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# EVALUATING AND RANKING MODEL FOR QUALITATIVE FACTORS IN OVERHAUL POWER PLANTS PROJECTS

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**RESUMEN**: El mantenimiento como uno de los componentes más importantes de la producción juega un papel importante en la provisión de objetivos organizacionales. Revisión de las plantas de generación de energía afecta el proceso de rendimiento. Algunos factores cualitativos son de gran importancia para mejorar la calidad del proceso y evitar el desperdicio de recursos. El presente ha clasificado los factores de calidad en la revisión mediante el enfoque de toma de decisiones multicriterio (MCDM). En este estudio se utilizó el método combinado de ANP (Analytic Network Process) y DEMATEL. Se identificaron cuatro factores principales y 16 secundarios en la clasificación final. Los resultados muestran que la experiencia y experiencia del contratista, el supervisor y la gestión de proyectos, la gestión del rendimiento y la autoevaluación, la capacidad de aplicar las herramientas y técnicas, la comunicación y la cultura de trabajo en equipo, Los mayores efectos sobre la revisión de las centrales eléctricas, respectivamente.

**PALABRAS CLAVE**: ANP; Operación y Mantenimiento; Revisión; Calidad; DEMATEL

**ABSTRACT**: Maintenance as one of the most important components of production plays an important role in providing organizational goals. Overhaul of the power generation plants affects the performance process. Some qualitative factors are of great importance in improving the quality of the process and avoiding wasting resources. The present has ranked the quality factors in overhaul using multi-criteria decision making (MCDM) approach. The combined method of Analytic Network Process (ANP) and DEMATEL technique were used in this study. Four main and 16 secondary factors were identified in the final classification. The results show that the experience and expertise of the contractor, supervisor and project management, performance management and self-assessment, the ability to apply the tools and techniques, communication and teamwork culture, proper documentation and having valid certificates and brand of parts have the highest effects on the overhaul of the power plants respectively.

**KEYWORDS**: ANP; Operating and Maintenance; Overhaul; Quality; DEMATEL

## 1. INTRODUCTION

Repair and maintenance are services carried out in order to achieve a desired objective or the expected performance of a component or system. Therefore, system can function properly and have proper or appropriate and desired mode (Tabucanon and Dahanayaka, 1989).Manufacturing firms and power plants have found that proper maintenance of equipment and production systems is a critical need (Meulen et al., 2008). Repair and maintenance are activities that support the main processes in organization (Alsyouf, 2009) .Corrective maintenance are operations, which are performed after the defective state, and its goal is to restore the instrument to operating conditions. Preventive maintenance operations carried out at time intervals or according to certain criteria to reduce the risk of quality deterioration or decline in the quality of the system functioning. Repair and maintenance includes two major sections, first, routine preventive maintenance and the other is fundamental repairs. Routine maintenance activities include inspection, lubrication, adjustment or replacement of parts that is carried out in periods with short intervals (weeks) and it is not expected to affect the capacity of power plants. The purpose of these activities is to reduce the probability of failure and problems of plants. The overhaul includes stopping the Power plant activities, carrying out a general inspection, lubrication, repair, disassemble and reassemble the equipment, which are carried out mainly in periods with long intervals of time (years).During this inspection and repairs, power-generating plants are shut down (Tabucanon and Dahanayaka, 1989).

In order to identify the quality factors of the overhaul project, the literature discussed the quality management of projects and maintenance projects. The literature on project management, identified target three criteria for assessment known as the triangle of time, cost and quality (Meredith and Mantel, 2003).The first two measures are relatively simple to define and measure, but defining and measuring the quality of the project as the third dimension of this triangle is much more difficult. Turner is of researchers who tried to define the quality of the project more clearly and put it in two dimensions of product quality and process quality (Turner, 2002).PMBOK guidelines of quality of the project also reflect the design process and the requirements of the process. ISO 10006-quality management standard, Guidelines for quality management in projects proposed two aspects of project management processes and processes related to project product for the quality of projects. For clarity in the definition of quality dimensions, Basu has proposed a three-dimensional model for the quality of the project including design quality, process quality and quality of organization (Basu, 2014).In periodic maintenance projects, quality is considered as adherence to SOP standards and technical specifications. These procedures will ensure compliance with engineering standards in all activities. Launch events are as a benchmark in quality projects of periodic maintenance (Levitt, 2004; Motylenski, 2003; Oliver, 2002).

In a study conducted by Obiajunwa, many organizations measured the quality of projects with criteria based on performance at the end of the shut period. Product quality and output performance are two parameters that are used to measure and several other samples under study, evaluated quality based on reliability, functionality and performance of power plant. High quality usually involves smooth setting up of a unit. In another study, he examined the important skills for periodic maintenance project management and their different nature. The findings showed in general, management should expertise in maintenance management, repair and maintenance service, project management techniques, maintenance planning, and logistics. In addition, a good knowledge of health, safety and environmental management is needed (Obiajunwa, 2012). Concerning the application of multi-criteria decision techniques in the field of maintenance, studies done with these techniques mainly include performance appraisal of maintenance system, right choice of methods and policies. Some of them are mentioned as follows. Wang et al chose the most optimal maintenance strategy using fuzzy process (Wang et al, 2007). Pardia et al developed a performance evaluation model for maintenance systems using Analytical Hierarchy Process (Pardia et al, 2006).The purpose of this research is to identify, develop and classify the most important qualitative factors and to rank them in terms of importance, using analytic network process (ANP). Also, finding casual relationships between factors and their influence on each other leads to a better understanding of them. Therefore, in this study the internal relationship of them using is assessed DEMATEL.

