Prioritizing Parameters for Software Project Management Using Analytical Hierarchy Processing

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Abstract—Since late 1980 the great advancement has been seen in the software industry, as most of the fields directly or indirectly depend upon software’s. There are many software projects and software’s available in the market that reduces human work, consumes less time than manual time taken and brings more accurate results. So the Software industry is manufacturing numerous software projects for every field. For the high acceptability of software projects by the customers, the manufacturing purely depends upon customer demands, budget, and advanced technology. However, all the importance of software and projects will be diminished if they are not managed and selected properly. So the proposed study is based on prioritizing various discovered parameters for the Management of Software Projects, by surveying several software project developing companies. The companies prioritize the parameter’s to make the better selection and the whole analysis has been made by using Analytical Hierarchy Process (AHP). The implementation is based on manual calculations and obtained results have been verified using BPMSG AHP calculator. The acceptability of results has been checked by using Consistency Ratio.


1. INTRODUCTION

In the Microsoft world, the huge demand of software’s and hardware’s lead to its rapid growth. The various ranges of software’s and software projects are developed since then. The Software Technology has been growing fast from 1970’s or late 1980’s and huge modification in the software’s and projects has been seen since then. The management of software Projects is as necessary as the production of software projects. Due to huge demand of software projects, the growth rate has also increased. As software projects are intended to achieve a certain goal, so Software Project Management plays a greater role in the Software Industry and. Every Software Manufacturing Company wants to shine in the share market and desires to gain higher share [21][27]. The huge production also requires proper management for the life time availability with minimum loss. The loss can be minimized, if the selection of both software and software project selection is effective in response to customer requirements. The decision regarding which one is best out of many is considered to be the most critical and important decision in the industry. The proposed research supports this type of decision making for the management of software projects. The goal is to manufacture the software projects in accordance to customer requirements with minor loss to company, minimum resource utilization and within the budget. The Company that excels in the competitive field, gains the maximum share of market and effective strategy is recognized by it. This strategy is simple to straight and aims at making effective decisions based on various comparisons of important factors that relate to various alternatives. To implement this strategy Analytical Hierarchical Processing (AHP) has been employed to select the most appropriate Software Project by prioritizing its parameters.

A. DECISION MAKING BASED ON AHP BY Decision MAKERS

Decisions are regarded as one of the most important part of living world. Decisions are often made either manually/unconsciously or by using existing techniques. There is a huge chance of false decision in case the. However there are some situations for which the decision has been made without proper judgment, lack of knowledge decision maker uses some techniques for the consistent result [15]. These techniques are helpful to make right decision at right time so that confusion gets eliminated [6]. The decision is made from many alternatives and one best is chosen that solves the problem completely. In other words decision can be regarded as the problem solver method that relies upon various criteria’s, having number of alternatives. The decision making process should be able to generate the best suited decision in the direction of goal. There is a problem of wrong decisions that are made under illusion but actually they are not exact. The decision making process must be robust in the manner to handle even multiple criteria’s. Software companies have to often make correct and fruitful decisions regarding the management of software projects. Hence the AHP techniques can be adopted to arrive at best decision. Decision making as a problem solver method can be used in various fields:

- Decision of medical treatment after diagnosing the patient.
- Business regarding decisions.
- In educational fields, regarding the selection of college or subjects.
- In industries, to decide the quantity and quality.
- In software companies, regarding the selection of best software project having maximum benefit and minimum cost.

B. ANALYTICAL HIERARCHY PROCESS (AHP)

Analytical Hierarchical Process is one of the prominent techniques to make veracious decisions. All confusions can be eliminated by using the decision making technique AHP. The decision maker can easily solve the problem and obtain the right solution. The widely known Analytic Hierarchical Process (AHP) was developed by famous researcher Thomas L. Saaty in the early 1970’s and it is refined since then [1]. Saaty also provided the scale for relative degree of importance known as saaty’s scale. Analytic Hierarchical Process is a decision based technique that eliminates the confusion and solves the problem. AHP is a structural technique, has the capability to solve even complex problems. Although the technique generates the correct decision, but also gives that one decision which completely best fits the situation. AHP can be applied to fields like government, business, industry, healthcare, and education. The technique is purely based upon psychology and mathematics. The procedure can be summarized as:

- Design the hierarchy model of a problem containing the goal at the top, then various identified criteria’s and at last the alternatives in the direction of goal [20]. There is no limit for the number of criteria’s so the hierarchy would different for different types of problem.

