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Study on the use of Statistics in Business - The Way to Earn Profit

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Abstract:

The main aim of this report is to use statistics in real world problems. Statistics has vast applications in our real life. It has been used to conduct research, evaluate outcomes, develop critical thinking and make informed decisions. It helps the government to compare the condition of a nation. If a country is showing a decline or deficiency in any particular sector then the government will take action accordingly. Statistics is very important for social science like conducting survey, sampling techniques, estimation theory, etc. This paper further explores how to solve such real problems.

Objective:

The main objective to study statistics is to find out the application of statistics in various fields. Statistics has broad coverage in various fields.

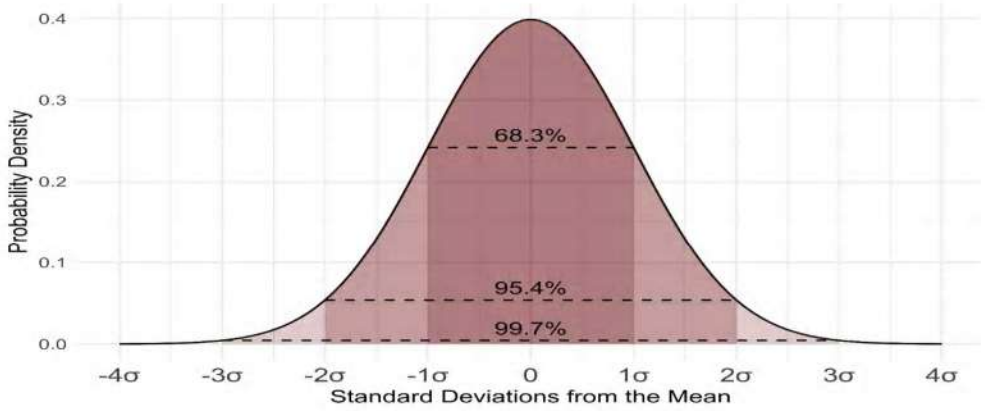
- Application of statistics
- Actuarial science: (manage risk in the insurance and finance industries)
- Applied information economics
- Astrostatistics: (statistical evaluation of astronomical data)
- Biostatistics: (interpretation of biological experiments)
- Chemometrics: (for analysis of data from chemistry)
- Data mining: (applying statistics to discover knowledge from data)
- Data science: (to extract insights from structured and unfractured data)
- Demography: (statistical study of population)
- Econometrics: (statistical analysis of economic data)
- Energy statistics: (analyzing data of commodities)
- Engineering statistics: (analyzing data)
- Epidemiology: (statistical analysis of diseases)
- Spatial analysis
- Image processing
- Political science
- Medical statistics
- Psychological statistics
- Social statistics
- Stock statistics

Application of Statistics in Real Life:

Here are a few examples of how statistics are used in everyday life.

1. All medical research relies on statistics. Doctors use statistics to keep track of where the infant should be in terms of mental development. Doctors also use statistics to assess the efficacy of treatments.

2. For observation, analysis, and mathematical prediction models, statistics are critical. To forecast future weather conditions, weather forecast models are constructed utilizing data that compare previous weather conditions with current weather circumstances.
3. Every day, a corporation produces thousands of products and ensures that only the highest-quality things are sold. It is impossible for a corporation to test each product. As a result, the organization employs statistically-based quality testing.
4. For stock analysis, the stock market also employs statistical computer models. Stock analysts use statistical techniques to gather information about the economy.



5. Retailers use statistics to keep track of everything they sell and to maintain track of their inventories. Leading retailers around the world utilize analytics to determine which products ship to which stores and when.

Limitations of Statistics:

Besides the importance of statistics in every field of life, it has some limitations. The following are the main limitations of statistics are:

Statistics does not deal with individuals:

A part of the definition of statistics is that it must be the aggregates of facts. That is, it deals only with mass phenomena. A single item or the isolated figure

cannot be regarded as statistics. This is a serious limitation of statistics. For example: the mark obtained by a student in English is 75 does not constitute statistics but the average of a group of students in English is 75 forms statistics.

Statistics does not study qualitative phenomena:

The science of statistics studies only the quantitative aspect of the problem. Statistics cannot directly be used for the study of qualitative phenomena such as honesty, intelligence, beauty, poverty, etc. However, some statistical techniques can be used to study such qualitative phenomena indirectly by expressing them into numbers. For example: The intelligence of the boys can be studied with the help of marks obtained by them in an examination.

Statistical laws are not exact:

100% accuracy is rare in statistical work because statistical laws are true only on the average. They are not exact as are the laws of Physics and Mathematics. For example: The probability of getting a head in a single toss of a coin is ½. This does not imply that 3 heads will be obtained if a coin is tossed 6 times. Only one head, 2 times head or all the times head or no head may be obtained.