## 2. RESEARCH METHODOLOGY

Identification of factors affecting the quality of overhaul projects was conducted for the development of a prototype, using literature review, interviews with experts of this field and reviews of documents related to the overhaul of plants. After identifying the factors for verification, classification and identification of the model, the consultation meeting held with the participation of experts in the power industry to approve model by experts and factors that do not fit model were corrected or deleted for validation .After identification and categorization, internal relationships between agents due to the impact of factors on each other, weighting of each of them with respect to the target and the weighting of the sub-factors are done through questionnaires. Power industry experts have been selected to respond to the questionnaire. To confirm the validity, the content validity was used in this study. This validity is achieved by a surveying experts and professionals. Reliability that terms like credibility and stability for which are used, shows logical consistency of response of measurement tool (Azar et al., 2008). Given that in the study, multi-criteria decision technique was used to evaluate the reliability, the inconsistency ratio calculations were used. It should ensured that there is a logical consistency between paired comparisons because the output quality is strictly linked to the compatibility of paired comparisons. Therefore, at this stage ratio of the inconsistency must be calculated. First λmax should be calculated. The inconsistency index (CI) is calculated by equation (1).In the above equation, n represents the number of rows or columns of matrix (number of criteria). In the next step, the inconsistency ratio (CR) is calculated via equation (2). It should be noted that IR (random inconsistency index) is extracted from the table and if the inconsistency ratio is less than or equal to 0.1 (CR ≤0.1).Then we could conclude there is consistency in pair wise comparisons and otherwise, it is necessary to reconsider the decision in the paired comparisons (Asgharpour, 2013).

$$CI = \frac{\lambda max - n}{n - 1} \quad (1)$$

$$CR = \frac{CI}{IR} \quad (2)$$

a. DEMATEL technique

In this study, in order to obtain internal relations of criteria and sub-criteria DEMATEL technique was used. This way, any system factors were divided into two groups of effective and affected and will help researchers to better understand the structural components relationships of the system (Zhou et al., 2010).Four steps of DEMATEL technique are provided based on Fontela and Gabus technique(Wang et al, 2007).

The first step- obtaining a direct relationship matrix: in order to obtain a direct relationship matrix each expert asked to specify level, which reflects the impact of i on j.These paired comparisons are defined by aij criterion between both criteria. The common range is a five degrees range .The difference is that, contrary to Likert there is no mediocrity .DEMATEL five–degree includes zero to four or a number system of one, three, five, seven, nine (Habibi et al,2014)of which were used in this study. Respectively, they indicate no impact, low impact, moderate impact, high impact and very high impact (Nikamal et al., 2010) in this step, direct relationship matrix (A) is obtained based on the relevance and impact of each criterion on each other through paired comparisons .To integrate the expert opinion in this technique, simple arithmetic average is used. The second step is normalization direct matrix: Based direct relation matrix (A), normalized direct relation matrix (X) is obtained by (3) and (4) equations. n represents the number of criteria.

$$X = K.A \quad (3)$$

$$k = \frac{1}{max \sum_{j=1}^{n} aij} \quad (4)$$

$1 \leq i \leq n$

The third step – Calculation of the total relationship matrix: using the matrix X obtained in the previous stage, total relationship matrix (T) is achieved according to equation (5) where I is an identity matrix (Wang et al, 2007).

$$T = X(I - X)^{-1} \quad (5)$$

Step Four, casual diagram: The total rows and columns of the matrix (T), respectively, are named D and R vectors (6 and 7). D + R and D-R values are calculated by these equations .D+R is the horizontal axis represents and that represents the importance value of criteria and vertical axis (D-R) criteria divided criteria into two groups of cause and effect (Wang et al, 2007).

$$D = \left[\sum_{j=1}^{n} t_{ij}\right]_{n*1} = [t_{i.}]_{n*1} \quad (6)$$

$$R = \left[\sum_{i=1}^{n} t_{ij}\right]_{n*1} = [t_{.j}]_{n*1} \quad (7)$$

b. Analytic network process

Analytic network process is general mood of Analytical Hierarchy Process (AHP) and its extended mode. One serious limitation of AHP is that the interdependencies between the elements of the decision-the criteria, sub-criteria and options-are not considered and it assumes the relationship of them as hierarchical and unilateral. Analytic network process, while having all the capabilities of AHP, including simplicity, flexibility, using quantitative and qualitative criteria simultaneously, the ability to assess the compatibility in judgments, and the possibility of ranking the final options, can overcome its serious limitations, including not taking into account the interdependencies between decision elements and the assumption that the relationship between the elements of decision are hierarchical and unilateral. Therefore, ANP consists of two parts: control hierarchy and network Relationship. Control hierarchy includes relationship between objective, criteria and sub criteria and is effective internal communication of the system and network relationship includes dependency between the elements and clusters (Saaty, 1999).

Analytic Network process can be summarized in four stages (Carlucci and Schiuma, 2008).

The first step is to build a model and to convert the problem / issue to a network structure: Issue / problem should be converted to a clear to a reasonable system, such as a network. At this point, the issue / problem turns to a network structure in which the nodes are considered as clusters .Elements within a cluster may be associated with one or the other cluster elements (affected by them or affect them).

The second step, binary comparison matrix and determining the priority vectors: similar to binary comparisons in AHP, elements of each of the clusters, based on their importance in relation to the control criteria are mutually compared. Clusters based on their role and their impact on achieving the goal, are mutually compared as well. Decision makers need to decide in pairs about binary comparison of elements or clusters. The effect of each element on other elements can be provided through a special vector. The relative importance is measured by Saaty nine-point scale (similar to AHP). In this section, Local Priority Vector is calculated. It can be obtained through equation 8. Where A is binary comparison matrix, W is eigenvector (Coefficient of importance) and λmax is the largest Eigen value number.

$$Aw = \lambda max\ w \tag{8}$$

The third step is the formation of super matrix and turning it into a limit super matrix: to achieve the overall priorities in a system of interactions, local priorities vectors (ie calculated W) are entered in the appropriate column a matrix .As a result, a super matrix (in fact, a partitioned matrix) is obtained that each part of the matrix shows the relation between the two clusters. This type of matrix is called Super matrix .By placing local priority vectors of (importance coefficients) elements and clusters in initial matrix super, unweighted Super Matrix is obtained .In the next stage, weighted Super matrix is calculated by multiplying the unweighted matrix values in cluster matrix. Then by normalizing weighted super matrix, the super matrix turns into random mode in term of column (Saaty, 1999).In the second stage, limit super matrix is calculated by exponentiation of all elements of weighted Super Matrix until the divergence is achieved (through repetition). In other words, until all the elements of Super matrix get identical (equation 9)

$$lim\, W^k\, k \to \infty \tag{9}$$

The fourth step, the preferred option: If the formed Super matrix in the third stage, covers the entire network- options are also included in the super matrix- the overall priority can be achieved from the column of options in the normalized super matrix. If Super Matrix, only included part of the network that are mutually dependent and options are not considered at Super matrix, further calculations are need to achieve the priorities of options. Options that have the highest general priority are the best options for the chosen topic (Zebardast, 2010).

