Unit-4

How do experiments determine cause and effect?

The main method for cause-effect research is experimentation. In experimental-based research, we **manipulate the causal or independent variables in a relatively controlled environment**. This means that we control and monitor other variables affecting the dependent variable (e.g. sales) as much as possible.

What are causes and effect for marketing?

Cause and effect, or causality, in marketing is **the relationship between two events**. This is mainly focused on the second event. You need to understand whether this event resulted from the first event, or if there is another unknown factor at play.

How to construct a cause and effect diagram step-by-step

Define the problem (effect) to be solved.

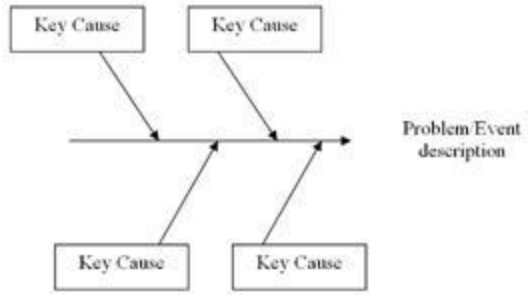
This first step is probably one of the most important tasks in building a cause and effect diagram. While defining your problem or event, your problem statement may also contain information about the location and time of the event. On the cause and effect diagram the problem is visually represented by drawing a horizontal line with a box enclosing the description of the problem on the tip of the arrow.

Identify the key causes of the problem or event

In this step, the primary causes of the problem are drilled down by using brainstorming techniques. Often these causes are put in categories such as people, equipment, materials and external factors. Some of the commonly used primary causes, but not limited to, include the four M's of manufacturing (machine, method, material and manpower); the four S's of the service sector (surroundings, suppliers, systems and skills); the five M's (measurement, maintenance, money, management and Mother Nature); and the eight P's of

marketing (product, price, place, promotion, people, process, physical environment and productivity).

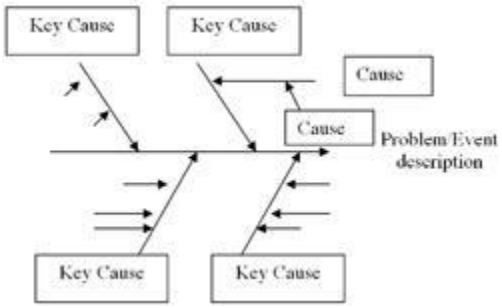
Other appropriate primary causes include service, quality, technology, consumables, work processes, environment, service level, etc. The image below shows how to visually depict these key causes on the cause and effect diagram.



Identify the reasons behind the key causes

The goal in this step is to brainstorm as many causes for each of the key causes. Tools such as the five Whys (the subject of a future column) can help your team to drill down to these sub-causes. To facilitate participation from all of your team members, ask each member of the group to provide one reason behind a key cause.

These suggestions should be written down and connected to their appropriate key cause arrow (see the image below). Remember that these reasons are free-flowing, form logical patterns and are inter-connected to a key cause.



Identify the most likely causes

At the end of step three, your team should have a good overview of the possible causes for the problem or event; if there are areas in the chart where possible causes are few, see if your team can dig deeper to find more potential causes.

How many formulas are in a spreadsheet?

Excel has **over 475** formulas in its Functions Library, from simple mathematics to very complex statistical, logical, and engineering tasks such as IF statements (one of our perennial favorite stories); AND, OR, NOT functions; COUNT, AVERAGE, and MIN/MAX.

What are the 5 symbols used in spreadsheet Formulae?

Excel uses standard operators for formulas, such as **a plus sign for addition (+), a minus sign for subtraction (-), an asterisk for multiplication (*), a forward slash for division (/), and a caret (^) for exponents**. All formulas in Excel must begin with an equals sign (=).

What is full factorial design of experiments?

A full factorial design is **a simple systematic design style that allows for estimation of main effects and interactions**. This design is very useful, but requires a large number of test points as the levels of a factor or the number of factors increase.

