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EFFECTIVENESS AND UTILISATION OF RESOURCES

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ABSTRACT

This Paper attempts to answer the continuous question by every company with regards to increasing profitability and incorporating processes that encourage the same. The paper uses the process of systematically applying statistical and logical techniques to describe, illustrate, condense and recap data. This study provides a way of drawing inductive inferences from data and distinguishing the signal (the phenomenon of interest) from the noise (statistical fluctuations) present in the data. It begins with the introduction of Data Analysis with reference to forecasting and then goes to look at how the beginning corporate companies analyse their resource utilization and effectiveness. The paper will allow an understanding to be developed on how company's attempt to make informed decisions based on analysis for resources allocated.

Keywords: Resource Allocation, Data Analysis, Profitability, Effective Utilization of Resources

Introduction

Data analysis is a process of inspecting, cleansing, transforming, and modelling data with the goal of discovering useful information, informing conclusions, and supporting decision-making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, and is used in different business, science, and social science domains. In today's business world, data analysis plays a role in making decisions more scientifically and helping businesses operate more effectively.

Data mining is a particular data analysis technique that focuses on statistical modelling and knowledge discovery for predictive rather than purely descriptive purposes, while business intelligence covers data analysis that relies heavily on aggregation, focusing mainly on business information. In statistical applications, data analysis can be divided into descriptive statistics, exploratory data analysis (EDA), and confirmatory data analysis (CDA). EDA focuses on discovering new features in the data while CDA focuses on confirming or falsifying existing

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hypotheses. Predictive analytics focuses on the application of statistical models for predictive forecasting or classification, while text analytics applies statistical, linguistic, and structural techniques to extract and classify information from textual sources, aspecies of unstructured data. All the above are varieties of data analysis.

Data integration is a precursor to data analysis, and data analysis is closely linked to data visualization and data dissemination.

The process of Data Analysis

Analysis refers to dividing a whole into its separate components for individual examination. Data analysis is a process for obtaining raw data, and subsequently converting it into information useful for decision-making by users. Data is collected and analysed to answer questions, test hypotheses, or disprove theories.

Statistician John Tukey, defined data analysis in 1961, as, "Procedures for analysing data, techniques for interpreting the results of such procedures, ways of planning the gathering of data to make its analysis easier, more precise or more accurate, and all the machinery and results of (mathematical) statistics which apply to analysing data."

There are several phases that can be distinguished, described below. The phases are iterative, in that feedback from later phases may result in additional work in earlier phases. The CRISP framework, used in data mining, has similar steps.

Data requirements: The data is necessary as inputs to the analysis, which is specified based upon the requirements of those directing the analytics (or customers, who will use thefinished product of the analysis). The general type of entity upon which the data will be collected is referred to as an experimental unit (e.g., a person or population of people). Specific variables regarding a population (e.g., age and income) may be specified and obtained. Data may be numerical or categorical (i.e., a text label for numbers).

Data collection: Data is collected from a variety of sources. The requirements may be communicated by analysts to custodians of the data, such as, Information Technology personnel within an organization. The data may also be collected from sensors in the environment, including traffic cameras, satellites, recording devices, etc. It may also be obtained through interviews, downloads from online sources, or reading documentation.

Data processing: Data, when initially obtained, must be processed or organized for analysis. For instance, these may involve placing data into rows and columns in a table format (known as structured data) for further analysis, often using spreadsheet or statistical software.

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Data cleaning: Once processed and organized, the data may be incomplete, contain duplicates, or contain errors. The need for data cleaning will arise from problems in the way that the datum are entered and stored. Data cleaning is the process of preventing and correcting these errors. Common tasks include record matching, identifying inaccuracy of data, overall quality of existing data, deduplication, and column segmentation. Such data problems can also be identified through a variety of analytical techniques. For example, with financial information, the totals for variables may be compared against separately published numbers that are believed to be reliable. Unusual amounts, above or below predetermined thresholds, may also be reviewed. There are several types of data cleaning that are dependent upon the type of data in the set; this could be phone numbers, email addresses, employers, or other values. Quantitative data methods for outlier detection, can be used to get rid of datathat appears to have a higher likelihood of being input incorrectly. Textual data spell checkers can be used to lessen the amount of mis-typed words. However, it is harder to tell if the words themselves are correct.