## 3. RESEARCH DESIGN

After reviewing the related literature and documents related to the overhaul of plants and interviews with experts, primary factors were collected. Categorizing main factors and sub-factors is done with experts and some that were not related to industry were removed. According to the model, initial super matrixes structure is shown in Figure 1. Figure 2 shows the research design.

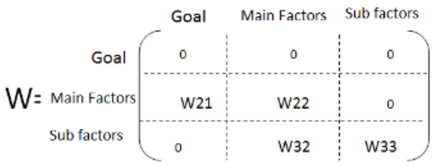


**Figure 1. Structure of initial Super matrix (Zebardast, 2010)**

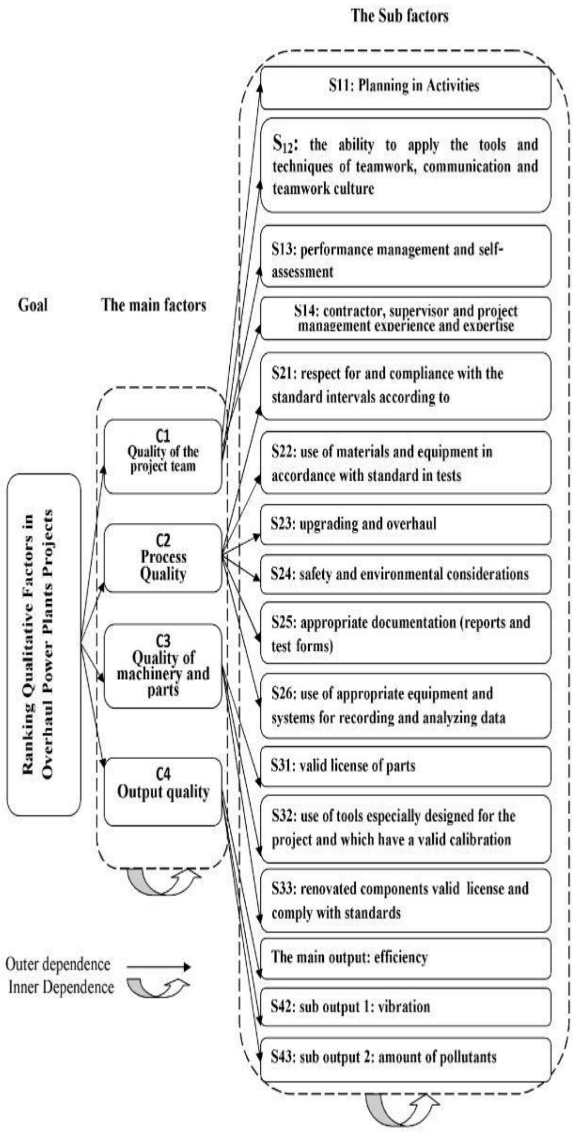


**Figure 2. Network model of quality agents in major overhaul**

## 4. DATA ANALYSIS

a. DEMATEL Calculations

The first step - the direct relation matrix, to assess the internal relationship between the factors, some experts will be asked to do pair wise comparisons among the main factors specified in Figure 3 (C1 to C4), in terms of influence of I (row) on j (column). With these comparisons, initial data of direct relation matrix (A) is obtained in accordance with Table 1.It is calculated using the arithmetic mean of ten experts.

**Table 1: direct relation Matrix**

| | C1 | C2 | C3 | C4 |
|---|---|---|---|---|
| C1 | 1.000 | 7.200 | 2.000 | 1.800 |
| C2 | 1.400 | 1.000 | 1.000 | 6.600 |
| C3 | 1.000 | 6.600 | 1.000 | 5.400 |
| C4 | 1.000 | 1.000 | 1.000 | 1.000 |

The second step - normalizing direct relation matrix: Based on the direct relation matrix (A) normalized direct relations matrix (X) is obtained through the equations 3 and 4 according to Table 2.

**Table 2. normalized direct relation Matrix**

| | C1 | C2 | C3 | C4 |
|---|---|---|---|---|
| C1 | 0.071 | 0.514 | 0.143 | 0.129 |
| C2 | 0.100 | 0.071 | 0.071 | 0.471 |
| C3 | 0.071 | 0.471 | 0.071 | 0.386 |
| C4 | 0.071 | 0.071 | 0.071 | 0.071 |

The third step - calculating total relation matrix: Using the matrix obtained in the previous stage, total relation matrix (T) is obtained in accordance with the equation 5 and Table 3. To obtain total relation matrix for sub factors we do the same stages listed for the main factors.

**Table 3: total relation Matrix for main factors**

| | C1 | C2 | C3 | C4 |
|---|---|---|---|---|
| C1 | 0.260 | 0.921 | 0.324 | 0.776 |
| C2 | 0.224 | 0.364 | 0.201 | 0.807 |
| C3 | 0.265 | 0.862 | 0.260 | 0.997 |
| C4 | 0.134 | 0.241 | 0.136 | 0.274 |

Step Four - the causal diagram: factors with positive D-R are causal and those with negative D-R are effect factors.C1 (the quality of the project team) and C3 (quality of parts and machinery) have more total row than other factors that is indicative of their great influence on other elements of the system.C4 (output quality) and C2 (the quality of the project process) have more total column than main other factors that is indicative of extent of influence on them than others. Factors that have greater interaction with the system (larger D+R) (or have significant impact on other factors (bigger D), or are influenced more than other factor( bigger R or both) and D-R is positive are more important for us. About Impacted factors, those that have higher interaction with system (larger D + R) (more influenced means to have smaller D-R), are more important. Here C2 (has high impact and is more affected) and C4 (more affected), respectively, have the greatest values.

