper extracts the importance of Use Case with AHP, and prioritizes them,

it judges whether the major idea is consistently determined or not through the estimation of AHP consistency.

2. Related works

AHP, which was developed by T. Saaty[7, 8], performs the pair wise comparison between categories composing the decision hierarchy. It accomplishes the assessor's consistency estimation with such a pair wise comparison. Accordingly, it can decide human being's subjective judgment reasonably [4]. The UCP technique [3, 4], which was developed by Gustav Karner in 1993, estimates the software size of the object oriented systems [4, 5]. The UCP method is based on similar principles as Function Point (FP) software estimation method, but was created to solve for the specific needs of object oriented systems and system requirements based on use cases [3, 4].

Many tools can be used to analyze data sets such as artificial neural networks, data regression [9], [10] and [11], these tools can be used to find the relationship between 2 or more sets of data and to predict the output knowing the input data sets, Here in this paper we will introduce a tool which is defer and it be suitable to measure the input data set consistency before going to any tool of data analysis.

3. Data collection

Data collection step was performed according to the following steps:

1- We set the most important challenges (categories) that face *JNDBR*, these challenges are illustrated in table 1.

Table 1: Challenges that face *JNDBR*

Challenge number	Challenge
1	Provided services
2	Used interface
3	Information value
4	Hardware
5	Software
6	Infrastructure
7	Planning and development
8	Support and maintenance

2- We conduct a special pair wise comparison questionnaire which is shown in figure 1.

3- The questionnaires were distributed a among 500 Jordanian universities academics to be filled.

4- The results of filled questionnaires were treated and weighted in order to obtain decision table which is shown in figure 2.

	A - Importance - or B?			Equal	How much more?
1	Provided services	or	Used intrface	1	2 **3** 4 **5** 6 **7** 8 **9**
2	Provided services	or	Information value	1	2 **3** 4 **5** 6 **7** 8 **9**
3	Provided services	or	Hardware	1	2 **3** 4 **5** 6 **7** 8 **9**
4	Provided services	or	Software	1	2 **3** 4 **5** 6 **7** 8 **9**
5	Provided services	or	Infrastructure	1	2 **3** 4 **5** 6 **7** 8 **9**
6	Provided services	or	Planning and developmen	1	2 **3** 4 **5** 6 **7** 8 **9**
7	Provided services	or	Support and maintenance	1	2 **3** 4 **5** 6 **7** 8 **9**
8	Used intrface	or	Information value	1	2 **3** 4 **5** 6 **7** 8 **9**
9	Used intrface	or	Hardware	1	2 **3** 4 **5** 6 **7** 8 **9**
10	Used intrface	or	Software	1	2 **3** 4 **5** 6 **7** 8 **9**
11	Used intrface	or	Infrastructure	1	2 **3** 4 **5** 6 **7** 8 **9**
12	Used intrface	or	Planning and developmen	1	2 **3** 4 **5** 6 **7** 8 **9**
13	Used intrface	or	Support and maintenance	1	2 **3** 4 **5** 6 **7** 8 **9**
14	Information value	or	Hardware	1	2 **3** 4 **5** 6 **7** 8 **9**
15	Information value	or	Software	1	2 **3** 4 **5** 6 **7** 8 **9**
16	Information value	or	Infrastructure	1	2 **3** 4 **5** 6 **7** 8 **9**
17	Information value	or	Planning and developmen	1	2 **3** 4 **5** 6 **7** 8 **9**
18	Information value	or	Support and maintenance	1	2 **3** 4 **5** 6 **7** 8 **9**

19	Hardware	or Software	1	2 3 4 5 6 7 8 9
20	Hardware	or Infrastructure	1	2 3 4 5 6 7 8 9
21	Hardware	or Planning and developmen	1	2 3 4 5 6 7 8 9
22	Hardware	or Support and maintenance	1	2 3 4 5 6 7 8 9
23	Software	or Infrastructure	1	2 3 4 5 6 7 8 9
24	Software	or Planning and developmen	1	2 3 4 5 6 7 8 9
25	Software	or Support and maintenance	1	2 3 4 5 6 7 8 9
26	Infrastructure	or Planning and developmen	1	2 3 4 5 6 7 8 9
27	Infrastructure	or Support and maintenance	1	2 3 4 5 6 7 8 9
28	Planning and developmen	or Support and maintenance	1	2 3 4 5 6 7 8 9