Statistics is only a means:

Statistical methods provide only a method of studying problems. There are other methods also. These methods should be used to supplement the conclusions derived with the help of statistics.

Statistics is liable to be misused:

The most important limitation of statistics is that it must be handled by experts. Statistical methods are the most dangerous tools in the hands of experts. Since statistics deals with masses of figures, it can easily be manipulated by inexperienced and skilled persons. Statistical methods, if properly used, may conclude useful results and if misused by inexpert, unskilled persons, it may lead to fallacious conclusions. We have the following example consisting of the result concluded by an inexpert and unskilled person.

Statistics is only a means:

Statistical methods provide only a method of studying problems. There are other methods also. These methods should be used to supplement the conclusions derived with the help of statistics.

Introduction:

1. Historical background:

The interpretation of the word 'statistics' has been changed from stats. Actually, the history of statistics can be said to start around 1799. In early times, the meaning of stats was very narrow. By the 18^{th} century, the term 'statistics' designated the systematic collection of demographic and economic data by stats. The data were mainly used as tabulations of human and material resources. The 'statistics' mainly used in the military for the taxed and their uses. The collection and intensified the meaning of statistics broadened to include, and analysis of data. The stats were used to summarize the data in a simple stats form.

Karl Pearson, a founder of mathematical statistics:

By the 1970s, Johnson and Kotz produced the four volume compendium on statistical distribution (first edition 1969-1972), which is still an invaluable resource. They used statistics with broad concepts such as for mathematical interpretation, designates mathematical theories and applied statistics in science. The science of business analysis by the use of statistics is basically known as business statistics. Business analysis has played a great role in the development of business.

The word 'statistics' originated from the Latin word 'status' which means a political state or government. Originally, it was used in the connection of keeping the record of the state. The prominent among those who applied statistics in different branches of science are Sir F. Galton (1822-1911), Karl Pearson (1857-1936) and R.A Fisher (1890-1962), (see [1-50]).

Definitions:

- Statistics can be defined as the collection, presentation and interpretation of numerical data. – Croxton and Crowded

- Statistics are numerical statements of facts in any department of enquiry placed interrelated to each other.

– Boully

- Statistics are measurement, enumeration or estimates of natural or social phenomena of systematic arrangement to exhibit their inner relation.

– Conner

- By statistics, we mean quantitative data affected to a marked extent by a multiplicity of causes.

– Youle and Kendall

- The science of statistics is essentially a branch of applied mathematics and can be regarded as a mathematics applied to observation data.

– R.A Fisher

In statistics there are mainly some measures of central tendency and it is classified into three categories. They are as follows:

1. Mean
2. Median
3. Mode

A systematic flow of data in a logical or specific order is called statistical series. It's of three types:

1. Individual series
2. Discrete series
3. Continuous series

Mean of grouped and continuous data:

The mid value of each class interval is obtained by using the formula rule:

$$\text{Mid value } (m) = \frac{\text{lower limit} + \text{upper limit}}{2}$$

It can be calculated in three different ways :

- **Direct method:**

$$\text{mean} = \frac{\Sigma fm}{N}$$

Example:

Marks obtained	0-20	20-40	40-60	60-80	80-100
No. of students	3	8	10	7	2

Solution:

Marks obtained	**Mid-value(m)**	**No. of students**	***fm***
0-20	10	3	30
20-40	30	8	240
40-60	50	10	500
60-80	70	7	490
80-100	90	2	180
Total		$N = 30$	$\Sigma fm = 1440$

$$\text{Mean marks} = \frac{\Sigma fm}{N} = \frac{1440}{30} = 48$$

- **Shortcut or assumed mean method or Deviation:**

$$\text{Mean} = A + \frac{\Sigma fd}{N}$$

- **Step Deviation method:**

$$\text{Mean} = A + \frac{\Sigma fd'}{N}$$

In grouped or continuous data mean can be calculated in three ways :

- **Direct method:**

$$\text{Mean} = \frac{\Sigma fm}{N}$$

Example:

BP (in mmHg)	70-75	75-80	80-85	85-90	90-95	95-100
No. of people	10	17	23	16	9	5

Solution:

BP(in mmHg)	**Mid-value**	**No. of people**	***Fm***
70-75	72.5	10	725
75-80	77.5	17	1317.5
80-85	82.5	23	1897.5
85-90	87.5	16	1400
90-95	92.5	9	832.5
95-100	97.5	5	487.5
Total		$N = 80$	$\Sigma fm = 6660$

$$\text{Mean} = \frac{\Sigma fm}{N} = \frac{6660}{80} = 83.25$$

- **Assumed mean method:**

$$\text{Mean} = A + \frac{\Sigma fm}{N}$$

- **Step deviation method:**

$$\text{Mean} = A + \frac{\Sigma fd'}{N} \times c$$

Median:

Median is an average that divides the given set of data into two equal parts.