D-R indicates power of the effectiveness of each factor. C3 (quality of parts and machinery) and C1 (the quality of the project team), respectively, have the highest influence.

Matrix of total relations for the sub factor is in accordance with Appendix 1, these factors S12 (the ability to apply the tools and techniques of teamwork, communication and teamwork culture), S14 (experience of contractor, supervisor and project management) and S13 (performance management and self-assessment) are outlined as the most important causal factors affecting the other factors. All of the sub factors of the quality of the project team. This indicates the importance of a quality project team in effectiveness ofrepairs.S21 (observing the permissible intervals and complying with the standards in accordance with the instructions, S41 (output: efficiency) and S23 (update along with overhaul) are of sub factors that are highly affected and these factors have (D + R) higher interaction with the system.

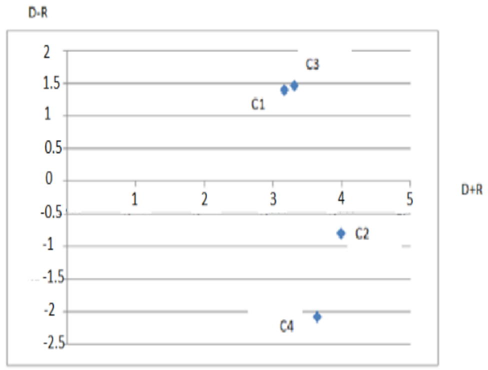


**Diagram 1. causal diagram of the main factors**

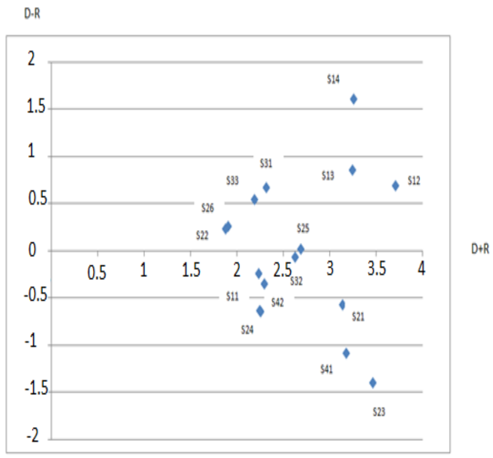


**Diagram 2. causal diagram of sub factors**

The fifth step - obtaining the matrix of internal relations (W22 and W33): At this stage in order to obtain internal relations and to put them in the super matrixes (un weighted) matrix T must be normalized in term of columns ( the sum of each column should equal to one (Wu, 2008). For normalization, each number is divided by the sum of column (Nikamal et al., 2010).

b. Weighting the main factors

At this stage, to obtain W21 matrix, the importance of the main factors to objective should be achieved. For this purpose, a dozen of experts were asked to do pair wise comparisons between the main factors. One represents the same significance of both factors with regard to the objective and nine represents the importance of one to others. When there are more than one decision maker rather matrix elements geometric mean can be used. It is calculated through equation 10, where aijl is element of ith row and jth column of the matrix of lth decision-maker and k number of on decision-makers. Views should be taken into account when compliance rate (CR) of decisions of each decision maker is less than 0.1 (Asgharpour, 2013).Table 4, shows the results of binary comparisons of the main factors and its weighted vector (W21) as well as the compliance rate (CR) that was performed using Super decision software.

$$a'ij = \left(\prod_{l=1}^{k} aijl\right)^{1/k} \quad ;l = 1,2,\dots,k \qquad (10)$$

$$i,j = 1,2,\dots,n; \quad i \neq j$$

**Table 4. pair wise comparison of main factors**

| W21 | C4 | C3 | C2 | C1 | Main Factors |
|---|---|---|---|---|---|
| 0.359 | 2.158 | 5.256 | 0.870 | 1.000 | C1. Quality of the project team |
| 0.365 | 1.933 | 4.829 | 1.000 | 1.149 | C2. Process Quality |
| 0.061 | 0.197 | 1.000 | 0.207 | 0.190 | C3 .quality of machinery and parts |
| 0.216 | 1.000 | 5.082 | 0.517 | 0.463 | C4. Output quality |
| CR=0.03 | | | | | |

c. pair wise comparisons of each sub-factors of the main factors

At this stage, to obtain W32 matrix the importance of each sub factor of main factor should be obtained through pair wise comparisons. These comparisons were done as previous part by the questionnaire using Saaty nine-point scale.

d. Formation of Super matrix and integration of results

A super matrix, is a divided matrix so that each sub matrix shows the relationship between two specific clusters (Saaty, Vargas, 2006).After the pair wise comparisons between the main and sub-factors, factors will be applied in ANP super-matrix (Nikamal et al, 2010).In this matrix, some columns may be random or simply the sum of the column is not one. In this case, the ultimate impact of criterion on all elements are not correctly shown (Saaty, 1996). Un weighted Super matrix should be converted into the weighted Super matrix (sum of columns of a matrix equal to 1). Then limit super matrixes that is obtained by exponentiation of weighted super matrix shows the final results of weights obtained from the combination of weights of the ANP and DEMATEL (Nikamal et al, 2010).Limit Matrix is the matrix that all numbers in each row is the same and represents the final weight of the same row (Saaty, 1996). Super matrixes calculation is done using Super decision software. Appendixes 2, 3 and 4, respectively, represent the un weighted, weighted and limit Super matrix of this research.

## 5. CONCLUSION

The aim of this study was to investigate, identify and rank the factors affecting the quality of the overhaul of power plants. Overhaul of good quality can have a significant impact on the level of readiness, efficiency and the availability of power plants when required. In addition it reduces emergency shuts down. Qualitative factors identification is done by reviewing the background, interviews with experts in the power industry. After identifying the factors, for verification, classification and determining the model, the consultation meetings were hold attended by professionals and experts in the power industry. After the classification, elements were ranked using a combination of ANP and DEMATEL. Table 5 shows the final weight of factors.