Exploratory data analysis: Once the datasets are cleaned, they can then be analysed. Analysts may apply a variety of techniques, referred to as exploratory data analysis, to begin understanding the messages contained within the obtained data. The process of data exploration may result in additional data cleaning or additional requests for data; thus, the initialization of the iterative phases mentioned in the lead paragraph of this section. Descriptive statistics, such as, the average or median, can be generated to aid in understanding the data. Data visualization is also a technique used, in which the analyst can examine the data in a graphical format in order to obtain additional insights, regarding the messages within the data.

Modelling and algorithms: Mathematical formulas or models (known as algorithms) may be applied to the data in order to identify relationships among the variables; for example, using correlation or causation. In general terms, models may be developed to evaluate a specific variable based on other variable(s) contained within the dataset, with some residual error depending on the implemented model's accuracy (e.g., Data = Model + Error).

Inferential statistics, includes utilizing techniques that measure the relationships between particular variables. For example, regression analysis may be used to model whether a change in advertising (independent variable X), provides an explanation for the variation in sales (dependent variable Y). In mathematical terms, Y (sales) is a function of X (advertising). It may be described as (Y = aX + b + error), where the model is designed such that (a) and (b) minimize the error when the model predicts Y for a given range of values of X. Analysts mayalso attempt to build models that are descriptive of the data, in an aim to simplify analysis and communicate results.

Data product: A data product is a computer application that takes data inputs and generates

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outputs, feeding them back into the environment. It may be based on a model or algorithm. For instance, an application that analyses data about customer purchase history, and uses the results to recommend other purchases the customer might enjoy.

Communication: Data visualization is used to help understand the results after data is analysed. Once data is analysed, it may be reported in many formats to the users of the analysis to support their requirements. The users may have feedback, which results in additional analysis. As such, much of the analytical cycle is iterative. When determining how to communicate the results, the analyst may consider implementing a variety of data visualization techniques to help communicate the message more clearly and efficiently to the audience. Data visualization uses information displays (graphics such as tables and charts) to help communicate key messages contained in the data. Tables are a valuable tool by enabling the ability of a user to query and focus on specific numbers; while charts (e.g., bar charts or line charts), may help explain the quantitative messages contained in the data.

Forecasting: Forecasting is the process of making predictions based on past and present data. Later these can be compared (resolved) against what happens. For example, a company might estimate their revenue in the next year, then compare it against the actual results. Prediction is a similar, but more general term. Forecasting might refer to specific formal statistical methods employing time series, cross-sectional or longitudinal data, or alternatively to less formal judgmental methods or the process of prediction and resolution itself. Usage can differ between areas of application: for example, in hydrology the terms "forecast" and "forecasting" are sometimes reserved for estimates of values at certain specific future times, while the term "prediction" is used for more general estimates, such as the number of times floods will occur over a long period.

Risk and uncertainty are central to forecasting and prediction; it is generally considered good practice to indicate the degree of uncertainty attaching to forecasts. In any case, the data must be up to date for the forecast to be as accurate as possible. In some cases, the data used to predict the variable of interest is itself forecast.

Average approach

In this approach, the predictions of all future values are equal to the mean of the past data. This approach can be used with any sort of data where past data is available. In time series notation:

$$\hat{y}_{T+h|T} = \bar{y} = (y_1 + \ldots + y_T)/T$$

where $y_1, \ldots, y_T$ is the past data.

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Although the time series notation has been used here, the average approach can also be used for cross-sectional data (when we are predicting unobserved values; values that are not included in the data set). Then, the prediction for unobserved values is the average of the observed values.

Problem Statement

When we analyse a company's performance and growth, employees play a big role in determining the future and past performance. To interpret this, the decision makers ask several questions which include the following:

1. How many productive hours does an employee spend in a week?
2. How many productive hours should be set as a target.
3. How many hours of the total time spent is given to a particular project or task.
4. How effective is the resource/employee? How is the performance?
5. What is the utilization of the resource?

