e-ISSN 2320 –7876 www.ijfans.org
Vol.10, Iss. 04,Dec 2021
 UGC CARE Listed (Group -I) Journal

PROJECT MANAGEMENT IN CONSTRUCTION SITES USING ARTIFICIAL NEURAL NETWORK BASED MANAGEMENT

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Abstract— Conventional studies on project prediction have frequently focused on only one or two aspects, rather than the whole performance of the project in accordance to the criteria that were established beforehand. This is since earlier study on the forecast of projects was carried out several decades ago. The fundamental purpose of this study was to concentrate on residential buildings while also taking into consideration the broad field that is construction projects in general. Project Management is planned and prediction using artificial neural network (ANN) in construction sites. It includes both multi-layered perceptron and radial basis function (RBF) to process the input data and provides prediction of both project management. The questionaries are conducted, and it is modelled to test and evaluate the efficacy of the ANN model. The results show that the proposed method achieves higher prediction ability than the existing methods.

Keywords— project management, forecast, ANN, multi-layered perceptron and radial basis function.

I. INTRODUCTION

In developed regions, the overall number of residential structures that have been created has seen a large increase as a direct result of the ongoing process of urbanization that is taking place. In addition, residential building projects (RBPs) have cornered a large share of the market for construction. This is especially true in developing countries, where there is a critical need for the immediate repair of aged and run-down housing stock [1].

The effective conclusion of RBPs will make it feasible to satisfy the growing demand for new homes in the quantity as well as the quality that will be necessary. There are a great many reports that have been written on the topic of the aspects of a project that are responsible for its successful completion. Most of them focus on defining exactly what it means to be successful, which is why they are frequently referred to as crucial success factors (CSFs) or success criteria [2].

This is because most of them concentrate on defining exactly what it means to be successful. These surveys cover the entirety of the spectrum of activities pertaining to industry and building. The bulk of the components that were examined fit into one of several general groups. This was accomplished by placing primary emphasis on the building projects that constitute the bulk of the construction industry. Second, in contrast to studies that were conducted in the past, this one considers all of the aspects and aspects that are taken into account when deciding the success of a project. The results of those other investigations did not point in this direction. To create accurate forecasts about the results of RBP, the authors of this study made use of an artificial neural network, more often referred to as an ANN. This strategy was chosen because it is an effective way for tackling issues related to nonlinear regression [3].

Project management is the practice of utilizing artificial neural networks (ANN) to plan and predict construction projects on various construction sites. This process is referred to as project management. It does this by conducting an analysis of the input data using a mixture of multi-layered perceptrons and radial basis functions (RBF). This gives it the ability to make predictions for both project management and project execution. In order to determine how accurate, the ANN model is, it is subjected to rigorous testing, which include carrying out surveys and modeling the results of those surveys. According to the findings, the proposed method can outperform the approaches that are currently considered to be state-of-the-art in terms of the accuracy of its predictions. This was determined by comparing the proposed method to these methods.

II. RELATED WORKS

We started by doing a literature review on the topic of critical factors that predict success. This allowed us to have a head start. It has been determined what all the pertinent aspects are, including those that are common to all fields of work as well as those that are unique to building projects. Everything that could not be directly linked to RBPs was omitted from consideration. Before settling on the essential set of frameworks, we put all the recovered criteria through the methodology to determine which ones were the most important by ranking them in order of importance. This allowed us to make an informed decision about which frameworks would make up the essential set.

When discussing a project, the term success can have a variety of distinct connotations for each individual participant as well as each group that is involved in the project. It will be much simpler for the most significant actors involved in the project to steer clear of controversies in the future if they can reach a consensus early on regarding the characteristics of a successful project. In the absence of such a system, it is highly likely that keeping track of and analyzing the project results will prove to be difficult, if not downright impossible [4].. Both factors are necessary for a project to be successful. These two aspects can act as a check and balance for one another, resulting in an understanding of the project on both a micro and a macro scale. Estimating or evaluating the level of success that a project will have been the subject of a number of studies that have been carried out in recent years [5].