**Table 5. Weights of ANP research method**

| Weights of ANP | | The main factors / Sub factors |
|---|---|---|
| Global Weight | Local Weight | |
| | 0.359 | C1. Quality of the project team |
| 0.050 | 0.095 | S11: Planning in Activities |
| 0.095 | 0.443 | S12: The ability to apply the tools and techniques of teamwork, communication and teamwork culture |
| 0.099 | 0.116 | S13: performance management and self-assessment |
| 0.115 | 0.346 | S14: contractor, supervisor and project management experience and expertise |
| | 0.365 | C2. Process Quality |
| 0.057 | 0.419 | S21: respect for and compliance with the standard intervals according to manufacturer's instruction |
| 0.050 | 0.161 | S22: use of materials and equipment in accordance with standard in tests |
| 0.049 | 0.139 | S23: upgrading and overhaul |
| 0.041 | 0.072 | S24: safety and environmental considerations |
| 0.069 | 0.144 | S25: appropriate documentation (reports and test forms) |

| | | |
|---|---|---|
| 0.053 | 0.066 | S26: use of appropriate equipment and systems for recording and analyzing data |
| | 0.061 | C3 .quality of machinery and parts |
| 0.066 | 0.279 | S31: valid license of parts |
| 0.058 | 0.475 | S32: use of tools especially designed for the project and which have a valid calibration certificate |
| 0.062 | 0.246 | S33: renovated components valid license and comply with standards |
| | 0.216 | C4. Output quality |
| 0.050 | 0.516 | S41: The main output: efficiency |
| 0.047 | 0.386 | S42: sub output 1: vibration |
| 0.041 | 0.098 | S43: sub output 2: amount of pollutants |

The results showed, S14 (experience and expertise of contractor, supervisor and project management), S13 (performance management and self-assessment), S12 (team's ability to use tools and techniques, communication and culture of teamwork) of sub factors of project team quality and S25 (appropriate documentation) of sub factors of process of project implementation quality, have the greatest impact on the effectiveness of the power plant overhaul.S31(valid license of parts), S33(renovated components should have a valid license and match with standard), S32(use of tools especially designed for the project and which have a valid calibration certificate) of sub factors od the quality of parts and machinery, S21(respect for and compliance with the standard intervals according to manufacturer's instruction), S26: use of appropriate equipment and systems for recording and analyzing data, S22(use of materials and equipment in accordance with standard in tests), S41(The main output: efficiency), of sub factors of output quality, S11( Planning in activities) of sub factor of quality of the project team, S23(upgrading and overhaul), S42(vibration), S43(amount of pollutants), S24(safety and environmental considerations) of sub factors of process quality are at the next ranks respectively.

## 6. RECOMMENDATIONS

Considering that, the results showed the high influence of sub factors of quality of the project team, to enhance the expertise and knowledge of contractors and observers of overhaul it is recommended hold to systematic professional training courses at various levels by relevant organizations.

In the process of selection of contractor tenders, enhancing the amount of technical knowledge of contractors in order to achieve effectiveness is recommended.

Considering that at past mainly overhaul was experimental and it was done with expertise and individual tastes of construction companies, this process was normal and even at the cases due to management Type, activities associated with the part of one or more indicators were done partially. We have seen that despite the high expenditure of repair and overhaul, it was not desirable of employers and even in some cases it was a waste of resources and duplication. The use of a system that a successful overhaul is largely can be predicted has a major role in the reform and prevention of problems. The full, systematic and standardized documentation of the steps that is ignored in industrial and power plant projects can provide the required information for the next major overhaul. Regarding the improvement of quality sub factors of project (by the priority), the following is recommended

1- xperience and expertise of the contractor, supervisor and project management (S14): Weight of factor equals to 0.115. Choosing experienced experts that their competence has been confirmed by relevant authorities as well as support of management from supervision of project can be effective in promoting the sub-factor.

2- erformance management and self-assessment (S13): Weight of factor equals to 0.099. Performance management involves selecting, measuring, monitoring and use of key performance indicators and self-assessment means the ability to regularly review all aspects of the organization by an acceptable checklist or an acceptable assessment process such as EFQM. To improve this sub criterion, control of methods to reform them and attention to recommendations of executive team is suggested. For proper use of self-assessment system, it is recommended to analyze the cases and review the feedbacks at project meetings.

3- he ability to use tools and techniques, teamwork, communication and teamwork culture (S12): weight of factor equals to 0.095. Education program for all people who are in the project can help to improve them. Before starting the repair process, controlling the required tools is very important. Before use it must ensured that they are functioning properly and are calibrated. In some cases, this factor is ignored.

4- o improve the proper documentation (S25) by weight 0.069, and use of equipment and systems for recording and analyzing appropriate data (S26) with a weight of 0.053, the application of project management information systems can be useful.

5-

arts used in repairs (S31): weight of factor equals to 0.066. These parts must be original and as far as possible from a certified and original manufacturer and in case of use of non-original parts, they should pass all quality control procedures and obtain the relevant certificates.

6-

The quality of the restored parts (S33): weight of factor equals to 0.062. In order to improve the quality of the rebuilt parts, given that the restructuring process is done outside of a project, generally it needs to monitor all stages of the work.

7-

bserving and complying with the standard intervals (S21): Preparation of standard test sheets and instructions of manufacturer and thorough review and analysis before starting the repair process and precise measurements before disassembling can be useful, which according the this paper are of important sub factors.

8-

lanning the activities (S11): The weight of this factor equals to 0.050. Taking advantage of the experienced project control group and providing a detailed schedule and explaining the complete activities of overhaul well as daily, weekly and monthly reporting, which will be regularly discussed in the meetings. In addition, at the final report of repair of each unit of the power plant, these points should be reviewed to include helpful cases for later repairs. It is better to have separate project control groups for both the observer and contractors.

9-

ompliance with standards and the use of appropriate materials and equipment in the test (S22): The weight of this factor equals to 0.050. Consumables used in the tastings (including destructive and non-destructive tests on components, oil testing, etc.) should be prepared and used according to the manufacturer's instructions. Equipment used in the testing should be inspected for quality control certificate. The certificate due time should be controlled and in case of expiry of certificate, equipment should be approved at an accredited institution to get valid certificate, otherwise tests will be unreliable and invalid.