Median of grouped and continuous data:

$$\text{Position of the median} = \frac{N^{\text{th}}}{2} \text{ term}$$

Actual Median within the Median class is obtained by

$$\text{Median} = L + \frac{N}{2} - \frac{c.f}{f} \times h$$

Where,

L = the lower limit of lower class.

$c.f.$ = $c.f.$ of the class just preceding the median class.

f = frequency of median class.

c = length or width of size of class interval.

Quartiles:

$$\text{Position of } 1^{\text{st}} \text{ quartile } (Q_1) = \left(\frac{N^{\text{th}}}{4}\right) \text{ term}$$

$$\text{Position of } 3^{\text{rd}} \text{ quartile}(Q_3) = \left(\frac{3N^{\text{th}}}{4}\right) \text{ term}$$

Actually quartile is obtained by

$$Q_1 = L + \frac{N - c.f}{4*c}$$

$$Q_3 = L + \frac{N - c.f}{\frac{4*c}{f}}$$

Mode:

Formula for calculating mode is $L + \frac{f_1 - f_0 * c}{2f_1 - f_0 - f_2}$

Mode can also be calculated by the formula: 3 median - 2 mean

Standard Deviation:

Standard deviation can be calculated by the following ways:

- Direct method
- Actual mean method
- Step deviation method
- Shortcut method

In business, "statistics" I'd widely used as a management and decision support tool. Econometrics is a word used for business statistics.

- Econometrics is an application of statistical methods to economic data in order to give empirical content to economic relationships.
- Econometrics theory uses statistical theory and mathematical statistics to evaluate and develop econometrics methods.

Experiments:

The basic steps of a statistical experiment are:

1. Planning the research, including finding the number of replicates of the study, using the following information: preliminary estimates regarding the size

of treatment effects, alternative hypotheses, and the estimated experimental variability. Consideration of the selection of experimental subjects and the ethics of research is necessary. Statisticians recommend that experiments compare (at least) one new treatment with a standard treatment or control, to allow an unbiased estimate of the difference in treatment effects.

2. Design of experiments, using blocking to reduce the influence of confounding variables, and randomized assignment of treatments to subjects to allow unbiased estimates of treatment effects and experimental error. At this stage, the experimenters and statisticians write the experimental protocol that will guide the performance of the experiment and which specifies the primary analysis of the experimental data.
3. Performing the experiment following the experimental protocol and analyzing the data following the experimental protocol.
4. Further examining the data set in secondary analyses, to suggest new hypotheses for future study.
5. Documenting and presenting the results of the study.

Importance of statistics in business analysis:

The field of statistics is concerned with collecting, analyzing, interpreting and presenting data. In a business setting, statistics is important for the following reasons:

- Statistics allows a business to understand consumer behavior better using describing the data.
- Statistics allows a business to spot trends using data visualization.
- Statistics allows a business to understand the relationship between different variables using regression models.
- Statistics allows a business to segment consumers into groups using cluster analysis.

Illustration with examples:

1. Understand consumer behavior using statistics. Businesses in almost every sector use statistics to gain a better understanding of how their consumers behave.

For example :

A grocery store might calculate the following data related to their consumers.
The mean number of customers who came in each day by using the formula.
The median sales order per customer.
The standard deviation of the age of the customers who come in the store.
The sum of the sales made each month.
Using the statistics, the store can gain a strong understanding of their customers and how they behave.
On the other hand, a bank might calculate the following datas.
The percentage of customers who default on their loan.
The mean number of their new customers who join the bank each day.
The sum of the total deposits made by all customers each month.
Using the statistics, the bank can get an idea of how their customers behave and how they handle their money.

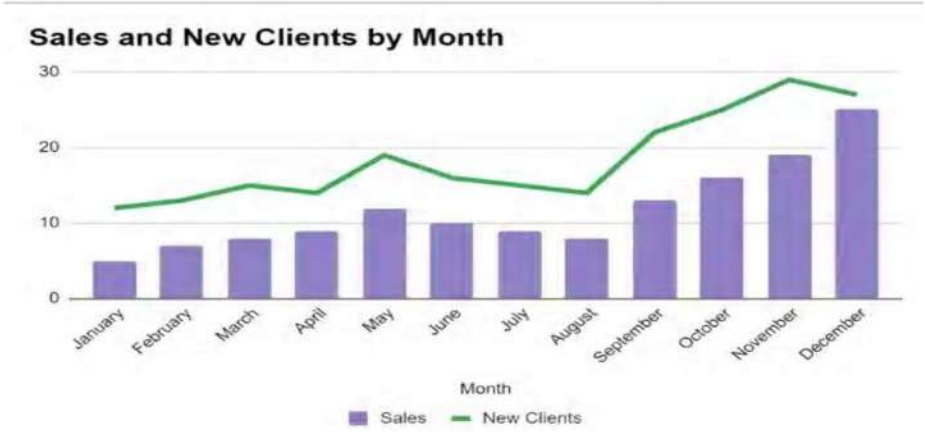
Not all Businesses build statistical models or perform complex calculations but just about every business uses statistics to gain a better understanding of their customers.

