Overview of the Analysis:

The purpose of this analysis is to create a deep learning neural network model to predict whether or not applicants to Alphabet Soup will be successful in receiving funding based on various features from the charity dataset. The model aims to achieve a predictive accuracy higher than 75% to make reliable funding decisions and optimize the allocation of resources.

Results:

Data Preprocessing:

Target Variable(s): The target variable for the model is 'IS\_SUCCESSFUL', which indicates whether an applicant was successful in receiving funding (1) or not (0).

Feature Variable(s): The feature variables for the model include all columns in the dataset except for 'IS\_SUCCESSFUL', 'EIN', and 'NAME'.

Removed Variables: 'EIN' and 'NAME' were removed from the input data as they are neither targets nor relevant features.

Compiling, Training, and Evaluating the Model:

Neural Network Model: The neural network model used 100 neurons in the first hidden layer, 50 neurons in the second hidden layer, and 30 neurons in the third hidden layer. These additional neurons were chosen to increase the model's capacity to capture complex patterns in the data.

Activation Functions: ReLU (Rectified Linear Unit) activation function was used for all hidden layers to introduce non-linearity and improve model performance. The output layer used a sigmoid activation function for binary classification, producing probabilities between 0 and 1.

Achieving Target Performance: The model was able to achieve the target performance of a predictive accuracy higher than 75%. By optimizing the model architecture and preprocessing the data, we were able to achieve this goal.

Steps to Increase Model Performance: To improve the model performance, we experimented with various hyperparameters such as the number of neurons, layers, and epochs. Additionally, we handled rare occurrences in certain columns (APPLICATION\_TYPE and CLASSIFICATION) by binning them into 'Other'. This helped to reduce noise and overfitting in the model.

Summary:

The deep learning neural network model achieved a predictive accuracy higher than 75%, making it suitable for predicting the success of funding applicants to Alphabet Soup. By preprocessing the data, handling rare occurrences, and optimizing the model's architecture, we obtained a robust and accurate model.

Recommendation:

A different model that could solve this classification problem is a Random Forest classifier. Random Forest is an ensemble learning technique that combines multiple decision trees to make predictions. It is capable of handling both categorical and numerical features, and it can handle non-linear relationships effectively. Random Forest is less prone to overfitting compared to deep neural networks, and it generally requires less preprocessing. Additionally, it provides feature importance, allowing better understanding of which features contribute most to the prediction. Therefore, a Random Forest model could complement the deep learning approach and provide a more interpretable and robust solution to the classification problem.

In conclusion, the deep learning neural network model achieved the target performance, and with the addition of a Random Forest classifier, Alphabet Soup can have multiple models to cross-validate and make well-informed funding decisions.

Note: In practice, the recommendation would be based on more detailed experimentation and analysis of the specific data characteristics and business requirements.