What is the advantage of a full factorial experiment?

Advantages of Factorial Experimental Design

Efficient: When compared to one-factor-at-a-time (OFAT) experiments, factorial designs are **significantly more efficient and can provide more information at a similar or lower cost**. It can also help find optimal conditions quicker than OFAT experiments can.

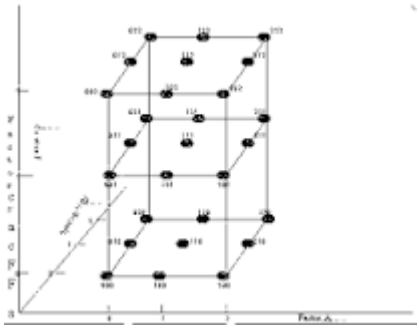
What is an example of a full factorial experiment?

For example, **$2^{(6-2)}$ is a {1/4} fraction of a 64 full factorial experiment**. This means that one may be able to study 6 factors at two levels in just 16 runs rather than 64 runs. The 2^{3-1} design is called a resolution III design, where a main effect is aliased with two-factor interactions (C=AB).

What is a 2 level full factorial experiment?

A two-factor factorial design is **an experimental design in which data is collected for all possible combinations of the levels of the two factors of interest**. If equal sample sizes are taken for each of the possible factor combinations then the design is a balanced two-factor factorial design.

What are the three levels of full factorial design?



The three-level design is written as a 3^k factorial design. It means that k factors are considered, each at 3 levels. These are (usually) referred to as **low, intermediate and high levels**. These levels are numerically expressed as 0, 1, and 2.

What is the difference between full factorial and fractional factorial design of experiment?

Full factorial designs are a common starting point when planning a test, but as the number of factors becomes large, the size of the design grows very quickly. Fractional factorial designs are an alternative that can help reduce the number of runs required for screening designs.

How do you design an experiment for marketing campaigns?

Media incrementality experiments are designed to understand the impact of a marketing campaign, channel, or ad on desired marketing objectives. A simplistic design to measure certain marketing stimuli like a TV campaign or a Facebook campaign is a 2-cell experiment, where the marketing campaign is published to a certain group of users and held out to another group of users. The response behaviors of the two user groups are then observed over a period of time. The impact of the marketing campaign is then assessed as the difference in response rates between those two user groups.

The science of experimental design applied to marketing is about carefully selecting and controlling the variables that affect outcomes, designing the approach for sample size sufficiency, and tailoring the overall design to have enough power to read the phenomenon being observed.

What are factors in experimental design for marketing campaigns?

The factors to be controlled depend on the phenomenon being measured. But in general, some of the factors that play a critical role in marketing that are candidates to be controlled are: marketing spend, campaign reach, impression frequency, audience quality, audience type, conversion rates, seasonality, collinearity and interaction effects.

Each marketing channel, like Facebook or TV or Google Search, each have their own unique campaign management levers to control audience reach, spend, frequency, etc. The challenge designing proper experiments is to apply experimental design principles to the specific channels and how they are typically operated by marketers.

Basic principles of experimental design in marketing measurement

Learning objectives: The first and foremost thing is to identify objectives that are meaningful to measure. Typically, these are sales and other business outcomes that marketing campaigns are looking to drive.

Audiences and Platforms: Each marketing platform like Facebook and Google have very specific ways to activate audiences and market to them. Experiments have to be designed around these campaign specific levers to control the factors relevant for the marketing experiments.

Decisions: Marketers make specific decisions around campaigns, like campaign budgets, campaign bids, creative choices, audience choices etc., Experiments have to be designed to inform the specific choices at the level of granularity that is meaningful for marketers.

What are the four 4 types of analysis?

The four types of data analysis are:

- Descriptive Analysis.
- Diagnostic Analysis.
- Predictive Analysis.
- Prescriptive Analysis.

What are 5 methods of Analysing?