It is vital to first identify and then elaborate on two important concepts before determining whether the project was a success. These concepts are CSFs and success criteria. In this setting, it is simple to get the two ideas mixed up with one another. The success criteria (SCs) of a project serve as the yardsticks by which its results are evaluated, whereas the contextual factors (CSFs) of the project are the variables that really drive such evaluations. CSFs that are exclusive to a single project should not be evaluated using the same standards as CSFs that were developed for other projects [6]. Several studies have been conducted with the intention of cataloging and ranking the CSFs utilized by a diverse spectrum of companies and organizations. Those who subscribe to the first school of thinking have only been able to detect CSFs, as opposed to the minority of persons who have classified them. The grouping of items into categories is doable through the utilization of a wide variety of objective and subjective criteria, such as the model of the four COMs (comfort, commitment, competence, and communication). Multiple pieces of study have not only found and classified the CSFs, but also taken the next logical step and rated them in order of importance [7].

The CSFs can be ranked using a variety of methods, some of which are based on the frequency with which they appear in the literature, others on the analytic hierarchy process (AHP), and still others on statistical analysis. Some of these methods are based on the frequency with which they appear in the literature, while others are based on the frequency with which they appear in the literature. A lot of scholars have investigated the links or interdependencies that exist between different CSFs rather than just ranking them in order of importance. One area of investigation that has been carried out concerns the application of CSFs to building and constructing endeavors. In academic settings, there hasn't been a great deal of research done on residential building and building construction projects. In most of the studies, the identification of the pertinent components was performed by field research, which entailed the administration of questionnaires to members of the academic community and industry personnel [8].

In addition, several studies have been carried out in order to investigate the elements that result in the failure of projects or the circumstances that cause them to be abandoned before they are finished. Previous CSFs can be seen of as an extension of the components that were investigated in these studies because they share many of the same properties. This is because these previous CSFs were developed using the same methods. The accomplishments of a project are evaluated in relation to predetermined standards of achievement, which may be construed either as guidelines or as benchmarks for the project. Every project, its stakeholders, and the parties participating in the project, such as the owner, the consultant, and the contractor, have their own individual expectations for what it means for the project to be successfully completed [9].

The idea that time, money, and quality form a iron triangle has been the subject of a significant amount of study ever since it was proposed. Examples of extra goals that are pursued during the development of mass housing in developing nations include minimizing negative effects on the environment and maximizing the level of satisfaction experienced by residents. In addition to the prerequisites that have already been covered, we also consider other considerations, such as the protection of resources, the amicable settlement of conflicts, and the assurance of personal safety. Finding success criteria has primarily been accomplished through doing field research, or the questioning of subject area experts, precisely like the CSFs.

Thirdly, according to the Adamowski J. & Karapataki approach, a sense of belonging, protection, and comfort are all offered by a person home, which is why it is one of the most essential needs of society. This is one of the reasons why housing is one of the most essential needs of society. It is possible to use the availability of housing in a society as a proxy for measuring how far along the path to sustainable development that society has traveled by looking at the quality of the housing that is available. In addition, the housing industry has the capability of fostering the growth of ancillary industries, which, in turn, can lead to an expansion of the overall economy and an increase in the number of jobs that are now available [10].

Despite this, the research that UN-Habitat has carried out on global cities shows that steadily growing over the course of the last few decades. The ongoing shift toward a greater concentration of urban life is the driving force behind this population increase. The revitalization of older buildings in urban areas and the development of newer, more functional structures have both led to an increase in the demand for housing in these types of settings. As a result of the tremendous rate of urbanization that is taking place in developing nations, the need for this is becoming an increasingly pressing one.

It has been a continual challenge for policymakers, particularly in nations that are still in the process of economic development, to ensure that metropolitan areas have access to housing that is priced at an affordable level. Social housing, affordable housing, and housing programs run in conjunction with public-private partnerships (PPPs) are a few examples of the many different types of housing initiatives that have been launched. These are only some examples among many others. RBPs need to be implemented successfully in order to reduce housing shortages in terms of both the amount and the quality of available homes.

III. PROPOSED METHOD

Both the MLP and the RBF networks made use of a backpropagation learning algorithm and were composed of three layers: an input layer with four neurons that represented the loading factor also an output layer with four neurons.