10-

pdate and upgrading of power plant along with the overhaul (S23): The weight of this factor is equal to 0.049. It is considered as a selective process to enhance the efficiency of power plant during overhaul. According to the results, this factor is highly influenced than other factors. Since in term of efficiency increase, the updates are classified into different levels and every update has its own advantages and different prices, it is recommended to improve the process they should be approved by employer and agreements should be made on the rate of efficiency to prevent the further problems.

11-

ompliance with safety and environmental considerations (S24): The weight of this factor is equal to 0.041. Increased use of experts in the field of safety and training the contractors and use of safety messages in the appropriate place can prevent many accidents. In addition, presence of a safety expert at team of overhaul project is recommended. In addition, the destruction of materials that at the end of the overhaul should be carried out from workshop should be carried in such a way that lead to the least environmental pollution .For example, lubricants used in turbines after change should be carried in certain standard packaging. In some cases, due to serious pollution to the environment ,they are carried out under certain conditions and are kept under special conditions that need above-mentioned processes and contentious inspections P

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**Appendix1.** Matrix of total relations for the sub factor

| | S11 | S12 | S13 | S14 | S21 | S22 | S23 | S24 | S25 | S26 | S31 | S32 | S33 | S41 | S42 | S43 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S11 | 0.054 | 0.121 | 0.053 | 0.044 | 0.077 | 0.044 | 0.092 | 0.063 | 0.056 | 0.044 | 0.044 | 0.063 | 0.044 | 0.084 | 0.058 | 0.060 |
| S12 | 0.086 | 0.097 | 0.085 | 0.070 | 0.253 | 0.070 | 0.288 | 0.154 | 0.090 | 0.070 | 0.070 | 0.197 | 0.070 | 0.257 | 0.217 | 0.124 |
| S13 | 0.185 | 0.242 | 0.097 | 0.067 | 0.140 | 0.067 | 0.151 | 0.237 | 0.233 | 0.067 | 0.067 | 0.102 | 0.067 | 0.137 | 0.097 | 0.094 |
| S14 | 0.205 | 0.252 | 0.154 | 0.076 | 0.290 | 0.076 | 0.203 | 0.211 | 0.106 | 0.076 | 0.076 | 0.254 | 0.076 | 0.168 | 0.106 | 0.107 |
| S21 | 0.062 | 0.069 | 0.060 | 0.050 | 0.079 | 0.050 | 0.236 | 0.067 | 0.064 | 0.050 | 0.050 | 0.065 | 0.050 | 0.194 | 0.057 | 0.081 |
| S22 | 0.056 | 0.063 | 0.055 | 0.046 | 0.072 | 0.046 | 0.222 | 0.061 | 0.059 | 0.046 | 0.046 | 0.059 | 0.046 | 0.094 | 0.052 | 0.063 |
| S23 | 0.055 | 0.062 | 0.054 | 0.045 | 0.070 | 0.045 | 0.084 | 0.060 | 0.057 | 0.045 | 0.045 | 0.058 | 0.045 | 0.187 | 0.051 | 0.074 |
| S24 | 0.049 | 0.055 | 0.048 | 0.040 | 0.062 | 0.040 | 0.075 | 0.053 | 0.051 | 0.040 | 0.040 | 0.051 | 0.040 | 0.068 | 0.046 | 0.053 |
| S25 | 0.075 | 0.088 | 0.174 | 0.052 | 0.177 | 0.052 | 0.113 | 0.086 | 0.083 | 0.052 | 0.052 | 0.068 | 0.052 | 0.101 | 0.061 | 0.071 |
| S26 | 0.057 | 0.064 | 0.066 | 0.045 | 0.081 | 0.045 | 0.087 | 0.062 | 0.166 | 0.045 | 0.045 | 0.059 | 0.045 | 0.079 | 0.052 | 0.061 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S31 | 0.067 | 0.076 | 0.066 | 0.055 | 0.086 | 0.055 | 0.213 | 0.074 | 0.070 | 0.055 | 0.055 | 0.071 | 0.055 | 0.238 | 0.160 | 0.101 |
| S32 | 0.062 | 0.069 | 0.060 | 0.050 | 0.180 | 0.050 | 0.228 | 0.067 | 0.064 | 0.050 | 0.050 | 0.065 | 0.050 | 0.110 | 0.057 | 0.070 |
| S33 | 0.064 | 0.072 | 0.063 | 0.052 | 0.082 | 0.052 | 0.190 | 0.070 | 0.067 | 0.052 | 0.052 | 0.067 | 0.052 | 0.188 | 0.157 | 0.091 |
| S41 | 0.055 | 0.062 | 0.054 | 0.045 | 0.071 | 0.045 | 0.085 | 0.060 | 0.058 | 0.045 | 0.045 | 0.058 | 0.045 | 0.077 | 0.052 | 0.192 |
| S42 | 0.053 | 0.060 | 0.052 | 0.043 | 0.068 | 0.043 | 0.082 | 0.058 | 0.056 | 0.043 | 0.043 | 0.056 | 0.043 | 0.075 | 0.050 | 0.150 |
| S43 | 0.049 | 0.055 | 0.048 | 0.040 | 0.062 | 0.040 | 0.075 | 0.053 | 0.051 | 0.040 | 0.040 | 0.051 | 0.040 | 0.068 | 0.046 | 0.053 |

