

A review paper on decision making using AHP (Analytical Hierarchy Process) techniques in different types of project management

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Abstract— Today project management in every field of life is prerequisite for the success of project by increasing quality reduces cost and schedule. But selecting tools and techniques to achieve our objectives and implement our plan fully is very difficult task because choice creates complexity. So, we discuss AHP to make decision simple. Ranking critical success factor, cloud computing services, risk prioritization, selection of right ETL software and many other systems AHP plays its important role. For the improvement of today's complex systems it is very important to prioritize and select projects to remove the root cause of the problem. To attain the right selection of construction equipment for carrying out schedule tasks with high efficiency, production and financial capability is the main purpose of procurement of construction equipment process. Certain conflicts can occur due to the construction of UML models in a collaborative way. AHP is used to remove these conflicts and for establishing and evaluating modelers judgments. Nowadays it is very important and critical decision to choose the best option from multiple alternatives for a successful career after passing 12th standard and also it affects our future. "AHP and TOPSIS" methods are used for this purpose. In this paper, an "AHP and Fuzzy AHP" based hierarchical trust model has been used to rate the service providers and their various plans for infrastructure as a service.

Keywords— Analytical Hierarchy process, AHP, fuzzy, project management, risk prioritization, critical success factors, ETL, MCDM, TOPSIS.

I. INTRODUCTION

According to project management integration, project is a temporary factor with some special objective and goal to achieve. Temporary means that it has some starting and ending time, in that time span project team has to face many difficulties and they try fully to make project successful. So, for the success of project ranking the critical success factors are very important for every company^[2]. Project management is basically a series of activities like planning, organizing, executing, monitoring resources and controls the project changes. All these activities helps to set goal and objectives to understand what customer actually want from system. But the important problem related to project is the selection and making decisions of software, tools and techniques, so, here we discuss "analytical hierarchy process" to solve this problem. No doubt project management tools provide large numbers of features to make the management easier but its selection is hectic task. Project management includes scheduling, budgeting and allocating resources. Good management software should facilitate the team collaboration

means that all stakeholders should have access of updated project. Project management software performs good quality scheduling if a new requirement come from customer then schedule should change. The best practice for this factor is to draw Gantt chart. The software should have capability to track the issues related to project management. "Analytical hierarchy process" was developed by Prof. "Thomas L. Saaty", it is a principle which helps to analyze, organize and choose the criteria based on pair wise comparison. Analytical hierarchy process contain some sequence of steps i-e, First determine problem and set goal, then structure a top down list passed through each level of all alternatives, then create pair wise comparison matrices. Then make comparison matrix by taking reciprocal of pair matrices, then compute priority vector using eigen value method, then create consistency ratio, on the basis of this ration decide your desired method or tool. The main objective of this research to demonstrate the usage of AHP in decision making in different types of project management like critical success factor, risk prioritization, cloud computing ranking service, domain based recommender systems and selection of ETL software etc.

The management of risks in mainly the construction project is very important for the success of projects and also it reduces the cost of project. There is an uncertainty in the risks due to the irregularity of results during planning^[6]. Nowadays in the field of BI the selection of right ETL software is a very big problem as it is a multi-criteria decision making problem so, we can used MCDM techniques which includes AHP and TOPSIS methods to solve this problem^[8]. It is the responsibility of software designer to choose the right repair action for the removal of conflicts in UML modeling^[13]. For the selection and prioritization of projects the FAHP based approach included cause and effect diagram helps the decision makers to identifying and categorizing the main causes of an effect and also identifying the relationships of causes^[9]. Under different levels of uncertainty for ranking alternatives "MCAHP" methods is better than AHP approach and it is also used for the selection and evaluation of project, ranking and supplier selection. AHP provides the ranking as a fixed value while MCAHP define pairwise comparisons as possibility deliveries and also it provides much richer output. Simulation algorithm is used to compare the performance of "MCAHP with AHP" method^[11]. The

selection of right career option after 12th standard is a multicriteria decision making problem which includes four criteria's that are interest, employ prospect, duration and fee. Both AHP and TOPSIS methods are applied on these criteria to calculate weights of each criteria and then final rank values assigned^[14]. The important highlights of paper are: Section II describes the literature review. Section III describes the full analysis of papers that we studied in our research.