- Assign the priority values (integer value) to all the identified criteria’s by making judgments for each pair of elements. This pair wise comparison differentiates each criterion in a pair and this comparison has to be made only in a single pair [13]. The very first element is compared with the second element then with the third element in the continuing manner till the last element and each of this comparison gives the rank to each criterion. These ranked values are arranged in a positive reciprocal matrix.

- Normalize the columns by dividing each column element by the column sum. From the normalized matrix the Eigen vectors are obtained by averaging each row. The process of obtaining Eigen vectors is called approximation method.

- At last the consistency is verified by using RIS (Random Index Scale) proposed by saaty [18].

Fig 2: AHP Hierarchy Model

II. LITERATURE REVIEW

TL Saaty et al. summarized the introduction and details of Analytic Hierarchy Process [20]. Described AHP as multi-criteria decision making approach, where the choices have to be made between competing parameters. Helena Brozova proposed the new methodology of identifying student’s preferences of teacher’s managerial competencies [14]. Pawel Cabala Characterized and discussed the general assumptions of Analytical Hierarchy Process (AHP) in the beginning [18]. Discussed the whole procedure of AHP that how the positive reciprocal matrix is presented and the role of pair wise comparison of elements using the appropriate scale. Kamal M. Al-Subhi Al-Harbi discussed about Analytic Hierarchical Process (AHP) as a decision making method for the management of software projects [21]. The hierarchical structure is constructed for the Prequalification criteria and the contractors. Mohammed I Al Khali has developed the model using a widely known technique i.e. Analytical Hierarchical Process (AHP) for the selection of an appropriate Project Delivery Method [26]. The target is to choose the best suited project delivery method because the success relies on the best selection.

Khalid Eldrandaly discussed the about the problem of selecting best suiting Geographic Information Systems (GIS) for a particular Geographic Information System (GIS) project [8]. This is Multi Criteria Decision Making (MCDM) approach, can handle qualitative and quantitative criteria’s to select the appropriate GIS package. The problem is decomposed into comprehensive set of factors and multiple objectives are balanced to determine the best suitable software for building GIS application. E.W.T. Ngai et al. presented one application of Analytic Hierarchy Process (AHP) for the selection of best tool to support Knowledge Management (KM) [35]. The proposed study adopted the multi-criteria decision making approach to compare and analyze the various Knowledge Management (KM) tools in the software industry.
Yusmadi Yah Jusoh et al. discussed the selection of Open Source Software (OSS) by considering various criteria’s and sub-criteria’s [17]. Also based on decision making therefore used AHP technique and was adopted in MyOSST v1.0 for the Open Source Software Selection. R. V. Rao et al. discussed about the software selection in manufacturing industries which is a decision making framework [23]. The work is done by using multiple criteria decision making method known as Preference Ranking Organization Method for Enrichment Evaluations (PROMETHEE). The PROMETHEE method is integrated with Analytical Hierarchical Process (AHP) and Fuzzy Logic. The used method can be extended for any type of complex problems having any number of criteria’s and alternatives. Tuli Bakshi et al. have highlighted the scenario of software industry [11]. The Analytical Hierarchical Process (AHP) and Quality Function Deployment (QFD) are integrated to establish a framework for prioritizing customer requirements by assigning integer values via comparisons and hence to reach at efficient decision for selecting a best software project.

Cengiz Kahraman et al. presented the supplier selection decision as a multi-criterion problem and considered this as one of the important decisions of companies [28]. The proposed work used the Fuzzy Analytical Hierarchical Process (AHP) to select the best suited supplier having much weighted criteria. Jiann Liang Yang et al. have also discussed the Fuzzy Analytical Hierarchy Process (AHP) Method to select the vendor and integrated Fuzzy Multiple Criteria Decision Making (MCDM) method to address this issue [34]. J.I.Pelaez et al. discussed an alternate for the measure of consistency and also demonstrates its applicability for different types of matrices [19]. This alternate consistency measure is different than the traditional way to measure the consistency as it is based on determinant of the matrix.

III. PROPOSED METHODOLOGY

For the analysis of the proposed problem, study has been done on all the existing methods used for prioritizing software project parameters. In the proposed study the Management of Software Project has been divided into two dimensions and both dimensions are based on decision making. Each dimension has its own identified parameters that differentiate one dimension from another. The proposed method aims to consider eight parameters for software project selection and seven parameters for software selection, so as to get more accurate results.