Figure 1: Pair wise comparison questionnaire

	1	2	3	4	5	6	7	8
1	1	3.00	2.00	8.00	9.00	6.00	4.00	5.00
2	0.33	1	0.50	5.00	6.00	2.00	2.00	2.00
3	0.50	2.00	1	4.00	4.00	3.00	2.00	2.00
4	0.12	0.20	0.25	1	1.00	1.00	1.00	1.00
5	0.11	0.17	0.25	1.00	1	1.00	1.00	1.00
6	0.17	0.50	0.33	1.00	1.00	1	1.00	1.00
7	0.25	0.50	0.50	1.00	1.00	1.00	1	1.00
8	0.20	0.50	0.50	1.00	1.00	1.00	1.00	1

Figure 2: Decision matrix

4-Cosistency Analysis

Consistency analysis is very useful in finding the consistency ratio (CR) and the rank of each category involved in the study{1, 2]].

The consistency analysis can be done and different data structures can be calculated according to following sequence of steps:

step 1: Finding the normalized version of the decision matrix

To do this we sum each column in the decision matrix(A) and divide each element in the decision matrix by its column sum and here are the results of this step:

The sums of decision matrix column(vector S) were as follows:

2.6800	7.8700	5.3300	22.0000	24.0000	16.0000	13.0000	14.0000

The obtained normalized decision matrix was:

0.3731	0.3812	0.3752	0.3636	0.3750	0.3750	0.3077	0.3571
0.1231	0.1271	0.0938	0.2273	0.2500	0.1250	0.1538	0.1429
0.1866	0.2541	0.1876	0.1818	0.1667	0.1875	0.1538	0.1429
0.0448	0.0254	0.0469	0.0455	0.0417	0.0625	0.0769	0.0714
0.0410	0.0216	0.0469	0.0455	0.0417	0.0625	0.0769	0.0714
0.0634	0.0635	0.0619	0.0455	0.0417	0.0625	0.0769	0.0714
0.0933	0.0635	0.0938	0.0455	0.0417	0.0625	0.0769	0.0714
0.0746	0.0635	0.0938	0.0455	0.0417	0.0625	0.0769	0.0714

Step 2: Calculating priority vector.

The normalized principal Eigen vector which is called priority vector (PV), since it is normalized, the sum of all its elements equal to one. The priority vector shows the relative weights between the categories which are to be compared. To obtain priority vector we have to take the average of each row sum in the normalized decision matrix and the result of implementing this step is as follows:

Priority vector:

0.3635
0.1554
0.1826
0.0519
0.0509
0.0609
0.0686
0.0662

Step 3: Calculating Priority Eigen value (Check the approximation error)

Priority Eigen value (PEV) can be obtained by summation of the products of the vectors B and PV.

```
PEV =

    8.3269
```

To check whether our approximation is closed to largest Eigen value we find the largest lambda by applying:

[W,L]=eig(A)


```
    max(max(L))

ans =

    8.2386
```

Which is very close to approximation value with a small error = 1.0614%

Step 4: Calculating Consistency index(CI).

To do this we have to:

- Find the product(P) of the vectors A and PV .

- Divide each element of P by the corresponding element in PV.

The results of this step are as follows:

```
CE =

    8.3604
    8.5153
    8.4250
    8.0729
    8.0595
    8.1872
    8.1425
    8.1548
```

Step 5: Consistency ratio(CR)

Consistency ratio can be calculated as follows:

- find the average sum of consistency index: L1=(sum(sum(CE)))/8;

CI=abs((L1-8))/(8-1);

- Divide CI by a random index given from the table 2: CR=CI/1.41

To check the consistency we have find the consistency ratio and it must be less than 10% according to (Saaty, T. 2000) .

The results of this step

CR= 0.0243 which is 2.4 % and it is acceptable.

Table 2: Random index(RI) depending on the number of categories

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

The following mat lab code was written and implemented to perform the analysis phase.

```
clc
clear all
%Worked example
A=[ 1   3.00    2.00    8.00    9.00    6.00    4.00    5.00
    0.33    1   0.50    5.00    6.00    2.00    2.00    2.00
    0.50    2.00    1   4.00    4.00    3.00    2.00    2.00
    0.12    0.20    0.25    1   1.00    1.00    1.00    1.00
    0.11    0.17    0.25    1.00    1   1.00    1.00    1.00
    0.17    0.50    0.33    1.00    1.00    1   1.00    1.00
    0.25    0.50    0.50    1.00    1.00    1.00    1   1.00
    0.20    0.50    0.50    1.00    1.00    1.00    1.00    1]


% STEP 1
% normalize the Decision Matrix by
% 1- find the sum of each row
%2- Divide eache element in the DM by its column sum
B=sum(A)
for i=1:8
    for j=1:8
        NA(i,j)=A(i,j)/B(j);
    end
end
        NA

%STEP 2
% Get the sum of each row and divide it by n(n=8) to obtain priority matrix

       PV=sum(NA');
       PV=PV/8;
       PV=PV'
% Find priority Eigen value
       PEV=0;
       for i=1:8
           PEV=PEV+B(i)*PV(i,1);
       end
       PEV
% Get Lmda
       [W,L]=eig(A);

%find the error
err=(abs(PEV-max(max(L)))/PEV)*100
% Step 3
% Calculte consistency index
CE1=A*PV
for i=1:8
    CE(i,1)=CE1(i,1)/PV(i,1);
end
CE
% Consistency ratio
L1=(sum(sum(CE)))/8;
CI=abs((L1-8))/(8-1);
CR=CI/1.41
```