The 5 methods for performing statistical analysis

- Mean. The first method that's used to perform the statistical analysis is mean, which is more commonly referred to as the average. ...
- Standard deviation. ...
- Regression. ...
- Hypothesis testing. ...
- Sample size determination.

What are the 7 steps to analysis?

Here are seven steps organizations should follow to analyze their data:

- Define goals. Defining clear goals will help businesses determine the type of data to collect and analyze.
- Integrate tools for data analysis. ...
- Collect the data. ...
- Clean the data. ...
- Analyze the data. ...
- Draw conclusions. ...
- Visualize the data.

How to Analyze Data in 5 Steps

To improve how you analyze your data, follow these steps in the data analysis process:

- Step 1: Define your goals
- Step 2: Decide how to measure goals
- Step 3: Collect your data
- Step 4: Analyze your data
- Step 5: Visualize and interpret results

What is before and after experimental design?

A before-and-after study (also called pre-post study) measures outcomes in a group of participants before introducing a product or other intervention, and then again afterwards. Any changes in the outcomes are attributed to the product or intervention.

What is the problem with pre post design?
Problems With Pretest-Posttest Designs

The main problem with this design is that it improves internal validity but sacrifices external validity to do so.

Before-after" designs

A before-after design involves the researcher in measuring the dependent variable both before and after the participants have been exposed to the independent variables.

The before-after design is an improvement upon the after-only design, in that the effect of the independent variable, if any, is established by observing differences between the value of the dependent variable before and after the experiment. Nonetheless, before-after designs still have a number of weaknesses.

Consider the case of the vegetable packer who is thinking about sending his/her produce to the wholesale market in more expensive, but more protective, plastic crates, instead of cardboard boxes. The packer is considering doing so in response to complaints from commissioning agents that the present packaging affords little protection to produce from handling damage. The packer wants to be sure that the economics of switching to plastic crates makes sense. Therefore, the packer introduces the plastic crates for a trial period. Before introducing these crates, the packer records the prices received for his/her top grade produce. Unless prices increase by more than the additional cost of plastic crates then there is no economic advantage to using the more expensive packaging.

Figure 6.3 Before-after designs

Suppose, for instance, that the packer was receiving $15 per crate, when these were of the cardboard type, but that the price after the introduction of plastic crates had risen to $17 per crate. The $2 difference would be attributed to better quality produce reaching the market as a result of the protection afforded by the plastic crates. However, there are several equally plausible explanations for the upward drift in produce prices including a shortfall in supply, a fall in the quality of produce supplied by competitors who operate in areas suffering adverse weather conditions, random fluctuation in prices, etc.

Basic concepts in experimentation

Dependency: Experiments allow marketing researchers to study the effects of an independent variable on a dependent variable. The researcher is able to manipulate the independent variable (i.e. he/she is able to change the value of the independent variable) and observe what effect, if any, this has upon the value of the dependent variable. Put another way, an independent variable is one which can be manipulated independently of other variables. Independent variables are selected for inclusion in an experiment on the basis of an assumption that they are in some way related to the dependent variable being studied. It is for this reason that independent variables are on occasion referred to as explanatory variables. The dependent variable is the one under study. The researcher

begins from the premise that changes in the value of the dependent variable are at least in part caused by changes in the independent variable. The experiment is designed to determine whether or not this cause and effect relationship actually exists.

Causality: A causal relationship is said to exist where the value of one variable is known to determine or influence the value of another. Green et al.3 draw a distinction between two types of causation: deterministic and probabilistic.

Where the independent variable (X) wholly explains changes in the value of the dependent variable (Y) and the researcher is able to establish the functional relationship between the two variables then this can be expressed as follows:

$y = f(x)$

In this case, it is said that X is both a necessary and a sufficient condition for Y to occur. The value of Y is determined by X, and X alone. Thus it can be said, in these circumstances, that X is a deterministic cause of Y. An illustrative example would be where the demand for agricultural commodities, say sugar, is dependent upon the world price.