Section IV describes the conclusion that we conclude by our research.

II. LITERATURE REVIEW

Today project management become an important part of every organization for the betterment of project cost, time, and schedule and satisfies the customer in most efficient ways. But the problem which is more common is to select the software and tools that perform all the activities and minimize all the related hurdles. In order to remove this problem we discuss “AHP”. Only managing the project is not important it is necessary to make effective decisions to reduce complexity. Project management is a series of activities like planning, organizing, promoting and control the availability of resources and procedures. “AHP” is a formalized technique for constructing and analyzing the complex problem and take decisions. It is basically used to rank the decisions and their selection [3]. Software project managers used different tools to make the management of project effective and administrative but this is not a new case, every manager do this the problem is tool selection on the basis of superiority of features, here we discuss “AHP” that groom the users to help in selecting tools. This paper briefly explains the process to choose “AHP” tools by dividing the model in three stages: structure the complexity, measure the ratio scale, and synthesizing. In analytical hierarchy process user first make the hierarchy of problematic elements then built the matrix make comparison of criteria where two elements of same criteria occur and then make decision.

As “Saaty” was the founder of “AHP”, he explain its advantages as unity, understandable, trade off, repetition and complexity to make the decision easy for users. He linked the “AHP” method with nearly all aspects of project management [2]. The analytical hierarchy process not only helpful for IT, it also helpful for students for the selection of their elective subjects as we study a paper in our research [1]. Besides all problems the other main issue related to project handling is risk prioritization that plays a very important role in risk assessments and planning. By using “AHP” techniques we can solve this problem. Every project has some risks and that will cause failure or even the financial loss. So, the risk management is very important in project management. To finding awareness relating to risks a risk model is created by using AHP model. Risk can be of any type like technology, management, product and stakeholder but challenge is to decide which risk can be ignored without effect the whole project, it is basically decision making. Using “AHP” methodologies this type of uncertainties and problems can be removed in order to maintain cost and improve success factor [4]. “AHP” is a tool combine with relative and absolute measurements that allow performance scoring for decision making. In our research we study a paper related to performance evaluation of employees in a company. The company faced a major problem to decide on which criteria evaluation can be perform, so company choose “AHP” model which we describe in detail later [5].

The “AHP” methods are also used to provision the management of connecting relations during the execution of construction projects. There are 18 parameters of partnering affairs that were assigned to the supportive relations between the general worker and four other participants which includes subcontractors ,designers, the material suppliers ,and the

investor and for the ordering of these limitations four criteria were used. In AHP algorithm the pairwise comparison is limited only on these four criteria not on parameters because they are in large amount. As a result of there is a recommendations were generated for the project manager [7].

For the extraction, transformation and loading of data into data warehouse the “ETL” software used its specific methods due to this the evaluation of “ETL” software is very problematic. For the success or failure of business intelligence projects the selection of right ETL software is very critical. For the multi-criteria decision making problem the “AHP” and “TOPSIS” methods are used that can easily select the right “ETL” software and for their substitute’s evaluations [8]. To improve the complexity of systems it is important to select and rank the projects to eliminate the root cause of the loss. For this purpose “Fuzzy AHP” method with cause and effect diagram is used. In this diagram there are causes and their sub-causes leading to the poor performance. With the help of this we can easily eliminate the root cause of problem [9]. For the multidimensional process the procurement of construction equipment is very complex. “AHP” framework is developed for the selection of right equipment that is based on tangible and intangible factors. It is the first decision model that is used for the selection of construction equipment to structure the projects [10].