**Appendix2.Un weighted Super matrix**

| | | Goal | Main Factors | | | | Sub Factors | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | C1 | C2 | C3 | C4 | S11 | S12 | S13 | S14 | S21 | S22 | S23 | S24 | S25 | S26 | S31 | S32 | S33 | S41 | S42 | S43 |
| Goal | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Main Factors | C1 | 0.359 | 0.294 | 0.386 | 0.352 | 0.272 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | C2 | 0.365 | 0.254 | 0.152 | 0.218 | 0.283 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | C3 | 0.061 | 0.301 | 0.361 | 0.282 | 0.350 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | C4 | 0.216 | 0.151 | 0.101 | 0.148 | 0.096 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sub Factors | S11 | 0.000 | 0.095 | 0.000 | 0.000 | 0.000 | 0.043 | 0.080 | 0.045 | 0.054 | 0.042 | 0.054 | 0.038 | 0.044 | 0.042 | 0.054 | 0.054 | 0.047 | 0.054 | 0.039 | 0.044 | 0.042 |
| | S12 | 0.000 | 0.443 | 0.000 | 0.000 | 0.000 | 0.070 | 0.064 | 0.071 | 0.086 | 0.137 | 0.086 | 0.119 | 0.107 | 0.068 | 0.086 | 0.086 | 0.146 | 0.086 | 0.121 | 0.164 | 0.086 |
| | S13 | 0.000 | 0.116 | 0.000 | 0.000 | 0.000 | 0.150 | 0.161 | 0.081 | 0.082 | 0.076 | 0.082 | 0.062 | 0.165 | 0.175 | 0.082 | 0.082 | 0.076 | 0.082 | 0.064 | 0.074 | 0.065 |
| | S14 | 0.000 | 0.346 | 0.000 | 0.000 | 0.000 | 0.166 | 0.167 | 0.129 | 0.092 | 0.157 | 0.092 | 0.084 | 0.147 | 0.080 | 0.092 | 0.092 | 0.189 | 0.092 | 0.079 | 0.081 | 0.074 |
| | S21 | 0.000 | 0.000 | 0.419 | 0.000 | 0.000 | 0.050 | 0.045 | 0.051 | 0.061 | 0.043 | 0.061 | 0.097 | 0.047 | 0.048 | 0.061 | 0.061 | 0.048 | 0.061 | 0.091 | 0.044 | 0.056 |
| | S22 | 0.000 | 0.000 | 0.161 | 0.000 | 0.000 | 0.046 | 0.042 | 0.046 | 0.056 | 0.039 | 0.056 | 0.092 | 0.043 | 0.044 | 0.056 | 0.056 | 0.044 | 0.056 | 0.044 | 0.040 | 0.044 |
| | S23 | 0.000 | 0.000 | 0.139 | 0.000 | 0.000 | 0.045 | 0.041 | 0.045 | 0.055 | 0.038 | 0.055 | 0.035 | 0.042 | 0.043 | 0.055 | 0.055 | 0.043 | 0.055 | 0.088 | 0.039 | 0.051 |
| | S24 | 0.000 | 0.000 | 0.072 | 0.000 | 0.000 | 0.040 | 0.036 | 0.040 | 0.049 | 0.034 | 0.049 | 0.031 | 0.037 | 0.038 | 0.049 | 0.049 | 0.038 | 0.049 | 0.032 | 0.034 | 0.037 |
| | S25 | 0.000 | 0.000 | 0.144 | 0.000 | 0.000 | 0.061 | 0.058 | 0.146 | 0.063 | 0.096 | 0.063 | 0.047 | 0.060 | 0.062 | 0.063 | 0.063 | 0.051 | 0.063 | 0.048 | 0.047 | 0.049 |
| | S26 | 0.000 | 0.000 | 0.066 | 0.000 | 0.000 | 0.046 | 0.043 | 0.056 | 0.055 | 0.044 | 0.055 | 0.036 | 0.043 | 0.125 | 0.055 | 0.055 | 0.044 | 0.055 | 0.037 | 0.039 | 0.042 |
| | S31 | 0.000 | 0.000 | 0.000 | 0.279 | 0.000 | 0.055 | 0.050 | 0.056 | 0.067 | 0.046 | 0.067 | 0.088 | 0.051 | 0.053 | 0.067 | 0.067 | 0.053 | 0.067 | 0.112 | 0.121 | 0.070 |
| | S32 | 0.000 | 0.000 | 0.000 | 0.457 | 0.000 | 0.050 | 0.046 | 0.051 | 0.061 | 0.097 | 0.061 | 0.094 | 0.047 | 0.048 | 0.061 | 0.061 | 0.048 | 0.061 | 0.052 | 0.044 | 0.048 |
| | S33 | 0.000 | 0.000 | 0.000 | 0.264 | 0.000 | 0.052 | 0.048 | 0.053 | 0.064 | 0.044 | 0.064 | 0.078 | 0.049 | 0.050 | 0.064 | 0.064 | 0.050 | 0.064 | 0.088 | 0.119 | 0.063 |
| | S41 | 0.000 | 0.000 | 0.000 | 0.000 | 0.516 | 0.045 | 0.041 | 0.046 | 0.055 | 0.038 | 0.055 | 0.035 | 0.042 | 0.043 | 0.055 | 0.055 | 0.043 | 0.055 | 0.036 | 0.039 | 0.133 |
| | S42 | 0.000 | 0.000 | 0.000 | 0.000 | 0.386 | 0.043 | 0.040 | 0.044 | 0.053 | 0.037 | 0.053 | 0.034 | 0.041 | 0.042 | 0.053 | 0.053 | 0.042 | 0.053 | 0.035 | 0.038 | 0.104 |
| | S43 | 0.000 | 0.000 | 0.000 | 0.000 | 0.098 | 0.040 | 0.036 | 0.040 | 0.049 | 0.034 | 0.049 | 0.031 | 0.037 | 0.038 | 0.049 | 0.049 | 0.038 | 0.049 | 0.032 | 0.034 | 0.037 |