The RBF network process (Figure 1) is very dissimilar to the MLP network in that it possesses a hidden layer that is made up of radial basis functions and its activation is determined by the distance between an input vector and a prototype vector (centers). This is because the RBF network has a hidden layer that is made up of radial basis functions.

However, it does have numerous advantages over the MLP network, such as speedier and more effective training, quicker learning, and the elimination of the requirement to begin with random weights because it is learned progressively. This is since the MLP network is trained all at once. While RBF networks are most helpful for approximating functions and time series, MLP networks are especially helpful for classifying data

Fig 1: CSF

3.1. Neural Network based Project Management

A random classification, a continuous flow of may be described by nonlinear equations, and the solution to these equations can be achieved by altering the loading factor value. This indicates that a value will be produced for each loading factor that corresponds to the magnitude of the voltage at each bus in the system. The value will be produced in the system. MLP networks, and the RBF in particular, perform rather brilliantly when dealing with information of this kind because of the superior

approximation functions it possesses (nonlinear functions of the continuous flow). This is because of the superior approximation functions it possesses.

An explanation of the activation functions that are utilized by the radial and linear hyperbolic tangents in the two distinct networks is provided as follows: Radial activation function and Linear activation equation (1)

The slope of the curve can be determined by using the expression.

$$f(u)=(1-e-tu)/(1+e-tu) \qquad (1)$$

Where,

t - arbitrary constant.

$$f(n1)=e^{-n}$$

$$f(u)=u$$

This output is then transmitted to the central neuron. The mean squared error, also known as MSE, is the vector of squared errors that occurs when comparing the actual outcomes of a neural network to the results that were anticipated. The following are some of the ways to gain MSE:

$$\mathbf{MSE} = \sum(Y_{ob}-Y_{des})^2 \qquad (2)$$

Where,

Y_{ob} - obtained output of MLP.

Y_{des} - desired output of RBF.

The greater their similarity to one another, both in terms of the degree to which their weights differ from one another and in terms of the degree to which they are properly calibrated, the more accurate their measurements will be. Many artificial neural networks, especially those trained using the backpropagation technique, can be thought of as black boxes because the underlying models do not present any reasoning.

The reasons for the network findings are rarely articulated. This is since these networks are trained with the use of backpropagation. As a result of this, a considerable amount of research has been carried out on the topic of extracting information from artificial neural networks and developing explanation methods that can be utilized to explain the behavior of the network in a range of different scenarios.

it is crucial to bear in mind that the value that is produced by the network will increase every time it is retrained. This is something that should be always kept in mind. There was a requirement for multiple

experiments to be carried out before a decision could be made about the precise criteria for the training and the number of layers.

During the training phase of the network, which makes use of the backpropagation method, there is a two-step process that occurs. During each stage, a different procedure will take place. In the beginning, a pattern is shown to the input layer of the network. Following then, the activity is passed on from one tier of the network to the next until it reaches the output layer, at which point it receives a response from there. In the second step, a comparison is done between the actual output and the output that would be best for the pattern that was provided.

In the case that this is not accurate, the extent of the error will be determined and accounted for. As the error is backpropagated from the output layer to the input layer, adjustments are made to the connection weights of the units in the internal layer. This occurs as the error travels from the output layer to the input layer. This is since the error results in the error being backpropagated. This study demonstrates how ANNs can be as a tool for classifying and making predictions about the future.

IV. RESULTS AND DISCUSSIONS

After gaining an understanding of the 16 CSFs that were used as input characteristics of models and the five key success criteria that were used as output characteristics of models, questionnaires were constructed to collect data from projects that had been completed. This was done with the goal of improving future research. This article offers an analysis of fifty residential development projects that can be found in twenty different parts of India. To determine which network architecture would result in the production of output predictions that were the most accurate, the network was trained with a portion of the dataset that was chosen at random from the training set. This allowed the most accurate network architecture to be identified. The quality of the ANN model was validated by using validation data, and concerns with under-fitting and over-fitting were addressed by using the stop criterion and weight reset. Validation data were used.