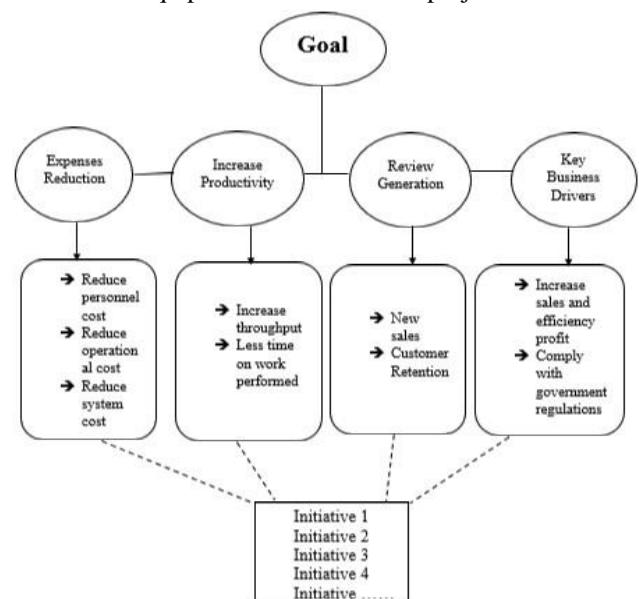


Fig 1 Analytical hierarchy process model

III. METHODOLOGY

As we all know that in every field of life every project whether it is relate to software or not success criteria of a project is very important that basically explains scope, schedule, budget and client’s needs about the product. So, ranking the critical success factors for the enhancement and progress of a project is very necessary. To make a project successful and long life it is necessary to create criteria and sub criteria to examine the alternatives. These criteria can be tangible and intangible. Intangible are not feasible and cannot provide clarity about the alternatives ratings. Success criteria in our research are taken from literature study of reference. Project success criteria include scope, time, planning, cost, quality, performance, tools and techniques and client’s acceptance. Scope should be clear, specified and according to customer needs, time should be properly managed and already planned

and agreed. “AHP” support all these criteria’s factors in decision making and rank the success factor and used approved methodology that is described in table II. The next important factor that we study is risk in requirements. This is key challenge to manage the success the project and prevent it from failing the whole system. The basic reason behind this problem is inappropriate, inconsistent, unambiguous requirements that make difficult for the manager and team to choose which requirements can be ignored, which can be managed and on what priority basics. For all this we need we need a decision maker but it is very hectic task to hire a person so “AHP” solve this problem and reduce complexity by employed a novel method in starting of requirement engineering stage^[4]. This method deals with impact value and level of risk which we define by our own with respect to the risk of requirements and then decide which requirements can be ignored and remove to reduce problems. In reality requirement risk are of nine different types. Impact values can be specify as 1-10 belong to low level, 11-20 from medium, 21-30 from high and >30 from very high level. Table Ia show this whole situation:

REQUIREMENT RISK	IMPACT VALUE	LEVEL OF RISK
Incomplete requirement risk	8	Low level
Ambiguous requirement risk	17	Medium level
Incorrect requirement risk	9	Low level
Infeasible requirement risk	15	Medium level
Complex requirement risk	22	High level
stakeholder requirement risk	4	Low level

Table Ia Requirement risks and level of risks
In the table Ia we can calculate impact values by the procedure that we discuss in table II. But here we just take assumption to clarify the method efficiently. The next case in which “AHP” application can be clear is cloud computing ranking services which is very popular now days. But to select which services can be choose is not done by only using “AHP” technique because “AHP” exhibit a deviation in parameters, to remove this deviation we use advance form of “AHP” which is fuzzy AHP model because customer satisfaction, trust is first and foremost and it overcome all the drawbacks that we face during ranking the services and provide high level opportunities. Metrices plays an important role in fuzzy AHP in which cloud computing services ranked according to accountability, agility, finance, assurance and performance etc. Fuzzy logic methodology in further describe in table II.