5- Results Discussions

During the analysis process some data structures we obtained and the consistency of study was proved by:

- The approximation Eigen value was very closed to the calculated one.

- The consistency ration was less than 10% which mean that the ranking (consistency index) is acceptable.

- According to the values of consistency index the challenges can be ranked as shown in figure 3.

	Category	Priority	Rank
1	Provided services	36.5%	1
2	Used intrface	15.8%	3
3	Information value	18.5%	2
4	Hardware	5.0%	7
5	Software	4.9%	8
6	Infrastructure	6.0%	6
7	Planning and developmen	6.7%	4
8	Support and maintenance	6.5%	5

Figure 3: Ranking JNDBR challenges

6- Conclusions

A set of challenges that face the process of improving *JNDBR* were conducted. A core data was collected and analyzed. The challenges were ranked and the consistency was proved which leads to the ranking process acceptance.

References

[1] S. Kim and H. Peter, "VIRE: Sailing a Blue Ocean with Value-Innovative Requirements", Software IEEE, vol. 25, **(2008)**, pp. 80-87.
[2] B. Park and R. Y. Kim, "A Comparative Study on the ViRE & Refined GoRE's Process", Journal of KIISE: Computing Practices and Letters, vol. 19, no. 4, **(2013)**.
[3] B. Park, S. Moon, K. Kim, B. Kim and R. Y. Kim, "Use Case Oriented Requirements Engineering for improving the previous ViRE's Process", The 38th KIPS Fall Conference, Jeju, Korea, **(2012)**, November 22-23.
[4] G. Cho, Y. Cho and H. Kang, "The Analytic Hierarchy Process", DongHyun Books, **(2003)**.
[5] Kou, G., Ergu,D., Shang,J. (2014). Enhancing Data Consistency in Decision Matrix: Adapting Hadamard Model to Mitigate Judgment Contradiction, *European Journal of Operational Research*, 236(1):261-271.
[6] Bokyung Park and Robert Youngchul Kim, Making a Decision about Importance Analysis and Prioritization of Use Cases through Comparison the Analytic Hierarchy Process (AHP) with Use Case Point (UCP) Technique, International Journal of Software Engineering and Its Applications Vol.8, No.3 (2014), pp.89-96, http://dx.doi.org/10.14257/ijseia.2014.8.3.09.

[7] Saaty, T. L. 1986. Axiomatic Foundation of the Analytic Hierarchy Process, Management Science 32(7): 841-855.
[8] Saaty, T. L. (1994), How to Make a Decision: The Analytic Hierarchy Process, *Interfaces*, 24: 19-43.
[9] Haitham Alasha'ary, Abdullah Al-Hasanat, Khaled Matrouk and Ziad Al-Qadi, Analysis and Optimization of PID Controller Parameters for a Second-Order Transfer Function, Middle-East Journal of Scientific Research 23 (8): 1685-1691, 2015 ISSN 1990-9233 © IDOSI Publications, 2015 DOI: 10.5829/idosi.mejsr.2015.23.08.163.
[10] Khaled M. Matrouk, Haitham A. Alasha'ary, Abdullah I. Al-Hasanat, Ziad A. Al-Qadi, Hasan M. Al-Shalabi, Investigation and Analysis of ANN Parameters, European Journal of Scientific Research ISSN 1450-216X / 1450-202X Vol.121 No.2, 2014, pp.217-225.
[11] Khaled Matrouk, Abdullah Al-Hasanat, Haitham Alasha'ary, Prof Ziad Al-Qadi, Prof Hasan Al-Shalabi, Speech Fingerprint to Identify Isolated Word-Person, World Applied Sciences Journal 31 (10): 1767-1771, 2014 ISSN 1818-4952 © IDOSI Publications, 2014 DOI: 10.5829/idosi.wasj.2014.31.10.468.