To achieve the objectives, following methodology has been adopted:

a. Study the T L Saaty’s decision based Analytical Hierarchy Process.
   - Study the approximation method for prioritization of parameters to obtain the Eigen vectors and study the Saaty’s scale.

b. Study about the possible parameters and sub parameters, for both dimensions i.e. software project selection and software selection.

c. Study and explore the previous accuracy of results.

d. Collected the data by taking approx 10 surveys of different software project developing companies.

e. Design and implement using AHP. From the complete survey an overall average values are obtained for each parameter and then their Eigen vectors are obtained by manual calculations using AHP.

BPMSG AHP Calculator will be used to find the Eigen vectors and consistency of each survey. The reason to choose the BPMSG AHP calculator is to verify the consistency of the result obtained through manual calculations. The BPMSG AHP calculator has the ability to generate the result along with the Consistency Ratio by taking the parameter comparisons as input. The performance of the proposed method will be evaluated on the basis of the Accuracy and Efficiency.

A. SOFTWARE PROJECT SELECTION

The software project parameters and sub-parameters are prioritized by using AHP technique and following is the structural design:

1. **Project Risk (PR)**
   - Risk in Planning (RIP)
   - Risk in Cost Estimation (RIC)
   - Risk in Technique (RIT)
   - Risk in Technology (RITECH)
2. **Project Benefits (PB):**
   - Increased Throughput (IT)
   - Elimination of Time Wasting Tasks (ETWT)
   - Lowering the Level of Unnecessary Resource Utilization (LLURU)
   - Improved Interest and Motivation among Team Members (IIMTM)

3. **Cost (CO):**
   - Hardware/Software Cost (HSC)
   - Staff Training Cost (STC)
   - New Technology Cost (NTC)

4. **Resource Utilization (RU):**
   - Resources Needed to Manufacture (RNM)
   - Human Resources (HR)
   - Security Resources (SR)

5. **Completion Time (CT):**
   - Gathering Requirements (GR):
   - Analysis (AN):
   - Design (DE):
   - Development (DEV):
   - Testing (TE):
   - Implementation/Training (IM):

6. **Project Quality (PQ):**

7. **Project Maintenance (PM):**

8. **Project Scheduling (PS):**

---

**B. SOFTWARE SELECTION**

The identified parameters and sub-parameters are shown structurally below:

1. **Supplier Support (SS)**
   - Demo (DEM)
   - Prior Experience with Supplier (PES)
   - Training Facility (TF)
   - Technical Help (TH)

2. **Software Cost (CO)**
   - Implementation Cost (IC)
   - Hardware Infrastructure Cost (HIC)
   - Maintenance Cost (MC)

3. **User friendliness (UF)**
   - Report Generation (RG)
   - GUI Based Response (GUI-BR)

4. **Life Span of Tool (LST)**
   - Implementation Cost (IC)
   - Hardware Infrastructure Cost (HIC)
   - Maintenance Cost (MC)

---

Fig 3: Structural Design showing the classification of Software Project Parameters and sub-parameters
5. Compatibility with Business Goal (CWBG)
- Functionality of Tool (FT)
- Upgrade Ability (UA)
- Maintainability (MA)

6. Flexibility of Software (FS)

7. Technological Risks (TR)
- Cost of Technology (CT)
- Higher Probability to Achieve Goal (HPAG)
- Software Compatibility (SC)

The detailed steps of the implementation are explained in this section [11] [8].
- Identified the problem i.e. prioritizing parameters for Software Project Management by using AHP.
- Decompose the problem into hierarchy of parameters and sub parameters.
- Do the survey from various software developing companies. The responses from all the surveys are aggregated to form one average matrix of each criteria and sub-criteria.

![Fig 4: Structural Design showing the classification of Software Parameters and sub-parameters](image)

Table 1. Pair wise comparison

<table>
<thead>
<tr>
<th>Criteria 1</th>
<th>Criteria 2</th>
<th>Criteria 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria 1</td>
<td>1</td>
<td>$a_{ij}$</td>
</tr>
<tr>
<td>Criteria 2</td>
<td>$a_{ij}$</td>
<td>1</td>
</tr>
<tr>
<td>Criteria 3</td>
<td>$a_{ik}$</td>
<td>$a_{jk}$</td>
</tr>
</tbody>
</table>