Last some years due to user’s privacy, recommender systems find difficult to recommend the users more quickly and precisely. In academia, business and entertainment industry recommender system developed faster but become useless due to some decision making problems. “AHP” solve this problem by using AHP based domain recommendation system. This method extract the domain features, indicate the user’s preferences and construct preferences model and use conventional collaborative filtering techniques to generate suggestions for use.rs more accurately. To extract the domain features domain extract engine can be used. For feature extract engine initially we have dataset on which we apply features extract concept which can be done through keywords and features that user set then it is identified and at last produce domain features for further working.

To analyze the result of “AHP and MCAHP” simulation algorithm is used. In this algorithm we create a random but reliable matrix for each decision alternatives and to represent their weights. If the level of uncertainty is below 0.24 then there is no difference between the performance of “AHP and MCAHP”. And if the uncertainty level increases then these two methods provide different results. In case of different results simulation identify threshold to investigate which method produce better result. For this purpose we used an alternative ranking method to measure the closeness of ranking of AHP and MCAHP.

As we know there is a high possibility of risks in the construction projects that will lead to the monetary loss. Project risk management is the logical procedure of isolating, measuring, examining, and reacting to that risk. For the construction of project risk management these risks are categorized by using the AHP hierarchical structure model as shown in the Figure1 ^[6].

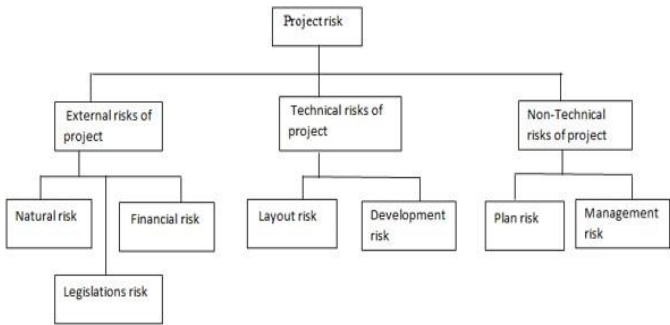


Fig 2. AHP Hierarchy Model for construct project risk management

Problem	Description	Methodology
Critical success factor	Critical success factors ensure the success of project and prevent the	Identify the problem that you face. Create framework;

	<p>project from failure. In order to make a project successful we create criteria and sub criteria to evaluate alternatives. CSFs are scope, time, cost, planning, quality, performance, techniques and client's acceptance. It is important to decide which factors have high ability to make a project success so we can use "AHP" model to make decision.</p>	<p>prepare questionnaires based on criteria and sub criteria to accommodate pairwise comparison with rating scale organized by "AHP" founder "Satty". Then rank the CSFs on the basic of Eigen value that we will obtain¹.</p>		<p>agility, and performance etc. This problem is not done using "AHP" only because "AHP" exhibit deviation in behavior.</p>	<p>their assigned weights. Then calculate the estimated trust values by using relative service ranking vector of attributes for the services. Repeat the AHP for next level. Trust values obtained then multiply it with their weights. Through this trust values services can be suggest .</p>
Risk prioritization	<p>Risk prioritization is very common in every institute but most common is requirements risk through which developer cannot develop the product properly, on time and appropriate. It is difficult to decide which requirements can be ignored which can be managed; in this case "AHP" model helps to take decision.</p>	<p>Novel method is used to solve this problem. In this method first we classify the requirements on the basis of risk as compared to other requirements in a pool based on multicriteria using "AHP". Calculate the core values of each requirement then categorize the each requirement in their respective category name low, medium, high and very high. The low risky requirements can be ignored and remaining can be managed by create priorities.</p>	Domain based recommender systems	<p>Now a days recommender system is useless due to privacy features. In order to suggest /recommend best features to users AHP based domain recommendation method is used.</p>	<p>In this method first we extract the domain features from data set on the basic of keywords and features that we set, then indicate user preference and construct users preference model and at last used conventional collaborative filtering techniques to recommend the results for users.</p>
			Partnering relation during the implementation of construction projects	<p>Now a day the partnership approach for the construction of projects becomes popular.it is very important to maintain good relations between members of a construction</p>	<p>The "AHP" and "Fuzzy AHP" method is used to solve this problem. When we apply AHP and FAHP firstly we create a hierarchy of 18 parameters that support the partnering relations is used</p>