Figure 2 presents the mean squared errors, also known as MSEs, that pertain to the ANN predictions of CSF value in terms of time, cost, quality, and safety, in addition to the satisfaction of stakeholders. According to what is depicted in the figure, the MSE values that were obtained during the training, validation, and testing stages of the ANN design that was all fell within the range of 0.03-0.07, which is also depicted in the figure. This demonstrates that the architecture can make accurate predictions regarding the outputs of the network.

One of the most important aspects of ANNs is the network architecture, which is also commonly referred to as the size of the network hidden layer. This is since the network architecture has a significant influence on the accuracy and efficiency of the model. To determine the architecture of the network that would perform best for our needs, we conducted tests with hidden layer sizes ranging from 5 to 20.

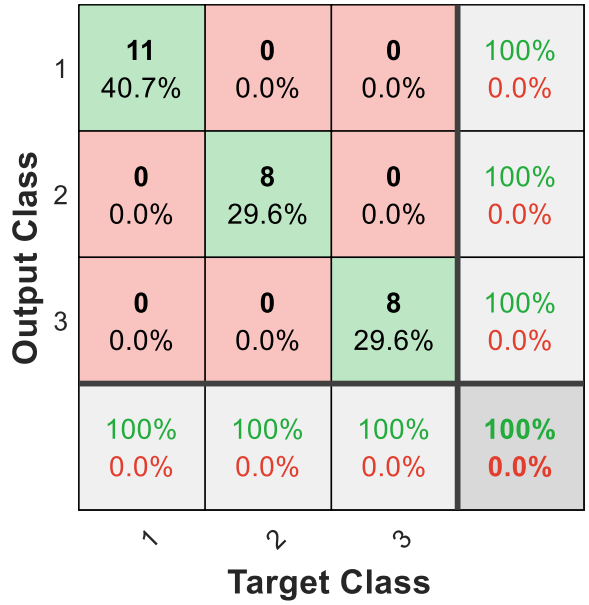

Fig 2: Time Prediction

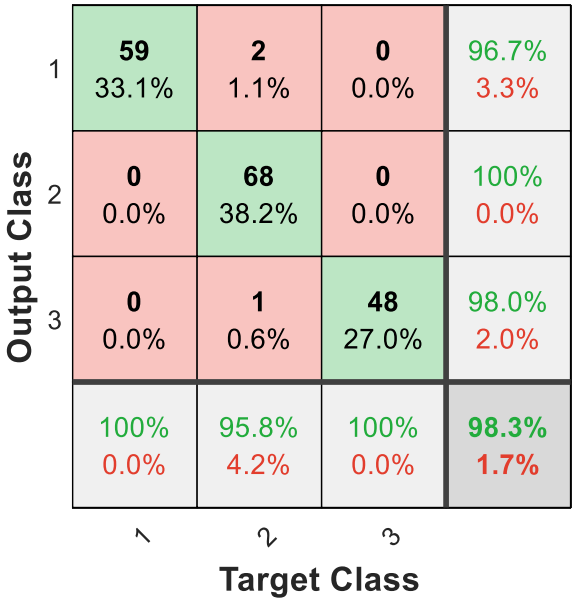

Figure 3: Cost

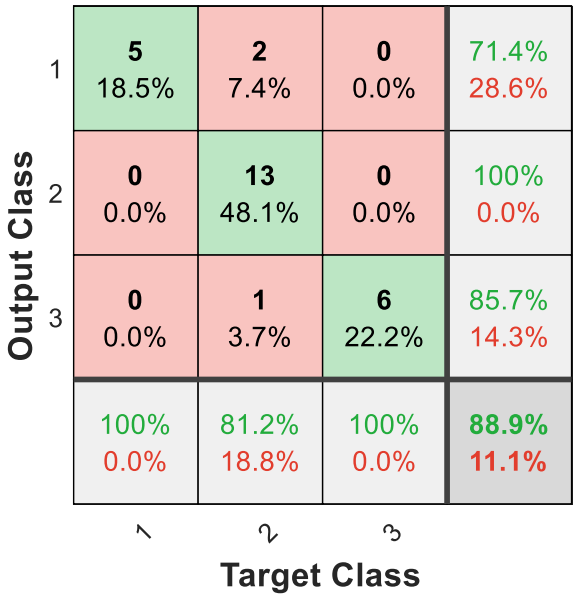

Figure 4: Quality

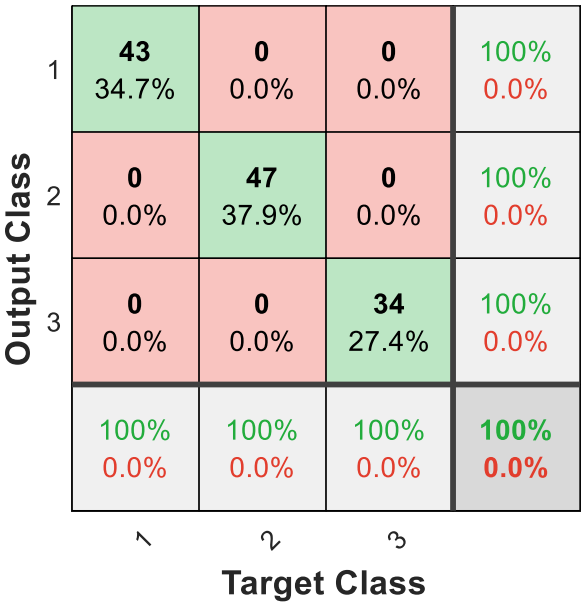

Figure 5: Safety

Figures 3 and 4 offer a comparison of the data that was gathered and the data that was predicted in order to illustrate the accuracy of both the prediction and the measurement. This comparison is presented to demonstrate the accuracy of both the prediction and the measurement. In addition to that, the incorrect values are displayed below.

As in Figure 5 that the distribution of prediction errors may be described using a normal function. This serves as an example of what we mean. This serves as an example to illustrate the point that was

just made. The presence of zero-error spots in the graphical representations demonstrates that the ANN model that was utilized in this experiment did not become stuck in a local minimum. This was shown by the fact that the model did not become locked in a local minimum.

Therefore, ANNs can be used to forecast the opinions of industry experts, much in the same way that they have been successfully employed in several construction management projects for the purposes of modeling. This is similar to the way that they have been employed in the construction industry for the purposes of modeling.