**Appendix3. Weighted Super matrix**

| | | Goal | Main Factors | | | | Sub Factors | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | C1 | C2 | C3 | C4 | S11 | S12 | S13 | S14 | S21 | S22 | S23 | S24 | S25 | S26 | S31 | S32 | S33 | S41 | S42 | S43 |
| Goal | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Main Factors | C1 | 0.359 | 0.147 | 0.193 | 0.176 | 0.136 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | C2 | 0.365 | 0.127 | 0.076 | 0.109 | 0.141 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | C3 | 0.061 | 0.151 | 0.181 | 0.141 | 0.175 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | C4 | 0.216 | 0.076 | 0.051 | 0.074 | 0.048 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sub Factors | S11 | 0.000 | 0.048 | 0.000 | 0.000 | 0.000 | 0.043 | 0.080 | 0.045 | 0.054 | 0.042 | 0.054 | 0.038 | 0.044 | 0.042 | 0.054 | 0.054 | 0.047 | 0.054 | 0.039 | 0.044 | 0.042 |
| | S12 | 0.000 | 0.221 | 0.000 | 0.000 | 0.000 | 0.070 | 0.064 | 0.071 | 0.086 | 0.137 | 0.086 | 0.119 | 0.107 | 0.068 | 0.086 | 0.086 | 0.146 | 0.086 | 0.121 | 0.164 | 0.086 |
| | S13 | 0.000 | 0.058 | 0.000 | 0.000 | 0.000 | 0.150 | 0.161 | 0.081 | 0.082 | 0.076 | 0.082 | 0.062 | 0.165 | 0.175 | 0.082 | 0.082 | 0.076 | 0.082 | 0.064 | 0.074 | 0.065 |
| | S14 | 0.000 | 0.173 | 0.000 | 0.000 | 0.000 | 0.166 | 0.167 | 0.129 | 0.092 | 0.157 | 0.092 | 0.084 | 0.147 | 0.080 | 0.092 | 0.092 | 0.189 | 0.092 | 0.079 | 0.081 | 0.074 |
| | S21 | 0.000 | 0.000 | 0.209 | 0.000 | 0.000 | 0.050 | 0.045 | 0.051 | 0.061 | 0.043 | 0.061 | 0.097 | 0.047 | 0.048 | 0.061 | 0.061 | 0.048 | 0.061 | 0.091 | 0.044 | 0.056 |
| | S22 | 0.000 | 0.000 | 0.080 | 0.000 | 0.000 | 0.046 | 0.042 | 0.046 | 0.056 | 0.039 | 0.056 | 0.092 | 0.043 | 0.044 | 0.056 | 0.056 | 0.044 | 0.056 | 0.044 | 0.040 | 0.044 |
| | S23 | 0.000 | 0.000 | 0.070 | 0.000 | 0.000 | 0.045 | 0.041 | 0.045 | 0.055 | 0.038 | 0.055 | 0.035 | 0.042 | 0.043 | 0.055 | 0.055 | 0.043 | 0.055 | 0.088 | 0.039 | 0.051 |
| | S24 | 0.000 | 0.000 | 0.036 | 0.000 | 0.000 | 0.040 | 0.036 | 0.040 | 0.049 | 0.034 | 0.049 | 0.031 | 0.037 | 0.038 | 0.049 | 0.049 | 0.038 | 0.049 | 0.032 | 0.034 | 0.037 |
| | S25 | 0.000 | 0.000 | 0.072 | 0.000 | 0.000 | 0.061 | 0.058 | 0.146 | 0.063 | 0.096 | 0.063 | 0.047 | 0.060 | 0.062 | 0.063 | 0.063 | 0.051 | 0.063 | 0.048 | 0.047 | 0.049 |
| | S26 | 0.000 | 0.000 | 0.033 | 0.000 | 0.000 | 0.046 | 0.043 | 0.056 | 0.055 | 0.044 | 0.055 | 0.036 | 0.043 | 0.125 | 0.055 | 0.055 | 0.044 | 0.055 | 0.037 | 0.039 | 0.042 |
| | S31 | 0.000 | 0.000 | 0.000 | 0.139 | 0.000 | 0.055 | 0.050 | 0.056 | 0.067 | 0.046 | 0.067 | 0.088 | 0.051 | 0.053 | 0.067 | 0.067 | 0.053 | 0.067 | 0.112 | 0.121 | 0.070 |
| | S32 | 0.000 | 0.000 | 0.000 | 0.228 | 0.000 | 0.050 | 0.046 | 0.051 | 0.061 | 0.097 | 0.061 | 0.094 | 0.047 | 0.048 | 0.061 | 0.061 | 0.048 | 0.061 | 0.052 | 0.044 | 0.048 |
| | S33 | 0.000 | 0.000 | 0.000 | 0.132 | 0.000 | 0.052 | 0.048 | 0.053 | 0.064 | 0.044 | 0.064 | 0.078 | 0.049 | 0.050 | 0.064 | 0.064 | 0.050 | 0.064 | 0.088 | 0.119 | 0.063 |
| | S41 | 0.000 | 0.000 | 0.000 | 0.000 | 0.258 | 0.045 | 0.041 | 0.046 | 0.055 | 0.038 | 0.055 | 0.035 | 0.042 | 0.043 | 0.055 | 0.055 | 0.043 | 0.055 | 0.036 | 0.039 | 0.133 |
| | S42 | 0.000 | 0.000 | 0.000 | 0.000 | 0.193 | 0.043 | 0.040 | 0.044 | 0.053 | 0.037 | 0.053 | 0.034 | 0.041 | 0.042 | 0.053 | 0.053 | 0.042 | 0.053 | 0.035 | 0.038 | 0.104 |
| | S43 | 0.000 | 0.000 | 0.000 | 0.000 | 0.049 | 0.040 | 0.036 | 0.040 | 0.049 | 0.034 | 0.049 | 0.031 | 0.037 | 0.038 | 0.049 | 0.049 | 0.038 | 0.049 | 0.032 | 0.034 | 0.037 |

## Appendix4. Limited Super matrix

| | | Goal | Main Factors | | | | Sub Factors | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | C1 | C2 | C3 | C4 | S11 | S12 | S13 | S14 | S21 | S22 | S23 | S24 | S25 | S26 | S31 | S32 | S33 | S41 | S42 | S43 |
| Goal | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Main Factors | C1 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | C2 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | C3 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | C4 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sub Factors | S11 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| | S12 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 |
| | S13 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 | 0.099 |
| | S14 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 |
| | S21 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 |
| | S22 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| | S23 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 |
| | S24 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 |
| | S25 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 |
| | S26 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 |
| | S31 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 | 0.066 |
| | S32 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 | 0.058 |
| | S33 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 |
| | S41 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| | S42 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 |
| | S43 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 |