Hence to answer the above stated questions, a dummy data which involves the working hours spent by each employee of a dummy company for 2 years with the following:

- The employee names
- The hours spent
- The hourly rate
- The client worked on
- The project of the client
- The task of the project
- The date

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Data Analysis technique used to justify the problem

The data for reference can be seen in the below image-

End	Break	Duration	Hourly Rate, $	Bonus, $	Earnings, $	Client	Project	Task	Note	#	YYYY-MM	YYYY-MM-DD	Year	End Date	Start.1
06-08-2021 16:00:00	0.041666666666667	0.291666666666667	25		175	Tristique Incorporated	Dashboard Projet	Implementation		1	2021-08	06 August 2021	2021	06-08-2021	06-08-2021 00:00:0
05-08-2021 16:00:00	0.041666666666667	0.291666666666667	25		175	Tristique Incorporated	Dashboard Projet	Implementation		2	2021-08	05 August 2021	2021	05-08-2021	05-08-2021 00:00:0
04-08-2021 16:00:00	0.041666666666667	0.291666666666667	25		175	Tristique Incorporated	Dashboard Projet	Implementation		3	2021-08	04 August 2021	2021	04-08-2021	04-08-2021 00:00:0
03-08-2021 16:00:00	0.041666666666667	0.291666666666667	25		175	Tristique Incorporated	Dashboard Projet	Implementation		4	2021-08	03 August 2021	2021	03-08-2021	03-08-2021 00:00:0
02-08-2021 16:00:00	0.041666666666667	0.291666666666667	25		175	Tristique Incorporated	Dashboard Projet	Implementation		5	2021-08	02 August 2021	2021	02-08-2021	02-08-2021 00:00:0
29-07-2021 16:00:00	0.041666666666667	0.291666666666667	25		175	Tristique Incorporated	Dashboard Projet	Implementation		7	2021-07	29 July 2021	2021	29-07-2021	29-07-2021 00:00:0
28-07-2021 16:00:00	0.041666666666667	0.291666666666667	25		175	Tristique Incorporated	Dashboard Projet	Implementation		8	2021-07	28 July 2021	2021	28-07-2021	28-07-2021 00:00:0
27-07-2021 16:00:00	0.041666666666667	0.291666666666667	25		175	Tristique Incorporated	Dashboard Projet	Implementation		9	2021-07	27 July 2021	2021	27-07-2021	27-07-2021 00:00:0
23-07-2021 16:00:00	0.041666666666667	0.291666666666667	25		175	Tristique Incorporated	Dashboard Projet	Implementation		11	2021-07	23 July 2021	2021	23-07-2021	23-07-2021 00:00:0
22-06-2021 17:00:00	0.083333333333333	0.291666666666667	25		175	Tristique Incorporated	Dashboard Projet	Implementation		32	2021-06	22 June 2021	2021	22-06-2021	22-06-2021 00:00:0
15-06-2021 16:30:00	0.0625	0.291666666666667	25		175	Tristique Incorporated	Dashboard Projet	Implementation		37	2021-06	15 June 2021	2021	15-06-2021	15-06-2021 00:00:0
28-05-2021 16:00:00	0.041666666666667	0.291666666666667	25		175	Tristique Incorporated	Dashboard Projet	Implementation		51	2021-05	28 May 2021	2021	28-05-2021	28-05-2021 00:00:0
11-03-2020 15:30:00	0.020833333333333	0.291666666666667	25		175	Arcu Vel Corp	Upper Management Project	Implementation		228	2020-03	11 March 2020	2020	11-03-2020	11-03-2020 00:00:0
10-03-2020 15:30:00	0.020833333333333	0.291666666666667	25		175	Arcu Vel Corp	Upper Management Project	Implementation		229	2020-03	10 March 2020	2020	10-03-2020	10-03-2020 00:00:0
15-11-2019 15:30:00	0.020833333333333	0.291666666666667	25		175	Praesent Industries	Audit Verification	Implementation		236	2019-11	15 November 2019	2019	15-11-2019	15-11-2019 00:00:0
14-11-2019 15:30:00	0.020833333333333	0.291666666666667	25		175	Praesent Industries	Audit Verification	Implementation		237	2019-11	14 November 2019	2019	14-11-2019	14-11-2019 00:00:0
13-11-2019 15:30:00	0.020833333333333	0.291666666666667	25		175	Praesent Industries	Audit Verification	Implementation		238	2019-11	13 November 2019	2019	13-11-2019	13-11-2019 00:00:0
12-11-2019 15:30:00	0.020833333333333	0.291666666666667	25		175	Praesent Industries	Audit Verification	Implementation		239	2019-11	12 November 2019	2019	12-11-2019	12-11-2019 00:00:0
11-11-2019 15:30:00	0.020833333333333	0.291666666666667	25		175	Praesent Industries	Audit Verification	Implementation		240	2019-11	11 November 2019	2019	11-11-2019	11-11-2019 00:00:0
06-11-2019 15:30:00	0.020833333333333	0.291666666666667	25		175	Praesent Industries	Audit Verification	Implementation		243	2019-11	06 November 2019	2019	06-11-2019	06-11-2019 00:00:0
04-11-2019 15:30:00	0.020833333333333	0.291666666666667	25		175	Praesent Industries	Audit Verification	Implementation		245	2019-11	04 November 2019	2019	04-11-2019	04-11-2019 00:00:0