2. Spotting the market Trends:

Another common way that statistics is used in business is through data visualizations such as line charts, histograms, box plots, pie charts and other charts.

These types of charts are often used to help a business spot trends.

For example, a small business might create the following combo chart to visualize the number of new clients and total sales they make each month.



Using this simple chart, the business can quickly see that both their sales and number of new clients tends to increase the most in the final quarter of the year.

This can allow the business to be prepared with more staff, later hours, more inventory, etc. during this time of year.

3. Understand the relationship between Variables Statistics:

Another way that statistics is used in business settings is in the form of linear regression models.

The use of statistics allows a business to understand the relationship between one or more predictor variables and a response variable.

For example, a grocery store might track their total amount spent on print advertising, their total amount spent on online advertising, and their total revenue.

They might then build the following multiple linear regression model:

Sales = 840.35 + 2.55(TV advertising) + 4.87(online advertising)

Here the data interpretation includes coefficients of variable.

For each additional dollar spent on TV advertising, the total revenue increases by $2.55 (assuming online advertising is held constant).

For each additional dollar spent on online advertising, the total revenue increases by $4.87 (assuming TV advertising is held constant).

Using this model, the grocery store can quickly see that their money is better spent on online advertising as opposed to TV advertising.

Note : In this example, we only used two predictor variables (TV advertising and online advertising), but in practice businesses often build regression models with far more predictor variables.

4. Segment Consumers into Groups using Analysis:

A machine learning technique that allows a business to group together similar people based on different attributes. Retail companies often use clustering to identify groups of households that are similar to each other.

For example, a retail company may collect the following information on households:

Household income
Household size
Head of household Occupation
Distance from nearest urban area

They can then feed these variables into a clustering algorithm to perhaps identify the following clusters:

1. Small family, high spenders
2. Large family, high spenders
3. Small family, low spenders
4. Large family, low spenders

The company can then send personalized advertisements or sales letters to each household based on how likely they are to respond to specific types of advertisements.

Statistics in businesses of Janakpurdham:

There are various types of Businesses running in Janakpurdham. There is growth in the Businesses of Janakpur, but there is not a proper growth or ideal growth of Businesses of Janakpur. There are e-hundreds of grocery stores, clothes

stores, stationary, banks, corporatives, etc. Although they might have profit, there is not proper growth in the businesses of Janakpur. The Businessmen are not being able to understand the customer behavior, not being able to learn the trend of customers. They don't prefer business analysis or business statistics. Actually I have visited two-three corporatives to understand how they are running their business. One of the cooperative institutes is using file records to keep data in this modern world. There is a huge change of error in keeping data. This corporation doesn't analyze their business timely. They prefer only the profit or loss to understand the customer behavior to manage the risk in their business.

The next corporation is having the whole data and representing the whole data in statistics form and then they follow interpretation. The corporation is growing day by day. It means the risk management is done by using the statistics. The statistics help them to understand the sales rate, customer behavior, etc. As the same, many businesses prefer business analysis whereas most of the businesses don't prefer business analysis using statistics in Janakpurdham. There are many other businesses where there is a strong need for business analysis by using interpretation statistics. The hotel should always note the customer's number in different months.

Also, a newly established hotel 'Okila Ven' at Ramanand Chowk, Janakpurdham has been increasing the customer's rate daily. The manager had said that they have basically interpreted the statistics on customers rate in different months. Their profit has increased 12%. As per the research, they have written the dates of a certain time period and then they have understood the customer's behavior, and market trends. They have learned how to establish the reputed hotel where everyone can come.

Conclusion:

This project consists of a simple report on the use of statistics in business. It is based on statistical sampling techniques. This report shows how different organizations, shops, business companies use the trend of the market through analysis reports via the statistics. There is an organization located in Janakpurdham which gives a general graph of their growth made by the use of statistics. This report concludes that the study of market trends helps to grow in the business. The report

made by using statistics makes easy, understandable and effective data id trends in profit and loss in the business. I have made this project through reading the articles based on use of statistics in business and other fields.

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