Cloud computing ranking services	Cloud computing is a vast concept but to decide which services can be choose is a difficult task. Ranking the cloud computing services is ranked through accountability,	Fuzzy AHP is used for this situation. In this method all “CSMIC” parameters are list in a table in terms of first and second level attributes with		project to achieve successful project.	to identify which parameters need to be improved. The valuation of parameter is done by project manager on a scale of 1-5 .The triangular fuzzy numbers(TFN) is given to each
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		pairwise comparisons in agreement with fuzzy version of AHP were obtained by altering the numbers used for risky valuations.
Selection of ETL software	Nowadays the selection of right “ETL” software becomes an essential decision in the business intelligence field and to ensure that the selected software meets the organizational goals and it’s beneficial for the organizations or not.it is very critical task to select right ETL software.	The “MCDM” technique is most appropriate for the selection of multi-criteria “ETL” software. Based on decision making the “AHP-TOPSIS” method is used for the right judgment of “ETL” software. For both qualitative and quantitative factors an integrated “AHPTOPSIS” model is used as shown in Figure II.
Maintainable Procurement of Construction Equipment	Now a day in the construction industry the sustainable procurement is evolving across the world and it is a very complex process to select right construction equipment for the project. For this purpose AHP method is used to take right decision and six sustainable criteria for the construction equipment.	The “MCDM” and “AHP” methods are used to solve this problem. The multipart decision problems are solved by using “MCDM”. There are two categories of MCDM which includes “multiobjective decision making (MODM)” and “multi-attribute decision making (MADM)”. In “MODM” firstly priorities are reduced from ideal set by introducing limitations to the objective

		function. In MADM quantifiable			evaluation alternatives. AHP is also used to achieve agreement in group decision making process and it also helps to quantify the weights of evaluated criteria. Six main criteria include Life cycle cost, Performance, system capability, operational governance, environmental impacts, and social benefits.
			Ranking systems	In the ranking system we use blog or weblog to rank their alternative status based on recommendations of user preferences. For this purpose AHP and MCAHP methods are used.	To compare the results of AHP and MCAHP for the alternative ranking two situations are included. For the first situation blogs are considered closed to each other and as a result it shows high degree of uncertainty while for the second situation blogs are considered different with each other and because of this nature of blogs they rank easily and shows lower degree of uncertainty.

Table II. Usage of AHP in different fields of life

IV. CONCLUSION

The selection of software project management plays an effective role in the success of project. To find out the ranking of success factors by AHP for development of project is very helpful for organizations for improvement. Rank the service providers using “AHP” can cause errors, more so when the parameters are not directly linked with high values of the contributing attributes. In this paper, it is shown that how these shortcomings of “AHP” may give rise to erroneous trust estimates for cloud services’ selection

problem and how fuzzy AHP solve this problem. AHP can reduces the different risks of project mainly construction projects and through this quality of project is improved. The methodologies that were introduced for the selection of ETL

software can also be applied for this kind of selection problems which includes multiple and conflicting criteria. To prioritized projects for improvement the AHP weights can be used .The results of “FAHP” method identified the

main cause of the problem. AHP provides best repair action to fix conflicts in UML modeling. For the development of supportable procurement AHP based framework is used which includes six main criteria and thirty eight sub-criteria. The life cycle cost is an important criterion for this purpose and has 38.5% weightage that is much greater than other criteria. By applying “AHP” and “TOPSIS” methods the numerical results obtained that gives final ranking of alternative courses and it also helps the students to choose better one and prioritize all available courses which also helps students for their bright future.

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