The software used for the interpretation and analysis of this data is POWER BI.

In order to get the answer to the above asked questions, the data was first cleaned and then restructured by using the techniques of Data mining, Modelling and algorithms, Exploratory data analysis, Data cleaning, Data collection, Data processing. Hence reaching a stage where a dashboard could be built and an analysis can be carried out. A few calculations about the average hourly rate, total earnings, total working hours, utilization rate, average earnings were then drawn from the restructured data as shown in the image below.

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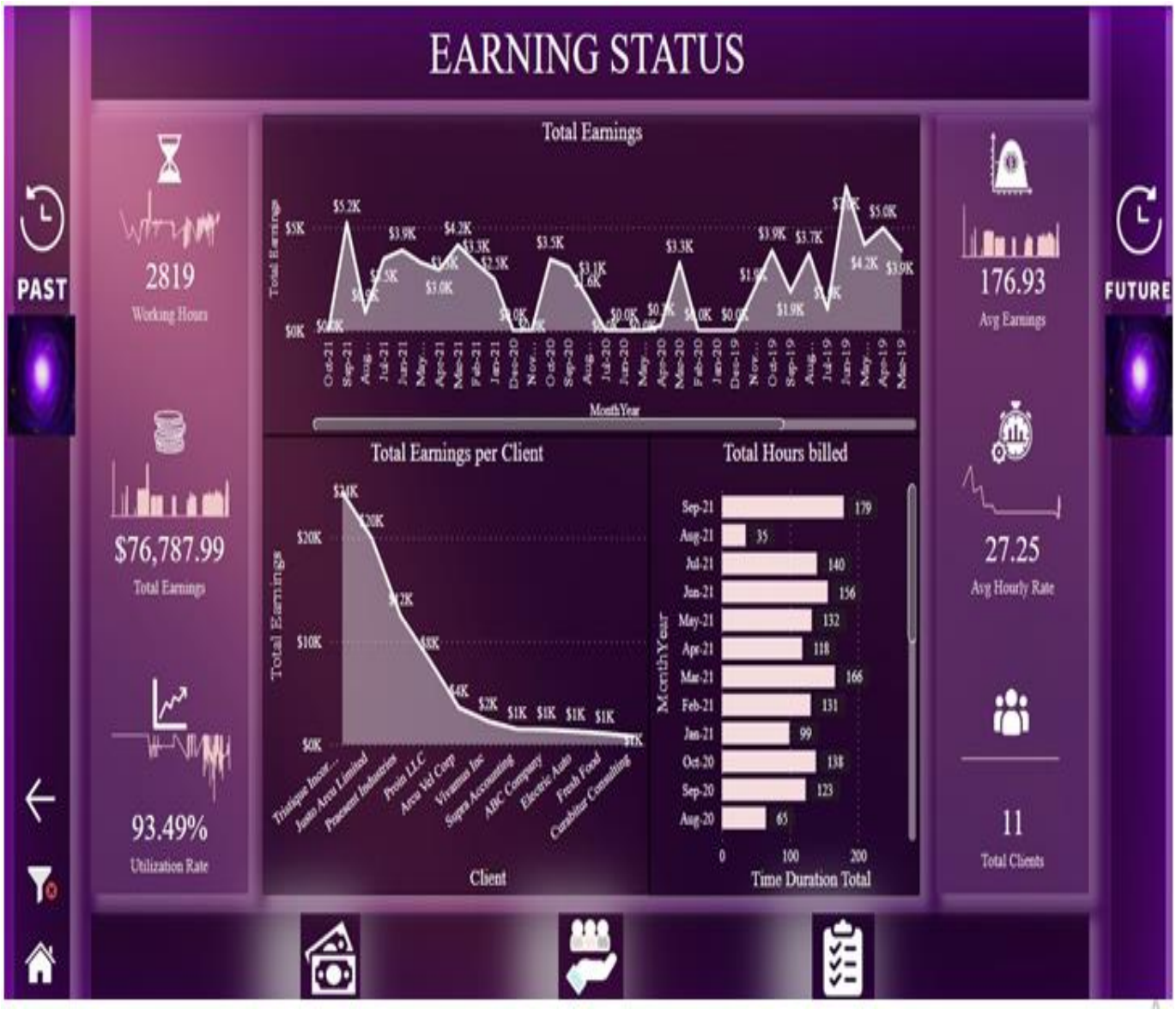