Total sum

Table 2. Showing the Eigen Vectors

<table>
<thead>
<tr>
<th>Criteria 1</th>
<th>Criteria 2</th>
<th>Criteria 3</th>
<th>Eigen vectors</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria 1</td>
<td>$\frac{a_{ii}}{\text{sum of col 1}}$</td>
<td>$\frac{a_{ij}}{\text{sum of col 2}}$</td>
<td>$\frac{a_{ik}}{\text{sum of col 3}}$</td>
<td>$\frac{\text{sum of row 1}}{\text{num of elements in row 1}}$</td>
</tr>
<tr>
<td>Criteria 2</td>
<td>$\frac{a_{ji}}{\text{sum of col 1}}$</td>
<td>$\frac{a_{jj}}{\text{sum of col 2}}$</td>
<td>$\frac{a_{jk}}{\text{sum of col 3}}$</td>
<td>$\frac{\text{sum of row 2}}{\text{num of elements in row 2}}$</td>
</tr>
<tr>
<td>Criteria 3</td>
<td>$\frac{a_{ki}}{\text{sum of col 1}}$</td>
<td>$\frac{a_{kj}}{\text{sum of col 2}}$</td>
<td>$\frac{a_{kk}}{\text{sum of col 3}}$</td>
<td>$\frac{\text{sum of row 3}}{\text{num of elements in row 3}}$</td>
</tr>
</tbody>
</table>
The parameter with rank 1 is considered to be the most important parameter among others and rank 3 is considered to be the least important parameter. Hence the final decision depends upon the winner parameter.

**CONSISTENCY RATIO**
The result is verified, to know whether it is acceptable or not. It is necessary to check the accuracy and validity of result, for this the consistency ratio has been used to check the consistency of each result. To calculate the consistency ratio \( \lambda_{\text{max}} \) calculated first

\[
[A][X]=\lambda_{\text{max}}[X]
\]

\([A] = \text{positive reciprocal matrix}
\]

\([X] = \text{Eigen vectors}
\]

Saaty has proposed a consistency index (CI), which is related to Eigen value method. The consistency index can be calculated from the maximum Eigen value known as \( \lambda_{\text{max}} \). The correct priorities are those which are derived from consistent or near consistent matrices. The proposed study also applied the consistency check. The consistency ratio (CR) is the ratio of CI and RI, which is given by:

\[
\text{Consistency Index (CI)} = \frac{\lambda_{\text{max}}-P}{n-1}
\]

\[
\text{Consistency Ratio} = \frac{\text{Consistency Index (CI)}}{\text{Random Index (RI)}}
\]

Where \( \lambda_{\text{max}} = \text{maximum Eigen value, } n = \text{order of matrix and RI= } \text{Random index (the average CI of 500 randomly filled matrices). } \)

If CR is less than 0.1 or 10% then, the matrix is said to be having acceptable consistency.

### Table 3. Saaty’s scale for Random Index

<table>
<thead>
<tr>
<th>Matrix Order</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
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</thead>
<tbody>
<tr>
<td>RI</td>
<td>0.00</td>
<td>0.09</td>
<td>0.58</td>
<td>0.99</td>
<td>1.12</td>
<td>1.24</td>
<td>1.32</td>
<td>1.41</td>
<td>1.45</td>
<td>1.49</td>
<td>1.51</td>
<td>1.48</td>
<td>1.56</td>
<td>1.57</td>
<td>1.59</td>
</tr>
</tbody>
</table>

### IV. RESULTS

#### A. RESULTS RELATED TO SOFTWARE PROJECT SELECTION

![Graphical View of prioritized parameters of Software Project](image)

**Fig. 5 Graphical View of prioritized parameters of Software Project**

From the table it is clear that the Resource Utilization has the highest priority therefore this is ranked one, followed by parameter Project Quality. Project Maintenance has the least priority.

**Consistency Ratio**

\[
\text{Consistency Ratio} = \frac{\text{Consistency Index (CI)}}{\text{Random Index (RI)}} = 0.0695
\]

<table>
<thead>
<tr>
<th>PR</th>
<th>PB</th>
<th>CO</th>
<th>RU</th>
<th>CT</th>
<th>PQ</th>
<th>PM</th>
<th>PS</th>
<th>Priority vector</th>
<th>Rank</th>
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<tr>
<td>0.1552</td>
<td>0.2127</td>
<td>0.2498</td>
<td>0.1382</td>
<td>0.1706</td>
<td>0.1207</td>
<td>0.0872</td>
<td>0.0913</td>
<td>0.1532</td>
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<td>0.0931</td>
<td>0.1276</td>
<td>0.2430</td>
<td>0.1470</td>
<td>0.1526</td>
<td>0.1170</td>
<td>0.0727</td>
<td>0.0710</td>
<td>0.1281</td>
<td>4</td>
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<td>0.0640</td>
<td>0.0541</td>
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<td>0.1625</td>
<td>0.1133</td>
<td>0.0737</td>
<td>0.1211</td>
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</tr>
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<td>0.1970</td>
<td>0.3053</td>
<td>0.2558</td>
<td>0.1529</td>
<td>0.1979</td>
<td>0.1990</td>
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<tr>
<td>0.0612</td>
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<td>0.1607</td>
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<tr>
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<td>0.0786</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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a. Project Risk Parameters:

Table 5. Column normalization Project Risk Parameters

<table>
<thead>
<tr>
<th></th>
<th>RIP</th>
<th>RIC</th>
<th>RIT</th>
<th>RITECH</th>
<th>Eigenvectors</th>
<th>Rank</th>
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<tr>
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<td>.4983</td>
<td>.3806</td>
<td>.2654</td>
<td>.3891</td>
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</tr>
<tr>
<td>RIC</td>
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<td>RIT</td>
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<td>RITECH</td>
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<td>.1421</td>
<td>.1374</td>
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</tr>
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</table>

Consistency Ratio (CR) = .0917

Fig. 6 Graphical View of prioritized parameters of Project Risk

b. Prioritized Cost Parameters:

Table 6. Column normalization Of Cost Parameter

<table>
<thead>
<tr>
<th></th>
<th>HSC</th>
<th>STC</th>
<th>NTC</th>
<th>Eigenvectors</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
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<td>.6621</td>
<td>.4267</td>
<td>.5535</td>
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</tr>
<tr>
<td>STC</td>
<td>.2082</td>
<td>.2411</td>
<td>.4090</td>
<td>.2861</td>
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</tr>
<tr>
<td>NTC</td>
<td>.2199</td>
<td>.0967</td>
<td>.1641</td>
<td>.1602</td>
<td>3</td>
</tr>
</tbody>
</table>

Consistency Ratio(R) = .0906

Fig. 7 Graphical View of prioritized parameters of Cost

c. Prioritized Resource Utilization Parameters:

Table 7. Column normalization of Resource Utilization Parameter

<table>
<thead>
<tr>
<th></th>
<th>MR</th>
<th>HR</th>
<th>SR</th>
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<td>.7738</td>
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</tr>
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<td>HR</td>
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<td>SR</td>
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<td>.0896</td>
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<td>.1198</td>
<td>3</td>
</tr>
</tbody>
</table>

Consistency Ratio (CR) = .0812

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B. RESULTS RELATED TO SOFTWARE SELECTION

Table 8. Column Normalization Of Software Parameters

<table>
<thead>
<tr>
<th></th>
<th>SS</th>
<th>CO</th>
<th>UF</th>
<th>LT</th>
<th>CWBG</th>
<th>FOS</th>
<th>TR</th>
<th>Eigen vector</th>
<th>Rank</th>
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</thead>
<tbody>
<tr>
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<td>.072</td>
<td>.190</td>
<td>.036</td>
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<td>.095</td>
<td>.047</td>
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</tr>
<tr>
<td>CO</td>
<td>.066</td>
<td>.061</td>
<td>.123</td>
<td>.185</td>
<td>.053</td>
<td>.026</td>
<td>.040</td>
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<td>.038</td>
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<td>.208</td>
<td>.2223</td>
<td>1</td>
</tr>
</tbody>
</table>

Consistency Ratio (CR) = .0670

Table 9. Column Normalization Of Supplier Support Parameters

<table>
<thead>
<tr>
<th></th>
<th>DEM</th>
<th>PES</th>
<th>TF</th>
<th>TH</th>
<th>Eigen vectors</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEM</td>
<td>.186</td>
<td>.294</td>
<td>.137</td>
<td>.089</td>
<td>.1770</td>
<td>3</td>
</tr>
<tr>
<td>PES</td>
<td>.283</td>
<td>.445</td>
<td>.567</td>
<td>.530</td>
<td>.456</td>
<td>1</td>
</tr>
<tr>
<td>TF</td>
<td>.266</td>
<td>.154</td>
<td>.196</td>
<td>.253</td>
<td>.2175</td>
<td>2</td>
</tr>
<tr>
<td>TH</td>
<td>.263</td>
<td>.106</td>
<td>.082</td>
<td>.126</td>
<td>.1486</td>
<td>4</td>
</tr>
</tbody>
</table>