The feed-forward artificial neural networks that are employed today have shown to be highly successful, and they are modeled after the biological neural networks that are found in the human brain. Because they can offer approximations of general functions, ANNs are useful in a wide variety of contexts. Because of this, they can be utilized for virtually any problem involving machine learning in which it is necessary to learn a complex mapping between the input and output regions. This is one of the most common types of machine learning problems.

V. CONCLUSION

In the construction business, project management regularly makes use of artificial neural networks for the purposes of planning and prediction. These networks simulate the activity of ANN. It can produce predictions for project management as well as scheduling since it processes the input data using a combination of a MLP and an RBF. Research is conducted in the form of surveys, and new models are constructed, all with the purpose of putting the ANN model through its paces and determining how well it performs. According to the findings, the proposed method fares significantly better in terms of prediction accuracy than the methods that are presently regarded as representing the state of the art in this field.

The findings of this research can be utilized in the process of developing informed forecasts regarding the potential of RBPs in the years to come, since the findings have been provided. A decision-support system for RBPs has been developed, and it is based not only on the data-analysis skills of artificial intelligence, but also on the input and output selection of domain experts. This system enables RBPs to predict their outcomes more accurately.

The findings of this research have significant implications for policymakers who work in the housing sector. This is because RBPs are such an important component of the socioeconomic fabric of developing nations. It has been that the likelihood of success of RBPs should be evaluated in advance utilizing an index that takes into consideration the criteria that will be utilized in the evaluation.

Thus, an index has been developed as a mechanism by which the success of the project can be judged in reference to the criteria that have been defined in advance. The variable coefficients is used as weights allocated to criteria, which reflects the fact that the term success is subjective and its value varies depending on the decision-makers in any given project. This is because the PSI was designed to account for the fact that the term success does not have a universally accepted definition.

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