Calculations:

The calculations and factors used for the analysis drawn are as follows:

- Total Working Hours: The sum of all the hours spent on all the tasks for all the clients.
- Total Earnings: The product of total working hours with the hourly rate for each employee.
- Average Hourly Rate: The dividend of Total Earnings by Total Working hours for each

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employee.

- Average Earnings: The dividend of Total Earnings by the total number of employees.
- Utilization Rate: The dividend of Total Working hours by the total hours spent including breaks.

These sets of calculations were then showcased with the analytical and visualization techniques to represent the data and answer the questions asked above. (i.e., giving meaning to raw data). The ability to understand and derive conclusions from various angles and timeframes is what gives a proper meaning to raw data which helps the CFOs and CEOs to draw conclusions and make decisions for the benefits of the company's future and growth.

Inferences:

Based on the above image, the following inferences can be drawn.

1. The total earnings made over the years is $76,787.99.
2. The total hours worked over the year sum up to 2819.
3. The Utilization rate was 93.49%.
4. The average earnings for all employees over the years was $176.93 per day.
5. The average hourly rate for all the employees over the years was $27.25.
6. Total number of clients worked upon over the years was 11.
7. The total earnings made per client can be seen in the "Total Earnings per Client" area chart.
8. The total hours billed per month can be seen in the clustered bar chart named "Total hours billed".
9. Finally, the total earnings made per month can be seen for all the year in the Area Chart named "Total Earnings".

Many more inferences can be made using the above image and analysis can be drawn whichis very useful for decision making.

Predictive Model built based on the above analysis carried out

Using the method of Average approach in data prediction, the data is then manipulated and

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formulated. In our case, the data is for a 2 years duration. To predict the next year'sperformance, we carry out the calculation based on yearly. This calculation is then averaged out for the 2 years and then an average of the two years is calculated. The results can then be interpreted as the future year's performance.

Note: The predictions are never 100% accurate, but they show us how the future will most likely be. If there are no alterations, which include unforeseeable factors, undetectable changes, or unlikely occurrences, then the data will be close to what is predicted in the model.

Calculations:

The calculations and factors used for the predictions drawn are as follows:

- Total Working Hours: The average sum of all the hours spent on all the tasks for allthe clients.
- Total Earnings: The average of the product of total working hours with the hourly ratefor each employee.
- Average Hourly Rate: The average of the dividend of Total Earnings by TotalWorking hours for each employee.
- Average Earnings: The average of the dividend of Total Earnings by the total numberof employees.
- Utilization Rate: The average of the dividend of Total Working hours by the total hours spent, including breaks.

Assumptions:

1. The next year shall see a 10% decrease in performance and working days.
2. The hourly rate shall be decreased for a certain division of employees.

(These assumptions are made to add additional known factors for the purpose of calculationand to show the impact of external factors)

Note: This would have a negative impact on the earning of the company warnings and total growth.

With these calculations and assumptions, the predictive forecast can be carried out, which will result in the manner as can be witnessed in the image below.