Consistency Ratio (CR) = .0815
b. Prioritized Cost Parameters:

\[
\begin{bmatrix}
1 & 1.5333 & 2.0984 \\
0.6521 & 1 & 1.8031 \\
0.4763 & 0.5546 & 1
\end{bmatrix}
\]

Table 10. Column Normalization of Cost Parameters

<table>
<thead>
<tr>
<th>IC</th>
<th>HIC</th>
<th>MC</th>
<th>Eigen vectors</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>.4698</td>
<td>.4965</td>
<td>.4282</td>
<td>.4648</td>
<td>1</td>
</tr>
<tr>
<td>.3063</td>
<td>.3238</td>
<td>.3677</td>
<td>.3326</td>
<td>2</td>
</tr>
<tr>
<td>.2237</td>
<td>.1796</td>
<td>.2039</td>
<td>.2024</td>
<td>3</td>
</tr>
</tbody>
</table>

Consistency Ratio (CR) = .0525

Fig. 11 Graphical View of prioritized parameters of Software Cost

c. Prioritized Life Span of Tool Parameters

\[
\begin{bmatrix}
1 & 2.9682 & 2.9089 \\
0.3369 & 1 & 1.9142 \\
0.3437 & 0.5224 & 1
\end{bmatrix}
\]

Table 12. Column Normalization of Life Span of Tool Parameters

<table>
<thead>
<tr>
<th>FT</th>
<th>UA</th>
<th>MA</th>
<th>Eigen vectors</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>.5950</td>
<td>.6609</td>
<td>.4995</td>
<td>.5851</td>
<td>1</td>
</tr>
<tr>
<td>.2004</td>
<td>.2226</td>
<td>.3287</td>
<td>.2505</td>
<td>2</td>
</tr>
<tr>
<td>.2045</td>
<td>.1163</td>
<td>.1717</td>
<td>.1641</td>
<td>3</td>
</tr>
</tbody>
</table>

Consistency Ratio (CR) = .04275

Fig. 13 Graphical View of prioritized parameters of Life Span of Tool
Prioritized parameters of Project Risk by using BPMSG AHP calculator

The proposed study implemented the result by performing manual calculations for all parameters and sub-parameters. For the verification purpose one efficient BPMSG AHP calculator has been used.

![Figure 14: Screen shots for Project Risk prioritized parameters](image)

The Project Risk is the sub-parameter of Software Project, whose result has been verified by using BPMSG AHP calculator. It has been observed that the RIP (Risk in Planning) parameter has the highest priority among all parameters of Project Risk. Whereas the RITECH (Risk in Technology) has the lowest priority and the obtained consistency ratio is 6%.

Prioritized parameters of Supplier Support by using BPMSG AHP calculator

The Supplier Support is the sub-parameter of Software, whose result also has been verified by using BPMSG AHP calculator. By making all the necessary pair wise comparisons, it has been observed that the PES (Previous Experience with Supplier) parameter has the highest priority among all parameters of Project Risk. Whereas the DEM (demo) parameter has least priority. The consistency ratio comes out to be 5.1%, which is purely acceptable.

![Figure 15: Screen shots for Supplier Support prioritized parameters](image)
V. CONCLUSIONS

The Software Project Management parameters are prioritized in the research for the selection of best software and project. It was observed that Prioritization scheme based on few parameters is not sufficient to get the accurate result. Various surveys for large number of parameters and sub-parameters may generate the more accurate result. Most of the existing work is not addressing this significant issue and this research is based on numerous surveys for various parameters and sub parameters. Most of the work done so far in the field of decision making based on single survey for basic parameters only. This process considered to be less accurate as the decision depends upon few judgments. On the other hand, the work presented here, based on around 10 surveys and considered 15 parameters and 35 sub parameters in total. Hence the result is much accurate as the average values of the whole survey were analyzed for prioritization. This process can also be applied to other types of software project selection and software selection by modifying or adding few parameters if needed. The work presented the multi criteria decision making that simplifies the problem of multiple attributes by assigning different weights for each attribute. The results are acceptable as the consistency is verified and concluded that most preferred parameter is Resource Utilization for Software Project Selection and Technological Risk is the most preferred parameter for Software Selection.

The Software Project Management is realized in this dissertation. However, this can be further extended to increase the accuracy of prioritization. In this study, the various parameters and sub-parameters are prioritized using Analytical Hierarchical Process (AHP). An extension to this research work is to use another technique i.e. Analytical Network Process (ANP), for prioritization of various parameters that could bring even more accuracy. However by researching for some more parameters and considering the further details of identified parameters and sub-parameters, more accuracy can be achieved.

REFERENCES