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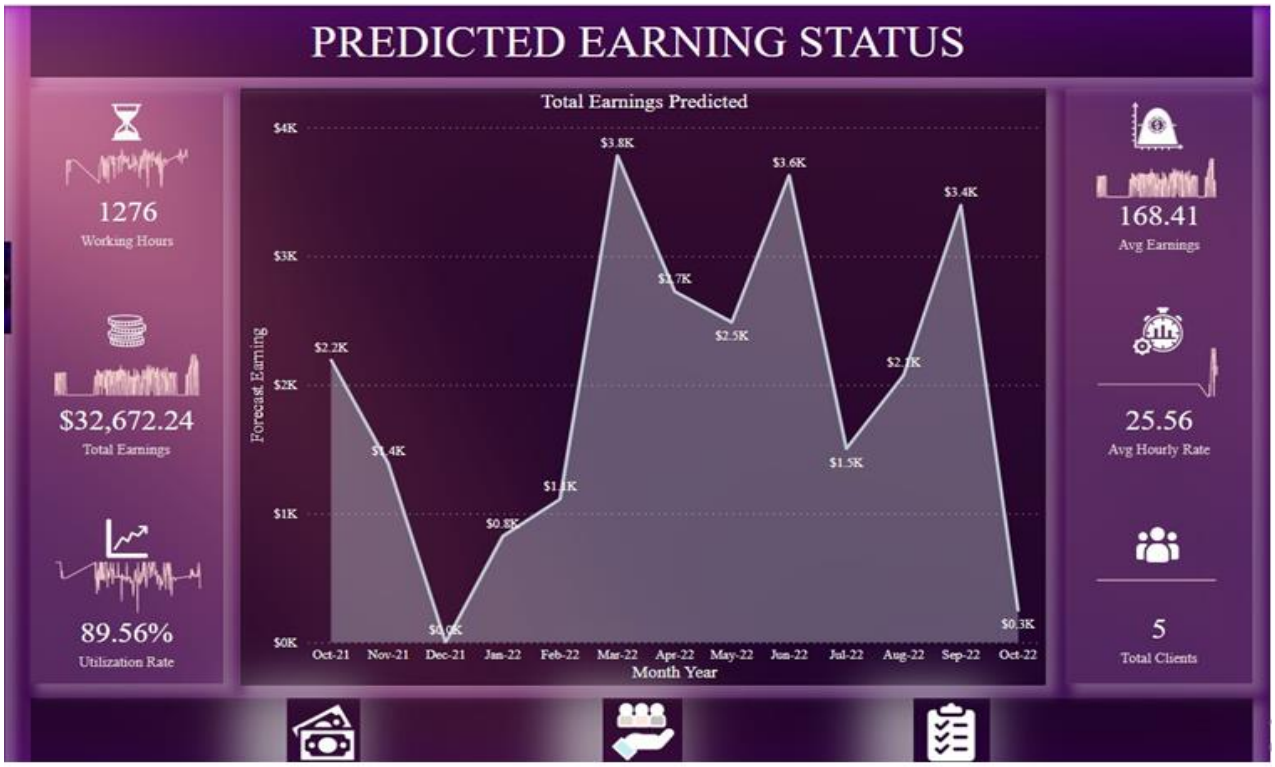

Inferences:

Based on the above image, the following inferences can be drawn.

1. The total earnings made in the next year shall be $32,672.24.
2. The total hours worked over the year will sum up to 1276.
3. The Utilization rate shall be 89.56%.
4. The average earnings for all employees over the years shall be $168.41 per day.
5. The average hourly rate for all the employees in the next year shall be $25.56.
6. Total number of clients that shall be worked upon will be 5.
7. Finally, the total earnings that can be seen per month in the future are shown in the Area Chart named “Total Earnings Predicted”.

Decisions and Analysis Drawn:

- The productive hours spent in two years were 2819 but shall see a decrease up to 1276

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hours in the upcoming year.

- The Utilization rate for the two years was 93.49 but shall see a decrease up to 89.56% the upcoming year.
- Due to this, the total earnings will decrease to $32,672.24 in the next year.
- This will urge the CFOs and CEOs of the companies to make a wiser decision on funds allocation and planning.
- They might take steps to increase or decrease the above drawn conclusions and act in the direction to stop the downtrend that can be observed.

Conclusion

A company must make decisions on a daily basis that impact the future for its growth. These decisions demand a logical reason and understanding based on past performance and future known factors that might affect or take place. To make the decision easier for them, the techniques of Data Analysis and Forecasting can be applied keeping in mind the external or internal factors that might be subject to change or might occur in the future. They should also keep in mind that the Analysis drawn for the past can be accurate as it has already happened but the forecast is subject to change based on unforeseen circumstances, external or internal factors that are unaccounted for. Still, it is of absolute importance to make the predictions, and take the decisions for the betterment of the company keeping in mind the importance and effect of those unaccounted factors. These decision makers are generally the CEOs and CFOs of the company as it is their responsibility to see the company's direction and take decisions accordingly.

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